Relating to the 'real'

Theories for and Experiences with Educational Database Systems

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One of the most ubiquitous computer applications is the database. Common databases are capable of handling massive amounts of data, which allow users to instantly find the factual data they seek. In most cases the assistance of a database is straightforward and objective. However, when people work with databases with a rich and diverse content, this can lead to unexpected findings, surprises and possibly a revolution in their understanding of a design problem. Furthermore multimedia databases and the systems with a more enhanced set of interactive features provide more appealing results. Databases become most interesting when the creators and the users can rise the data to a level that touches knowledge, wisdom and creativity.

This paper goes into questions about the application of databases in architectural education. What can be the role of databases in the education of next generation architects? What should educators offer the students through database content, or what should be left open for creative initiatives?

We present a broad overview of possible database content, various modes of interaction with the databases and several ways of representation of the database content. The overview shows areas where educational database technology is still underdeveloped and areas where a lot of concurrent databases exist. The theoretical overview enabled us to set out a further strategy for database applications in our school of Architecture.

Besides the theory, we present our recent experiences with a database for architectural realizations. The database of buildings can be used in different educational exercises.

***Keywords**: Database, architectural analysis, content, education, design*

On the nature of the database

Literally a database is a collection[1] of data. A collection implies some kind of order or structure and, quite obviously, the collection exists for a reason. The data in a database is more or less abstract information that relates to specific phenomena. A database has one or more creators. During or after creation there are database users. Like in libraries and archives, there are persons, rules and methods related to the correct creation, collection and use of the database. In digital database applications much of this is arranged through the database design, in particular the design of the database structure and the inter-

[1] Among the descriptions for a 'base' one finds in an encyclopaedia 'that on which something is mounted and built; groundwork; foundation; a starting place in certain games'. It becomes clear the data in a database is intended to be the starting point for more intellectual and complex work.

face. However, 'passive availability' is one more aspect of the general nature of databases. This signifies that a well-designed database can only get its value through active use and a plan to activate the use.

Here the term 'educational database' will be used for digital systems that hold specific data, which can be used in architectural education. We assume that general knowledge about educational databases and their applications are important subjects to the international CAAD community. We want to nourish the discussion by stating that successful implementation of databases into the architecture curriculum implies much more than just providing collected information through a well programmed interface. The social aspects and 'the relation to the real' are of utmost importance.

The following paragraphs describe particular themes (for the nature of databases) which can be situated between technical and utility aspects. First the aspects are introduced and described, then in the next paragraph, we discuss one particular database-application in architectural education.

Modes of interaction with databases

In order to classify different types of interaction with databases, we look at the role of the database-user and the role of the database-creator (see table 1). A passive role indicates that there are no important information processes involved when the data is added or retrieved. An active role indicates that the information is reorganised. A computational active role (e.g. in the data classification process of search engines), gives the information a new structure or representation. A human active role does also reshape the information, but this can be labelled with (more human related) words like cognition and understanding.

Another classification of the interaction with databases can be seen when we look at the status of added and retrieved data. In a quite straightforward way, the information can be labelled with the words objective and subjective[2] (see table 2). We placed different kinds of databases in the matrices of table 1 and 2. This method gives an indicative (that is not prescribed) view on how we attempt to classify known types of databases.

User Creator	Passive	Active
Passive	Fixed set of data	Information structure
Active	Search engine	Information pump

Table 1. Role of the user / creator.

Query Content	Objective	Subjective
Objective	Fixed set of data	Information structure
Subjective	Search engine	Information pump

Table 2. Indication of objective / subjective data.

When a database consists of a fixed set of data, there is only the passive retrieval of information. The information is searched and used in single sessions that perform in separation from further processes. There is no evolution in the database itself. Such databases can be very efficient to provide direct access to factual information. Both the stored content and the requests for content can be straightforward and objective. In our opinion, a good example is datarq (http://www.-datarq.fadu.uba.ar/datarq/ May 2002), which shows a number of linked webpages about modern and contemporary architecture. It is obvious that such databases are useful to provide background information in design processes and education. Nevertheless, fixed and passive databas-

[2] *The authors are aware of the gradual and relative nature of the terms objective and subjective.*

es stand on their own and do not play a role in the interesting processes that can emerge from creative computer use.

A good way to facilitate and co-ordinate the active use of a database is by providing a typical information structure. The neutral structure of database-tables and possibilities to make appropriate queries to the database is crucial for the usability. Here, the user plays an active role by filling in the content of the database according to user-specific data. A well-designed information structure gives clarity to the content of the database. This clarity is a main result and advantage of the database. The user is forced and (at the same time) guided in order to get a structured view of the information. By means of clever queries and manipulation of the data on the basis of the structure, it is possible to get an alternative (subjective and personal) view that can lead to unexpected insight. An information structure can be used by a group of users in order to store content from a collaborative effort. For example when a group of teachers stores their lessons in a structured way, one can get a complete course programme (Verbeke, et. al., 2000) See the AVOCAAD projects (http://www.avocaad.org/ May 2002). The MECANO database (http://www.mecano.org May 2002) at Sint-Lucas is another example of such an educational database, which can be used to provide students with very clear and structured information about the more basic CAD-functions. A more research-focussed example is the publications database cumincad (http://itc.fgg.uni-lj.si/cumincad/ May 2002).

Opposite roles (an active creator and a more passive user), can be seen in the use of search-engine databases. The engine is a piece of active classification software that creates an enormous database of query-able keywords. The collected information can be denominated as subjective, inclusive and unfocussed. The user just needs to submit a few well-chosen and objective words to get a nicely presented set of results. Similar to working with a fixed set of data, there is no further involvement of the search-engine database in the processes of the user. The user is dependent on the catalogued information provided by the creator and preliminarily the creator (the search engine) is dependent on the bulk of information, which is then available. Internet search-engines, whether they classify the whole Internet or just a specific place of interest, create immense lists of subjective index-words. Only the Boolean operations in the user query relate two or more index-words in order to get a more or less 'objective' search request.

The 'information pump' is the most difficult database application to start and to maintain, as it depends on the commitment of active creator- and user groups. The idea is to have a database in which it is possible to find interesting information while, at the same time, it is possible to comment (annotate) and change that information or to add other information. Ideally, the information gets richer, more reliable and more refined as it is judged and altered by many people. Data in an information pump no longer have one single author. Ideas merge and change during the process. The database functions as a medium that stores, organises and reflects ideas. The content in an information pump is vivid but the database can keep track of changes in the process. The insights of the users and possible solutions to specific topics develop in an iterative way. Activity (giving, commenting, rearranging, listening) and subjectivity are the fuel to let the information pump do its work.

The same types of interaction can be found in educational database applications.

Representation types

Besides the different modes of interaction, there is a whole range of representation types that make the database communicate with its human users. Structure and meaning transform the raw

data into information, when patterns are understood the information becomes knowledge and if the knowledge provides understanding of principles, the data finally appeals for wisdom. (See also http://www.outsights.com/systems/dikw/dikw.htm May 2002).

Because an image can sometimes tell more than a thousand words, it is clear that databases can similarly give more insight if the data is represented in an appropriate way. Current databases can get multimedia interfaces with iconic, textual, numeric, spatial, imaged, key-framed animated, video, procedural and even Artificial Intelligent Agent representations. We currently investigate the opportunities to make interfaces in order to have VRML and Flash as attractive interfaces for a MySQL database. VRML agents keep track of changes and other interesting features in the database. Such interfaces become conceivable trough special functions in PHP scripts. See for the interface between MySQL – PHP – VRML: (http://web3d.vapourtech.com/workshop/php-vrml/ May 2002) and for the interface between MySQL – PHP – Flash: (http://www.flash-db.com/Ex1/ May 2002).

Persisting problems

Several problems emerge with almost each new database application. Most problems come at the start, when new users need to learn what they can expect from a database and how they need to work with it. In order to protect the database for misuse, there has to be some sort of login procedure. When passwords are forgotten, it should be easy to get them again by email. In order to keep people interested and alert, there needs to be a system that distributes awareness of database changes. Major updates to the database should not interfere with on going processes of the users. All these problems are already solved in many different ways. Solutions can be found on the Internet. However, it remains a lot of work to design and implement a specific goal compliant database in which all functionalities and the pitfalls are covered. Furthermore, when users get accustomed to use a database, they start asking for more advanced functionality and they demand a higher level of quality for the content and the interface.

As stated above, it is difficult to have continuity in commitment of all database users and creators. Several tricks are used to let databases survive in the 'Information Economy'. For example the Spanish architecture database for students and professionals [Base de Datos on: http://www.todoarquitectura.com/ May 2002] uses an amount of credits which you can earn by adding new information to the database. When you want to retrieve information from the database, you have to pay with an amount of credits. Such constructions might work, but, in the scope of educational databases, students and teachers (users and creators or vice versa) are already committed / dependant to each other. Another related question is if the database needs continuous availability of a supervisor/manager. Especially in experimental database applications (as developed in schools and at universities) it might be considered utopian to have vividly used databases that are completely stand-alone. Maintenance of databases is less interesting yet a necessity.

Current experiences with an educational database: DYNAMO

Besides the reflection on the nature of databases, we present our recent experiences with a database for architectural realizations: DYNAMO (Dynamic Architectural Memory On-line). DYNAMO is a multimedia library of architectural projects, explicitly intended to provide students in architecture with a rich source of information and inspiration. The projects are represented by photos, plans, descriptions etc. and can be selected through different criteria. (Heylighen, Neucker-

mans, 2000) This database of buildings was used in different educational exercises. We asked four different groups of teachers (3D-modelling, architectural history, design and engineering courses) and different sorts of student groups (big and small groups, second year and fourth year students, local and international students) to participate in the exploration of the possibilities of the database.

We gained insight in the application of design precedents in architectural education and the various kinds of attitudes towards the database.

The four different approaches can be summarized as follows:

Analysis exercise in the design studio, combined with 3D-modelling: retrieving 'objective' data and adding 'subjective' analyses to the database

The aim of this exercise was to explore different types of interaction and different types of information. In a first stage, groups of four to six students made a thorough study of a specific building. Each study was mainly based on information provided by the database. Additional information was found through the more 'traditional' way: research in libraries, interview with the architect etc. The major advantage of the use of the database for the students was the tremendous gain of time, while this working method also offered direct access to high-quality digital material.

Concept, contextuality, construction, building philosophy, social context etc. were analyzed. Furthermore, a summarized introduction was made concerning the architect's oeuvre. A three-dimensional representation of the building (both scale models and computer models) was also obligatory for the next stage of the workshop: a preliminary review of the analysis by the Dynamo collaborators. These 3D-models, along with the analyses, were uploaded to the database with the help of the DYNAMO-team.

A third stage consisted of a comparison between the different housing models in order to discover links and/or contrasts and to deepen certain particular aspects of the analyzed buildings. Finally, a second review took place, in which these crossed results were shown to the review team, focusing on the interpretation of these particular aspects, which were also added to the database afterwards.

Structural and technical analysis: completing the database with 'subjective' analyses

This study consisted of a detailed analysis of a specific building, hereby focussing on the following aspects: materials, construction and construction typologies. Since this workshop took place before the integration of the DYNAMO database in the educational curriculum at Sint-Lucas, all information was found without consulting the database. The results were presented using different multimedia techniques and afterwards selected by the project collaborators. Furthermore, these analyses were made available as separate web pages and linked to the database, in order to differentiate the *objective* data from the *subjective* analyses.

Historical analysis: enrichment of the database with new 'objective' data and 'subjective' analyses

The main subject of this historical analysis was the World Exhibition in Brussels of 1958. Several pavilions were analyzed by groups of two students. The analysis consisted of the following aspects: the architect's oeuvre, the theoretical concept of the pavilion, context, function and spatial construction. Since one of the aims of this study was to gather as much documentation as possible, the database was mainly used as information source for analogue projects, for instance to search for other buildings of the same period. Afterwards the gathered data and the final analysis were put in the database with the help of the project collaborators.

These experiences were applied to the earlier

mentioned classifications of interaction (passive – active) and information (objective – subjective) and the results are schematised in the following tables.

Role / Focus	Passive	Active
Objective	Design analysis (1# stage)	Historical analysis
Subjective	Structural analysis	Design analysis (2#-3# stage)

Table 3. Main roles and focus of students in their courses

Role / Focus	Passive	Active
Objective	Historical analysis	Design analysis (1# stage)
Subjective	Design analysis (2#-3# stage)	Structural analysis

Table 4. Main roles and focus of the DYNAMO team.

Eye-catching is the complementary interaction between the users (i.e. the students) and the creators (i.e. the DYNAMO team). The flow of information between creators and users appears to be necessary to establish an information pump.

Future expectations and conclusions

In the coming years we want to continue our efforts to make interesting educational- and design related- database applications. We see the metaphor of the information pump as driving force in the ongoing research. Running projects like the use and development of DYNAMO (http://dynamo.asro.kuleuven.ac.be/ May 2002) in collaboration with the CAD-lab (ASRO) of the KU-Leuven

Figure 1. Objective building information in the DYNAMO database.

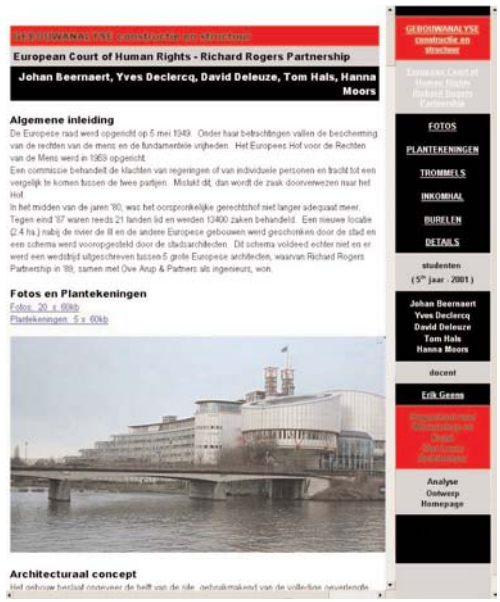

Figure 2. Partially subjective information of building analyses on the school website. DYNAMO provides hyperlinks to such student work..

should bring DYNAMO in the direction of a real information pump. Therefore we need to have more subjective building analyses of students next to the objective building data that are already available. Discussion and annotation of each other's work is a further step in that direction.

Our new proposal for a European AVOCAAD network aims at establishing a major information pump between local and European key stakeholders. The local activities are discussed in yearly conferences and other meetings. In contrast, we keep the MECANO database as a fixed set of useful instructions.

We also see our {ACCOLADE} initiative (Stellingwerff, Verbeke, 2001) for research on Collaborative Architectural Design as a major platform to develop and test information pumps in 3D enhanced collaborative design databases. We want to connect moments of activity and passivity in the design process, we want to facilitate the combination of objective and subjective information and we want to confront explicit thoughts with implicit ideas. In our view, these subjects (though still vaguely mentioned at this moment) are cornerstones in the complex processes that lead to creative design.

'Relating to the real' remains important. Databases with all their available strength need to connect to real data from the street. This makes all the educational and research efforts relevant for the increasingly complex urban situations and for the people, paths and purposes (Thiel, 1997).

In modern and academic education, the teacher should not be merely content creator / provider, nor should the student be just user of collected information. Both groups are in need for an information pump. They both benefit from an intensive interaction, about the course content, through the database.

The experiences with the building database and other experiences with several kinds of design support and educational databases show that an intense involvement of students increases the richness and appeal of the content. Interaction with the database is crucial. After a number of good experiences with the database, people become acquainted with the potentials and the database becomes part of their daily tools. It is cumbersome that most difficult aspects of using the database, such as getting a login and finding the way through the interface, are the first aspects one is confronted with. A proper introduction to the database (by technical and personal means, tutorial and help functions) can help to overcome possible setbacks.

To conclude, one may say that databases could become 'knowledge bases'. This will require that databases are properly introduced and tightly linked to the educational curriculum. They need to be managed as a 'knowledge pump'. Both students and teachers need to understand the advantages of the variety of database applications, which can only be obtained throughout intensive use and interaction. Above

Figure 3. Presentation of studentwork at Sint-Lucas. Computer presentations and more traditional presentation techniques go hand in hand.

Figure 4. Group discussion about building analyses, this is 'real interactive'.

all, establishing an interesting database content demands not only time, but also commitment, from all, creators and users.

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Acknowledgements

The authors want to thank the Flemish Government for their support for the DYNAMO project under the Flemish Innovation Fund (STIHO). They also want to thank their DYNAMO colleagues from the KU-Leuven and the teachers Joke Vermeulen, Jan Demuynck, Jan Verheyden, Johan Verleye, Erik Geens, Yves Schoonjans and all students involved.