

# InterAction through Information

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*Past designs have been recognised as a significant source of knowledge in architectural design. IT offers the opportunity to represent these designs not only by text, graphics and images, but also by 3D-models, computer animation, sound and video. In spite of the growing availability of multimedia archives, libraries and case bases, their contribution to the development of students' 'design craftsmanship' so far seems to be limited. If IT wants to make a valuable contribution to this development, the challenge is not to passively provide students with information on past designs, but to (inter)actively support the dynamic interplay between these designs and the student's design process. We are developing a tool that fundamentally attempts to explore this potential by using information as a vehicle to initiate, nurture and improve this interplay. The tool, which is intended to assist (student-)architects during the early conceptual stage of design, is conceived as a an (inter)active workhouse rather than a passive warehouse: it is interactively developed by and actively develops its users' knowledge. We have implemented a working prototype of the tool, at first stage for the design studio, yet with the potential of expansion into the office setting.*

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## Introduction

Information technology (IT) has slipped into architecture schools under several masks and for various reasons. One of them is to provide student designers with information on more or less famous pieces of architecture, usually called 'past designs', 'precedents' or 'design cases'. Past designs have been recognised as a significant source of knowledge in the creative process of design (Oxman 1994). Whereas the pages of a magazine or a book are limited to text, images and graphics, IT offers the opportunity to represent these designs by 3D-models, computer animation, sound and video. Hence the recent 'boom' of multimedia systems - on CD ROM, local networks or the Internet - ranging from digital archives over intelligent libraries to case-based design systems. Digital archives do little more than representing architectural projects in a computer medium making search and retrieval more efficient than with conventional media. Intelligent libraries differ from these archives because of the high level of knowledge behind the representation, intelligent support for search, potential for browsing and cross-indexing when information sought is incomplete, etc. (Oxman & Oxman 1993). Even more 'artificially intelligent' are systems dealing with case-based reasoning in design such as FABEL (Schmidt-Belz & Hovestadt 1996) and SEED (Flemming et al. 1994) for building design, ACHIE and ARCHIE-II (Kolodner 1993) specialised in courthouse design and IDIOM (Smith et al. 1996) for apartment floor layouts. Several of them, like for example PRECEDENTS (Oxman & Oxman 1993) and EDAT (Akin et al. 1997), are explicitly education-oriented.

In spite of the growing availability of these multimedia archives, intelligent libraries and design case bases, their contribution to the development of students' 'design craftsmanship' so far seems to be limited. Students may endlessly navigate through these "universes of information" without actually getting involved in the subject (Kühn & Herzog 1994). In our opinion, this is not so much a problem of technology itself, but rather of the underlying

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view on the role past designs (can) play in the acquisition of this design craftsmanship. Where most multimedia tools limit this role to a one-way traffic from the past to the current design situation, teaching and learning design involves a dynamic interplay between past designs and the student's - and teacher's - design process (Heylighen 1998). The real potential of IT does not lie in passively providing students with information - be it in a more fascinating form than traditional media. It offers a mechanism to (inter)actively stimulate, support and even improve this unique interplay which seems so essential to design education.

### **A Case Library for the Design Studio**

In order to explore this potential, we decided to develop an interactive case library, at first stage for the design studio yet with the potential of expansion into the office setting. The tool is intended to assist (student-)architects during the early conceptual stage of design. The case library tries to kill two birds with one stone. At short notice, it wants to provide (student-)designers with a rich source of inspiration, ideas and information, as it is filled with examples relevant for their own project. Its long-term objective is to initiate and nurture the life-long process of learning from existing designs. The trick is not only to use the cases in the library as a vehicle to help students design a better project, but also to use the project they are designing as a vehicle to pick up knowledge about previous designs along the way.

At its core, the library has an indexing-system that allows the easy retrieval of relevant information. Every project is labelled with several features - building name, concept, program, site, surface etc. - and linked to projects with common characteristics. The user can select each or a combination of these features as a filter to search the library for relevant projects. If we consider design cases as encapsulations of design knowledge, this labelling and linking further enhances each case's value. It allows the user to approach a design from different perspectives and to situate it in relation to other designs. Thus the knowledge content of the library does not only reside in the cases it contains, but also in the way these cases are structured.

#### **(Inter)Action**

In fact, a similar indexing-system can also be found in many other multimedia archives, libraries and case bases. However, most of these tools do not fully exploit IT's potential as they are static in nature: just like a warehouse, they inventory information that can be consulted, yet these consultations leave the information unchanged. Our case library, on the other hand, is conceived as an (inter)active workhouse rather than a passive warehouse (Schank & Cleary 1995): it is interactively developed by and actively develops its users' knowledge.

The library is interactive in the sense that the user cannot only consult cases already present in the library, he can also add new projects, make links between them, create extra indices etc. The need for such open-ended approach to case collection and indexing derives from the specific nature of design. In design the problem definition grows parallel to the solution (Bruce Archer quoted in Neuckermans 1994), which makes it impossible to foresee which cases might be useful at the outset. The same applies to the features used to index these cases. Being involved in a new project, an architect may discover relevant concepts in a previous project he was not aware of before. For this and other reasons, it is highly questionable whether a previous design can be indexed once and for all by its underlying concept(s) (Heylighen 1997). Making the library user at the same time librarian has the advantage that the library can draw on the user's knowledge to permanently nourish its content and refine its structure so as to stay in tune with his evolving needs and insights.

The library is interactive, however, not only in the traditional sense of human-computer interaction, but also because it supports interaction among students, studio teachers and other architects in multiple ways. First, it gives students access to the work - and thus design knowledge - of architects outside the studio. Second, it acts as a collective external memory (Wegner 1987) for the students and studio teachers in the studio, enabling them to share knowledge, expertise and insights. Finally, it has the potential to increase the frequency and quality of the dialogue among students as well as between students and studio teachers. Newly added cases or indices, for example, may act as points of departure for discussion by highlighting specific aspects of the assignment not initially shared (Press 1998).

Apart from interaction, the tool can also be ascribed a certain action in the sense that it actively develops the user's design knowledge by stimulating him to learn from previous projects. When adding a new case to the library, for example, the user is responsible for representing and labelling the project in such a way that important aspects are legible and easily accessible (Åkin et al. 1997). This forces him to view the project from different perspectives and to answer questions like 'what does this project tell me?', 'in what circumstances might it be a relevant example?' and 'where does it fit in relation to the other projects?', questions that enhance the student's

ability to understand and remember the project (Schank and Cleary 1995). In this way, the tool promotes the kind of thinking that helps to better learn from existing designs. Using the library in the studio in addition ensures that design knowledge is gained in the same context as it will be used. In general, students very rarely bring knowledge acquired in theoretical courses to the studio (Marda 1997). The reason is that they have not mentally encoded the material in terms of issues they face when designing. Because they have not thought about how it helps to solve problems at stake during design, the knowledge is difficult to access when they do face such a problem (Schank and Cleary 1995). In the studio, on the other hand, the project in which students are involved provides a framework on which students can hang newly acquired knowledge. Thus, the project does not only serve as a motivator - it stimulates students to learn because they are eager to design a good project - but also as a guiding context to integrate what they learn.

## **Implementation**

Within the scope of a graduate's thesis (Segers 1998), we are developing a working prototype library to explore the ideas presented in the previous section. In order to scale down the problem, we decided to build a case library for one specific design assignment. The honour goes to the design of a single-family dwelling on a sloping site, a compulsory project for the architecture students of the 2<sup>nd</sup> year at our department. However, this assignment should be seen as nothing more than a test-case. With an eye on a wide applicability, the library should be easily extendible to other building types and thus not tailored specifically for single-family dwellings on a sloping site. The prototype library consists of three major components: 1. a collection of cases - the actual content of the library; 2. an underlying database that structures the library; and 3. an interface allowing to consult and modify the library.

### *Cases*

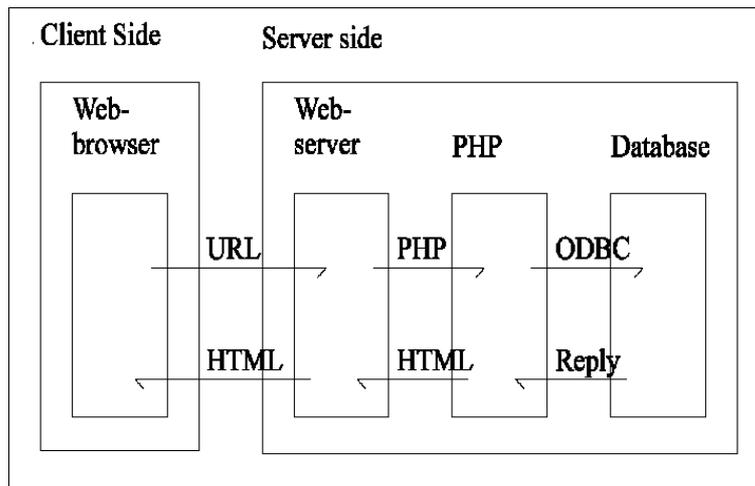
To initialise the library, we collected cases from several sources. The selection was consulted with the studio teacher in charge of the assignment. Cases in the library are entire building designs and can be represented by several media, such as text, images, graphics, 3D-models, video and sound. For each case, all information available in the library is collected in a central catalogue page with links to the corresponding files. Next to each item, additional information can be listed as to the type and source of the file, when and by whom the file was entered, etc.

### *Structure*

The underlying database that structures the library, was created with Microsoft Access 97. For each case the database inventories the address of the corresponding catalogue page as well as a set of attributes that can serve as filter criteria during retrieval. Provisionally, these attributes are architect, author (i.e. the person who entered the case into the library), building name, concept, program, site, special characteristics, surface and year of construction. We deliberately use the term 'provisionally' because as soon as the library will be in use, the user can decide to delete attributes that turn out to be irrelevant or to add new ones. Only architect, advisor and building name are obligatory indices which taken together form a case's ID. Therefore they must be specified for each case in the library and cannot be deleted. The other labels are optional and only filled in when the attribute is considered relevant. This is certainly the case for the concept, since the library is primarily intended to support conceptual design. It seemed advisable, however, to index cases with other features too. Concepts in architectural design do not appear out of the blue, but often have to do with a particular position with regard to the program, site, etc. Moreover, the extra indices allow to select cases by other than conceptual criteria. When a project was built, for example, may be indicative of the style - be it Renaissance, Baroque, Post-, Neo- or other Modernism - or of the building technique used.

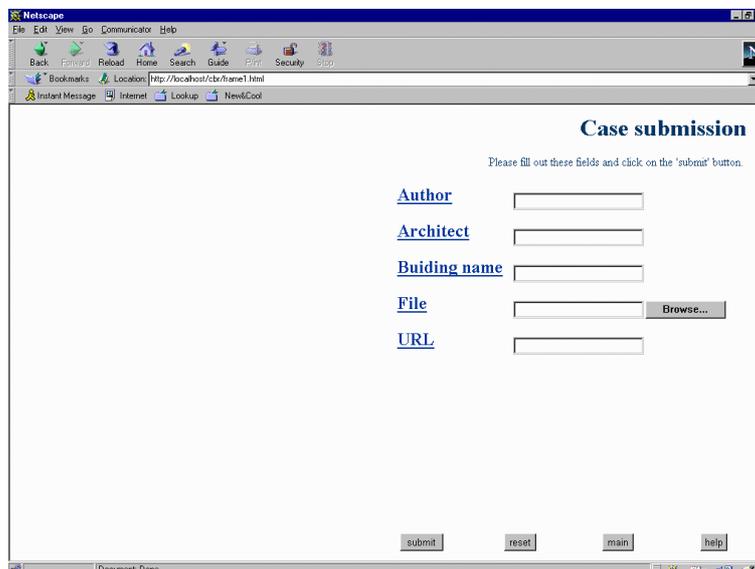
### *Interface*

The interface needed to access the library is composed of different modules (figure 1). The user interacts with the library through a standard browser like for example Netscape. He can consult the library by simply specifying the selection criteria on the search page. The query may be very simple, for instance, the name of an architect. It is also possible to enter more complex queries as to find cases that match two or more criteria. Upon submission, the server transfers the query to a PHP-script which bridges the gap between server and database. By means of Open DataBase Connectivity (ODBC), this script can search the database for cases that match the query without having to start up Access. When the search is completed, the script transmits the catch via the server to the browser, which displays the results as a list of cases with links to the corresponding catalogue pages.



**Figure 1: Chain of modules giving access to the library**

Apart from consulting the library, the interface also allows to transmit cases via the browser without having to change to another program. A user who wants to add a project, first sees a dialogue box requesting to fill in the case's ID - i.e. author, architect and building name - and to select the file(s) he wants to enter (figure 2). As soon as this mandatory information is submitted, a new dialogue box pops up with the request to specify one or more of the optional indices. In a similar way, the user can add supplementary files to cases already present in the library or label them with extra indices.



**Figure 2 : Dialogue box adding cases to the library**

### Summary and further work

Past designs have been recognised as a significant source of knowledge in architectural design. IT offers the opportunity to represent these designs not only by text, graphics and images, but also by 3D-models, computer animation, sound and video. In spite of the growing availability of multimedia archives, libraries and case bases, their contribution to the development of students' 'design craftsmanship' so far seems to be limited. In our opinion, the real potential of IT does not lie in passively providing students with information on past designs, but

in (inter)actively supporting the dynamic interplay between these designs and the student's design process. We have outlined a conceptual model of a tool that fundamentally attempts to explore this potential by using information as a vehicle to initiate, nurture and improve this interplay. Furthermore we have implemented a working prototype of the tool within the scope of a graduate's thesis. The next step is now to deploy this prototype in the design studio, on the one hand to test its functional performance; on the other and more important hand to explore the underlying theoretical ideas. Awaiting this deployment, the case library already was received with mixed feelings.

A prevalent prejudice is that its use in the design studio will considerably increase the danger of students blindly copying (parts of) previous projects, a phenomenon known as 'design fixation' (Christiaans and van Andel 1993). Yet, we strongly believe that specific designs have the potential to add to a student's pool of knowledge just as well as a lecture or a book. The present emphasis on originality and uniqueness wrongfully excludes this treasure of knowledge from informing design in the studio (Press 1998).

Another reaction we received is the suggestion to extend the retrieval mechanism of the library with a content search facility. The idea is to compare the search criteria specified by the user not only with the cases' indices in the database, but also with the text files they contain, which allows to find all documents which contain a given word. Since such search would indeed considerably increase the power of the tool, we hope to implement this extension in the near future.

A further step is to deploy the case library across multiple design studios within different classes, schools and even professional offices connected via the web so as to fully exploit its potential of knowledge exchange between (student-)architects in different contexts and at different levels of experience. However, we do not expect to undertake this step before the prototype has been tested and has proved to accomplish our goals within the walls of a single studio.

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