CAAD: Education -Research and Practice
ECAADE Conference 1989
School of Architecture in Aarhus Denmark

TOWARDS A KB SYSTEM / IMAGE-DATABASES INTEGRATED INTERFACE: A TOOL FOR ARCHITECTURAL EDUCATION

Claudio Cajati

architect - researcher

Dipartimento di Configurazione e Attuazione dell'Architettura
Università di Napoli
Via Tarsia 31 - Palazzo Latilia - 80 135 Napoli
Italia

Keywords: Architecture, Education, KB System, Image-database Interface

Abstract :
Focusing on the tasks of university architectural education, a special stress is first laid on the possibility of going beyond some limits of traditional CAAD, as coming out from the recent debate, and on the opportunities offered by knowledge based systems as metadesign supports in architectural domains.
Particularly, with regard to image-databases, their importance for explaining and exemplifying the knowledge representation in KB Systems, and their integration via intelligent interface are discussed.
At last, some possible uses of the whole as an educational tool in the daily university training are proposed.

The Standing out of Knowledge Based Techniques

The international debate about the relationship between computer and design is going through a delicate phase. A diffuse and deep reflection is concerning:

- the ambiguity of CAAD: Computer Aided Architectural Design or Computer Aided Architectural Drafting? And which ones, precisely, the differences? [1]

- the computability of design [2]: which features of design - by which tools and techniques - may the computer be entrusted with?

- the roles of traditional Informatic and of Artificial Intelligence: which the tasks of the former and of the latter in relation to the design process, given the decline of the "philosophy" of the "design methods"? [3]

It is impossible here to answer so many and so difficult questions, object of a collective continuous research, What can be very briefly said. within this paper, is that many expectations, probably too high, towards the role of the computer just in the core of the design process, have been frustrated.

So the CAAD presented as Computer Aided Architectural **Design** often revealed itself as simply Computer Aided Architectural **Drafting.** On the other hand, the evaluation of the building performances as a whole is quite different from the set of controls of single performances, on their turn not simple to evaluate by proper software [4]. Analogously, the data bank has often become something like a 'maze' of information without a clear 'Arianna's thread'. Even the relational database, born just to overcome the limits of the data bank, cannot answer the request for more flexible and unforeseeable data relations. what the daily experience in architectural education and practice proposes.

Synthetically, in more general terms, either the irreducible complexity of design, spread with uncertainty, lack of information. unforeseen news, or the growing centrality of knowledge and of communication as two considerable features of our times (not only in education. research and practice) demand a more mature use of the computer.

More than direct prescriptions, certain information, precise procedures, architectural design needs indirect references and guidelines, critically presented knowledge, sophisticated euristics to deal with uncertainty and lack

of information, And that's what the applications of Artificial Intelligence like knowledge based systems nowadays seem to offer [5].

The KB Systems in Architectural Domains as Metadesign Supports

A new conscience began to ripe. Before the attempt was to try to control the design process (typical aim and illusion of the "design methods"). Now it seems better to provide a set of preliminary design aids, only aimed to help the designer to find one's bearings in relation to the decisional phases of design and, at the same time, more interactive and personally manageable than the traditional computerized tools.

KB Systems allow all that, especially if they are built just in order to constitute metadesign supports and not direct design tools. In particular, in this paper they are considered in relation to the university students' training, even more than in relation to the use in practice, so that the knowledge to be represented is more methodologically than technically oriented [6].

Once defined the university classroom as the most appropriate environment for the use of such a kind of KB Systems, the construction of these ones is tightly linked to the hypotised users and to their competence.

Such competence must move within an interval, whose minimum assure the capacity of having an useful approach and interaction with the System. and whose maximum remain at a level lover than the experts' one. In other words, the user's specific competence. within the aforesaid interval. must attain a given minimal threshold: a basic competence as a substratum for the reception of the experts' knowledge.

The complete experiences of elaborating and validating KB Systems in architectural domains are, at the present time. rather few. Generally these systems refer to the users' supposed competence by means of the symbolic level of natural language, more than through the world of images. That involves, then. the capacity or not of the users (and in any case within certain interpretative margins) to translate the indications of the system in terms of natural language into the terms of a visual culture of architecture.

The Role of Image-databases in the Knowledge Representation:
Towards an Integrated Interface

That doesn't mean, however, that the presence of image-databases in the KB System directly solve the problem of the reference to the users' competence.

And neither it immediately gives indications on how to elaborate a KB System/ image-databases integrated interface.

Therefore, in order to make this topic deeper, let's consider a specific case: a KB System for building analysis [7]. Three kinds of basic parameters may be considered:

- the viewpoints for a building analysis (for architectural recovering or new buildings' design), the two time directions ('synchronic' and 'diachronic'), the levels and scales of abstraction for such an analysis (from the max of abstraction, symbology, through topology, typology and morfology, till technology, and from the whole building, the 'macro', to the material details. the 'micro'),

- the ways to produce, store and retrieve the images (from the 'real' images of photos and slides - scanned in "pictorial" - to the 'artificial' ones like plans, elevations, sections, schemes, diagrams - built in "drafting");

- the forms of knowledge representation adopted in natural language's terms (semantic networks, 'frames', rules, etc.)

Here it is impossible, of course, to specifically consider the question with regard to many coming out problems. Nor is this the central topic of this paper. So, as an example, the stress will be laid only on one point, decisive for the management of the knowledge representation in a KB System when such a representation is realized also by images, organized in proper image-databases.

The point is the disparity between the unique individuality of any building to analyse and the types of the classifications necessary to articulate an ordered knowledge fit for a representation in the KB System. Even by the help of proper images, it is impossible to immediately take into account the difference between an indication, in the KB System, at any rate generalizing, and a single individual case in front of the user. At this point we're in the kingdom of hermeneutics: the kingdom where the user's intuition may he aided by the knowledge of the KB System.

Here is too, in front of uncertainty and lack of information, where the KB System may show its skill in the interaction with an user interested in analysing any real building, The number of images stored in the image-databases is, of course, limited, but great enough to generate a problem: to see one's way clear in what otherwise could show itself to be a dangerous maze'. Nor the ordered construction of the image-databases, according to the three above considered parameters. is enough to avoid this danger.

The problem is how the images suitable for clarifying the knowledge representation in natural language are referred to, during the interaction KB System/ user. That is, how KB System and image-databases may be linked via

intelligent interface, along the interaction, in some peculiar moments where explanation and/or exemplification by images may be provided in consequence of user's request or even automatically without any one.

A detailed answer to this question is not considered in this paper. All what can be said here is that the criteria selected for building analysis must be translated in correspondent parameters, common to the natural language's and images' knowledge representation.

These parameters may be focused according to the essence of the main knowledge representation tools used in KB Systems: rules, semantic networks, frames, etc. Let's then consider, for a moment, these tools.

The rules, resulting from empirical associations, according to the scheme <<if>> -<<then>>, may be used in building analysis, for example, in order to help to recognize and classify the main typologies. So the connected images could be, for the premise <<if>>, real images drawn from photos and slides; for the conclusion <<then>>, the proper systems generalizing the types recognizable in the many real cases.

The semantic networks, constituted by 'nodes' (objects, concepts or events), linked by 'arcs' (relations like <<is a>>, <<is a pail of>>) may answer a basic feature of the building analysis: the division in parts and elements. that assume different names according to different viewpoints, like historical, technological, structural. So, the division of the same building may be represented in different semantic networks: the images, correspondingly, will explain and exemplify these different division criteria.

Analogous hypotheses may be presented for the frames, hierarchical networks of nodes and relations, quite fit for representing general and specific concepts, just as the building analysis repeatedly proposes. In particular, frames seem to be specifically adequate to answer the wide variety of real building cases, since their nodes are defined by attributes and certain values for them.

Some Possible Uses in Education

The roles of a KB System developed in an university environment are, at least, three:

- a new and deeper conscience of the design process and of the subject whose knowledge the KB System deals with [8], just for the researchers who produced it and even for any single "expert" involved;

- a new opportunity for university education, since the students need a critical

and interactive approach to the knowledge in a phase in which their competence is very low;

- a possible tool in the practice for "non-expert" users, if the experts validate it.

Apart from the delicate and complex problem of the validation of the KB Systems, the first two roles are certainly the main ones from the viewpoint of people who are mainly interested in education and research.

We know that one of the opportunities the computer offers in educational terms is to have a powerful tool for classroom presentations at one's disposal [9]. In our case the computer may be the means to present the KB System itself and the integrated interface with the aforesaid image-databases.

According to a first possibility, therefore, the classroom demonstration may have as its object the simulation of the interaction between the user and the integrated interface KB System/image-databases. That is, a demonstration in which the emphasis is on the logics such tools work with, in order to introduce the students to the "philosophy" and the practice of their use. All that, apart from any stress on the subject of the whole, i.e. the architectural analysis.

According to a second possibility, the starting point may be the comparison - interrelation between traditional ways to design and the ones supported by the KB Systems/ image-databases integrated interface. Once again, the centre of the classroom training is not about the architectural subject we deal with.

According to a third possibility, at last, the stress is on the architectural analysis, and the KB System interfaced in an integrated way with the image-databases becomes a possible partner to better deal with the architectural analysis of a building.

In any case, the computer conquers a steady place in the classroom university education, by right co-operating with the old traditional educational tools in a multimedial integration [10]. And this one must always represent the guarantee and the symbol of a technological innovation as a further opportunity for the enrichment of human skills.

Notes

[1] These aspects of the debate, as an important subject for the contributions of the members of eCAADe, have been in particular proposed by the President. Prof. H.E. Kramel.

[2] That's the argument of a very interesting paper, titled *Computability of*

Design, presented by Prof. Y.E.Kalay at the l[st] National Conference of the Building Finalized Project (Italian National Research Council), May 3-4-5. 1989, Sorrento, Italy.

[3] About the nature and the reasons of such decline, I'm preparing an essay titled *Architectural Design: From the Design Methods of the '60 towards the KB Systems of the '90.*

[4] About the need for new approaches to the software for the computability of the technical performance of building, see the basic work by T.W. Maver, The *Computability of Technical Performnce of Building,* paper presented at the l[st] National Conference of the Building Finalized Project (Italian National Research Council), May 3-4-5, 1989, Sorrento, Italy

[5] For these concepts, see E. Burattini. *Sistemi esperti per il Recupero Architettonico (Expert Systems for Architectural Recovering),* Report on work in progress at the l[st] National Conference etc.

[6] Such a research, in the domain of Architectural Recovering within the Finalized Building Project (see also note 5), is being carried out at the University of Naples, Italy - co-ordinator Prof, E. Burattini - on a grant of the Italian National Research Council. In this regard, see E. Burattini et al., *Report on work in progress - july 89* (in press).

[7] Some conceptual bases for building analysis criteria are expressed in C. Cajati, *Geometrie dell'identità architettonica: il ruolo del disegno progettuale (Geometries of Architectural Identity: the Role of Design Drawing)* - in press.

[8] Analogously, even if at a lower grade, to use any software for CAAD involves for the user to re-consider and to closely examine one's competence in the domain of architecture and of design process. So, what sometimes architect declare, the computer to be after all only a new kind of drafting device, results to be rather reductive in relation to the actual role of revision of traditional procedures and skills that the computer involves.

[9] In this regard, see the pioneeristic work by Alan Bridges: *Computer Aided Architectural Design Education,* in Proc. of the International joint Conference CAD and Robotics in Architecture and Construction, June 25-27, 1986, Marseille, France.

[10] In this regard, see C. Cajati, A fully Integrated Use of Available Media and of Computer Technology for Up-to-date Educational Tools in Architecture , in ACADIA Workshop '86 Proceedings, October 24-26,1986, Houston, Texas.