Abstract

IPER (hypertext for the knowledge of building patrimony) is the result of a research developed with C.N.R. (National Research Institute). The aim of IPER is to provide the knowledge, the description and the management of one or more historical buildings for public or private institutions.

IPER allowed us to improve our methodology of building analysis, covering various disciplinary fields, in two different systems:

- the first one, synthetic and suitable for a group of historical buildings,
- the second one, complex and particularly made for monumental buildings;

This experience is related to the new regulation of teaching architecture in Italy made in 1993. The main novelty is the introduction of the laboratories with the contemporary presence of two or three teachers of different disciplines, working together with the students on the same project with different approaches. This opportunity allowed us to introduce the "knowledge engineer" as a teacher in the laboratory of building technology.

IPER is given to the students with the aim of experimenting and solving the theoretical and practical difficulties that students of different years may encounter in the knowledge and representation of buildings and in the organization of all the data from the case
Introduction

For many years our group has been working on the knowledge and representation of building through multimedia systems and specifically using the hypertext, both the Macintosh o.s. one and the IBM o.s. one.

The aim of our applications has three different objectives, research, operative application and didactic use:

- The first one, research, is intended to explore the possibility offered by these instruments, of enriching the methodology and representation of technical knowledge of buildings, elaborating an ipertextual instrument with flexible input and dynamic output. To this purpose we intend to integrate capabilities of multimedia management of data input and an expert characterisation of output modules, in relation with some expert systems for the diagnosis of existing building, elaborated with others experts (Burattini, De Glas and De Gregorio 1091).

- The second one, operative application or tool, is developed with the aim of offering to technical offices of public or private institutions, such as Council Administrators, Board Managers, Religious Patrimony Administrators, a flexible instrument for collecting information about their building patrimony and managing the different phases of its existence in terms of analysis, rehabilitation and maintenance (Amirante 1989).

- The third one is conceived with the aim to discover the real utility of didactic application of these objects, in particular with the new regulation of Architecture Faculty in Italy, allowing the students to test and practice specific parts of the entire system; in order to facilitate the students in managing a great variety of different information and experimenting their capability of the implementation of data, picking these from real case study. However this methodology could show them, by practice, the need of multidisciplinary work, which is, nowadays, one of the main characteristic of architects and civil engineers. This methodology could also teach the student the assumption of the systemic logic in the classification and organization of building, introduced by all the national normalizing institutions in Europe, for the quality control of building construction process (Amirante 1992a).

We produced a first experimental prototype which we called IPER (hypertext for the knowledge of building patrimony), applied to a residential building located in the historical centre of Naples, with a group of researchers, financed by the PFEd of the CNR Institution (I.Amirante, E.Burattini, C.Gambardella, A.Bosco, F.Castagneto, M.R.Di Filippo, P.Gallo, A.Montuori, etc.). During the implementation of this tirst object it was confirmed our consciousness of the complexity of the subject, the difficulties of taking in such various disciplinary fields and the need to balance the quantity and the quality of information with the capability of a normal user of managing a great variety of data and its correlation, equipped with a current P.C. (Amirante 1992b).

From this experience we have been persuaded to define two different systems:
the first one. synthetic and made in particular for one or a group of historical residential buildings with similar lexicon; the second one, more complex and particularly made for monumental buildings. The occasion for practising the second one hypothesis was offered to us by the Livorno Council Administration, who asked us to make an hypertext, according to our methodology of building analysis, in order to collect all the data they are producing during the analysis, diagnosis and project of restoration of the Goldoni Theatre, an impressive building built in 1847, designed by Giuseppe Cappellini.

**Informative instrumentation and levels of use**

The choice of operating with an hypertext has spread from the fact that it is made up of fragments of information (texts, graphics and animation); this fact can contribute to the creation of logical mechanisms similar to the human ones. The efficiency of an hypertext mainly depends on the context-sensitive relations, on the possibility of freedom in navigation, on the introduction of modifications by the user. Those three aspects originated many complex input problems which an author must face in the elaboration phases. Also in our research the choice of the hyper textual system should guarantee maximum flexibility in linking documents. In our first application, Hypercard 2.2 system allowed us to elaborate a multimedia application in which the information is organized in stacks; each stack is made up of a series of informative lists related to the possibility of linking information of a list with those of another one or also with a different stack (hyper textual linking).

In the experimental model, the information present a hierarchical tree-structure with the possibility to carry out transversal connections. (Ciribini 1985; Amirante 1992b) For each investigative field a series of information files are predicted, where the iconic - information was preferred to the textual information, in any case it has always been accompanied by photographs, movies or drawings (plans, sections, prospects, diagrams and so on) (Caturano 1992).

These images represent hot areas for the mouse, which gives the user the possibility of obtaining supplementary information about a showed element clicking on it. It is possible at any moment to access to a path utilities file which offers to the user the summary of the path he has followed and the possibility to come back to any files he has already seen.

Even if we have concentrated in these first phases of our investigations only on single buildings, the hypertext provides a structure which allows the insertion of relative information about a series of different buildings. Particularly a method of access to chosen building has been created for the user based on the cartographic or orthophotometric recognition.

Moreover a file find-key has been implemented which allows the user to quickly recognise the hyper textual files presenting particular text-key and to arrive immediately at that file.

**IPER, an hypertext for the knowledge of historical buildings**

The first prototype of IPER, as we had just underlined, was the result of a research, developed with researchers of the Cybernetic
Institute of C.N.R in Arco Felice (NA). In IPER there are seven sectors where different methods of representing the knowledge of a building are implemented: survey, environment, historical information, living spaces and technological subsystems, structural analysis, degradation phenomena. The co-ordination of the different sections is oriented to explore a series of ways of navigation for various users, according to their capabilities and needs (Amirante and Bosco 1994).

The information is also organised with a precise tree graph structure, that select the survey and the environment in a sort of preliminary sections, to which it is possible to refer directly from the other five sections, during the implementation and the use of the system. These preliminary sections collect the most objective and neutral data of the entire system.

The others, on the contrary, are organised in a particular, synthetic evaluation and correlation of the single data: we want to underline that this organisation of the data is the result of many years of practice and reflection about the methodology of analysing and representing the knowledge of building (Amirante 1992b). So, in these others five sections of IPER, the different pages represent a synthetic result of comparison of various data, according to the methodology we had chosen. For example, the method used for the technological analysis is based on systemic logic, elaborated by UNI for residential building. This logic allows a tree-graph representation of the building, from the general to the particular. The division of the building into two different sub-systems an inside environment and a technological one, allows us to distinguish between spatial qualities and technical performances.

Talking about the historical investigation of a pre-industrial masonry building without monumental elements but interesting for its typology and lexicon, the essence of the investigation proposed points out the relation between the global constructive system, relating to the first building configuration, and the logic of successive modifications.
Fig. 1 - A screen image of IPER, historical section, reading of the sources.
The synthetic methodology we realised was based on the opportunity of accessing informatic archive of historical maps to be considered as a data base that allowed us to discover the changing on the typology and lexicon of the building selected, during the five century of its existence.

The successive phase was the critical evaluation of the data, inserted in a synthetic list of modifications. Other considerations of the
data regard a visual evaluation of the drawing lists, available as data base. This phase, which could be defined as a "phase of thematic survey", is completed by a contemporary investigation of the environmental and technological sub-systems, co-ordinated through various links (Amirante et al. 1992).
Moreover the hypertext allows us to refer to a series of information, in a sort of bibliography, which can vary among:

- urban and administrative identifications of the building;
- individualisation of property units;
- record of technical administration acts, that could contain an index of documents about construction, management and maintenance;
- normative of reference;
- description and notes on previous maintenance and restructuring.

In order to help the users to take the maximum advantage of all the features of the system, we insert in the first page of IPER a help button that could explain the structure of the system if required. It was made through an animation that explains all the facilities, describing them and showing, with examples, how they work.

**The hypertext for the "Goldoni theatre" in Livorno**

The realisation of the hypertext for "Goldoni theatre" was born from the need of systematisation of all the complex and various informative materials collected by the council technical department of Livorno during the first phase of the restoration of the theatre. Engineer Cesare Rini, responsible of the technical department for Goldoni theatre project management, decided to experiment in this office the application of multimedia support for the management of this intervention as significant step of the informatisation of building patrimony management. The group involved for this project is co-ordinated by I.Amirante (Second University of Naples) and E.Burattini (Cybernetic Institute of CNR) and involves A.Bosco, F.Castagneto, M.R. Di Filippo, P.Gallo, A.Montuori.

The informative instrument to realise this program for organisation of knowledge is an hypertext that involves some notable differences with the IPER made for residential building; it uses the software for PC Toolbook 3.0 in order to facilitate the subsequent use of the technical administrators. First of all the entire program for Goldoni theatre provides two main sectors according to the phases of the restoration process: analysis and design. In this particular case our group decided to emphasise the singleness and complexity of this theatre. The difference between the various, specific activities in the building, persuaded us to choose a different kind of organising the analysis of all the data, dividing the building into five parts, referred to the specific activities of the theatre. We started with the first main sector, analysis and diagnosis, which involves also the collection and organisation of different and numerous documentary sources, such as many photos which illustrate the transformation, restoration, and consolidation works.
realised over the years; till the most recent documentation regarding the restoration of the structures. All these materials resulted in difficulty concerning consultation, whether due to a sparse dislocation on the territory or due to the lack of an organic criterion of listing.
Relating with particular functions of the building that involve different users of the informative system, we decided to organise the structure of information in five sectors, in order to allow individual routes which are extremely diverse and congruent depending on the various demand of the users, administrator, technician, manager, ordinary citizen. These sectors are: survey of the theatre, environmental context, history, the building, and its management.

- **Survey of the theatre.** First of all, starting from the original design of the architect Cappellini, and the original documentation of the whole design and realisation process, this sector shows the entire theatre in a few synthetic drawings that allow also non technician users to perceive the different parts of the theatre (synthetic survey); the second section contains all the drawings of the actual shape of the building directly implemented by DWG CAD files, in order to make easy for the technician the record of all the variations occurred during the restoration process. The other sections collect photos and archive documents.

- **Environmental context.** This sector explains the present relation between the theatre and its environment, collecting all the urban, morphological and climatic data in order to improve the quality of the project.

- **History.** This sector would link the history of the theatre with the town grown; consequently the main aspects of the section are the growth and evolution of the urban shape and its public buildings, a brief history of the main theatres in Livorno, an accurate history of the Goldoni theatre itself, that contains also the history of artistic representations and various subsequent uses (lyric theatre, drama theatre and cinema hall).
La torre del Marzocco in una litografia del 1850 ca. (Livorno, Biblioteca Labronica, raccolta Mirutelli).

per il rilancio delle attività portuali cui fanno riscontro le opere di riparazione della darsena e delle fortificazioni: costruzione di una torre ottagonale, il "Marzocco", e di una struttura fortificata sul luogo della "Torre rossa pisana". Tuttavia, il programma di Cosimo il Vecchio che vedeva in Livorno una delle basi su cui avviare una politica marittima, fallisce sul piano economico e alla fine del secolo...
Fig. 5 - A screen image of the hypertext of the Goldoni Theatre, historical section.

- **The building.** This sector is particularly oriented to technical users. The first section, environmental analysis, as we had just underlined, is organised in relation with the complexity of the theatre, dividing the entire building in five parts (environmental units). Entrance, auditorium, stage, service area one and service area two, are the environmental units explained according to theatrical functions. The other sections of the building analysis have their data organised according to these five environmental units such as technological subsystem, structural and state of conservation analysis. In these sections are illustrated the general characteristic of the building according to the systemic logic previously explained, with regard to the internal and external surfaces (Rinaldi 1992), the quality of the technical units and its constituent materials, the general static condition and that one of the significant technical units. In the state of conservation section the result of diagnostic tests and computerised simulations of the acoustic behaviour of the auditorium are systematised according to facilitate the relationship among the single data collected (Amirante et al. 1992).

- **The management.** This sector is conceived strictly related with the need of administration and maintenance problems, actually referred to the diagnosis and restoration yard (Savi 1992).

**Didactic aspects**

During the last years we have started to introduce the use of Information Technology for construction as a methodological support to educate the future professional operators at the Faculty of Architecture at the University of Naples Federico II (Amirante, Burattini and Cajati 1990). We have involved fourth and fifth year and last-year undergraduate students in the following subjects at the experimental stage as degradation diagnosis supported by an Expert System in courses of the Technology of Building Rehabilitation. In these and other similar works our programs have played a significant part for a global synthesis in students’ methodological approaches of building technology, involving the students directly in realising our different informative programs applied to their case study (Amirante, Rinaldi and Muzzillo 1992).

Since 1993 the new regulation of teaching architecture in Italy caused the necessity of renewing the didactic praxis and finding the different role of the specialised teaching, for the training of the architecture student. The main novelty is the introduction of the didactic laboratories with the aim of teaching design through practice (Gangemi 1992; Amirante 1993). The most interesting aspect of these laboratories is the contemporary presence of two or three teachers of different disciplines, working together with the students (not more than 50) on the same project with different approaches. Each Faculty could choose a mixture of disciplines in the laboratories related to the local needs and the environmental features.

Another main aspect of these new regulation is the division of the studies in three cycles: the first due to the general design approach; the second one due to the knowledge of various aspect of architecture design process; the last one due to a multidisciplinary
laboratory connected with project graduation thesis.
Our experience in particular concerns Building Technology Teaching. In the new scheme of the Faculty the technological approach is the main teaching of the Building Construction Laboratory in the first cycle. At the Faculty of Architecture of the Second University of Naples we had the opportunity to introduce the "knowledge engineer", as a teacher of the main Principle of Information Technology, in the Building Technology Laboratory, Ernesto Burattini, Italian CNR Researcher, who guided the students in their first experience in dealing with the computer science. The second step was to introduce students to the methodology of building construction with the help of our Ipermedia program named IPER.
Showing IPER to the students allowed us to improve the idea of the multidisciplinary procedure for designing building and, hopefully, in future we could experiment and solve the theoretical and practical difficulties that a second year student may encounter in knowledge, representation of building and in the organisation of all the data.

Conclusions

In conclusion of this explanation of our recent experiences, teaching with the knowledge engineer in the building technology Laboratory at the Second University of Naples, we can maintain that the didactic application of multimedia systems can have many results, but it is necessary to adequate the single programs to the capability of the users especially for the teaching of building technology. It seems very useful to develop tutorial programs specifically designed for the new teaching at the faculty of architecture. In the first cycle of the study could be useful to improve the capability of students of managing the multidisciplinary aspects of the building process and the Multimedia Systems can be used as support to the disciplinary work, but it is necessary to simplify the quantity of information knowledge required for the implementation of the data of the case study. On the contrary, during the second cycle it is possible to involve students in knowledge, representation and design of the building with the help of expert systems, hypertexts or interactive programs for architectural design, developing tutorial programs for University use. The aim is to improve the quality of design control and facilitate the confidence of the new generation of architects with these systems, which could be implemented in their work and could be in the future expanded, in order to apply to various building design problems and environmental processes.

References


