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The interface for designing

Elena Mortola

Universit di Roma "La Sapienza"
Dipartimento di Progettazione Architettonica e Urbana
CENTRO CAAD
via Gramsci 53 00197 Roma tel. 06-3221460 Fax 06-3217094

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Abstract: A case which supports the use of computer graphics in design process is presented in this paper.

The case is put forward in three stages: the first stage analyzes the relationship between drawing and design (design-by-drawing) and explores the transformations generated by the computer graphics. The second stage describes a didactic experience in the Faculty of Architecture of Rome. The third stage describes a project related to design interface.

1. Computer Graphics for drawing and design

1.1 The Architect is accustomed to designing by drawing

Before describing teaching experience at the Faculty of Architecture at the University of Rome, as far as Computer Aided Design (CAD), Computer Graphics, taught in the course on "The Theory of Design Models" (now "Design Methods") and in the post-graduate course in "Computer Aided Architectural Design" are concerned , it is advisable to comment briefly on the theoretical basis and the methodological problems underlying the use of computer graphics in designing since drawing has always played an important role in the architectural profession.

In architecture drawing is linked to design. Design is a result of the process of drawing, erasing, modifying and drawing again (B. Lawson, 1988).

Architects spend a third of their working day drawing (G. Broadbent, 1973).

Design-by-drawing involves a relationship between thinking about the design and visualizing it graphically. It means establishing a relationship between mental image and its representation.

By studying design, the mental process and the development of the designees image can be understood, even if the designs are "not faithful reproductions of the mental image (of the designer) but can only share some of the properties" (R. Arnheim, 1969).

The images can help to resolve a design problem and to arrive at a decision.

In common practice, as in the whole history of architectural design, the chief method is design by drawing, to which reference is made when we speak of an architect's production.

Although he acknowledges the fundamental role of drawing in the design process, Jones has indicated some of the limitations. It is impossible, for example, to check whether the drawing fits the outside context of the project, that is, whether it is compatible with the physical and social environment of which it is part, or whether t corresponds to the demands of users and builders, which do not depend exclusively on the geometric and dimensional aspects (J .C. Jones, 1970). Given the close link between drawing and design, it is not surprising that architects express concern about giving up a practice they have used for over 500 years, and replacing paper and pencil with a mouse and digitizer.

Their anxiety diminishes if data processing is used in the final drafts, that is, when the design has already been defined, or in the maps, statistical charts, graphs or ideograms.

1.2 Drawing is not the only design tool

Designing is not the same as art, or science, or mathematics. There are substantial differences among all these activities. The designer, unlike the artist, the scientist or mathematician, must view what will exist in the visualized future as a reality. He must establish the ways to make what he visualizes become real.

The success of a design operation depends nevertheless on the proper and well balanced use of procedures employed by the artist, the scientist and the mathematician. In order to envisage the future, the designer needs to know the present and then proceed in the same way as the scientist (he must apply systematic doubt, and have an ability to organize, conduct a controlled experiment and to interpret the results) .

But when the designer needs to envision the future, systematic doubt has no place.

The artistic approach is important when the designer must find his way in a forest of alternatives, when he has to construct a new coherent figure on which to base his decisions. In this circumstance it is important to act quickly, at the speed of thought, employing a means that can provide immediate responses and represent the synthetic "form" of the problem.

Traditionally the designer makes use of sketches and mental images outlining possible design solutions.

The mathematician's procedure consists in presenting a hypothesis, with the aid of symbols and in manipulating the symbols to arrive at a solution. This procedure can be used by the designer when the solution to the problem has already been worked out in broad general lines, that is, when the basic hypotheses no longer need to be altered to resolve conflicts arising between objectives and partial results of the design process (Giangrande, 1975).

The increasing drive to more and more sectorialization and specialization in architectural design and urban planning, owing to the complexities of the contemporary word, symbolizes acutely the existence of serious, unresolved problems which affect industrialized countries . The problems such as traffic, urban degradation, growing environmental pollution, the shortage and lack of services, all combine to make the architect's traditional methodological tool inadequate. He must admit to being ill equipped and endowed with insufficient experience to handle this broad range of issues.

Specialization within the profession of designer has meant that drawing has lost its central role as a methodological tool.

1.3 New Design Methods

In the last twenty-five years a great number of design methods have come into being and were developed further. They entail the use of techniques borrowed from various disciplines and involve the client and user in the decision-making process (J.C. Jones, 1970), (H. Sanoff, 1977).

The roots of this phenomenon can be identified in some of the experiences of the Bauhaus aimed at establishing new relationships between the designers and other operators; between design, organization of the work, social needs and new technologies (L. Martin, L. March, 1972).

Search for a more "rational" design method became explicit only towards the middle off fifties at the Hochschule fur Gestaltung of Ulm, involving many designers and experts.

The methods developed then and in the years immediately following, were described and published at the Conference on Design Methods held at the Imperial college in London in September 1952. The purpose of the conference was to "put people with common interests and objectives, who work individually or in groups, in different artistic and scientific fields, in contact with one another so that they could check the applicability of the scientific method to their specific problems, and to break down the barriers between the various disciplines and discover the possible relations between creative activities. (J.C. Jones, D. Thomley, 1963).

The causes for this change in the design process - a change that led to the gradual demise of "professional imperialism" (Gans, 1978), and to a more systematic and participatory conception of design - are to be found in the evolution in social relationships, in the recent advances in technology and especially in the increasingly obvious inability of design by drawing to respond to the complexities of the present-day problems in cities and in the environment, mentioned earlier.

The majority of designers, while aware of the inadequacy of traditional methods, are reluctant to adopt new way of practicing their profession.

Difficulty in learning and mastering the often complex techniques required to apply new methods - techniques based on operation research methods, statistics, the theory of decisions and so on - is certainly one of the reasons explaining reluctance, but not the only one.

Another reason, and probably the most important, is the designees skepticism as to whether the new methods really contribute to an improvement in design results.

In fact, this skepticism, stemming both from the inability to rationalize some of the phases of the design process, and from the drastic simplification of reality which the use of the new methods often entails, prevents many designers from examining the row methods or experimenting with them personally.

An attitude of blind faith in the empirical method used in traditional design, also contrasts with the equally acritical attitude of some methodologies, adopted with such enthusiasm that this very enthusiasm prevents a dispassionate assessment of their limitations.

This is at the basis of the split and antagonism between empirical design and methodology and represents a further obstacle to the already arduous process of redefining and recomposing the design process. (Ouaroni L. 1978).

These new, more abstract, design methods have not been widely adopted and drawing continues to be the most common way of resolving design problems (J.C. Jones, 1970).

The alternative is still that of resorting to traditional methods, that is, to design by drawing, running the risk of overlooking the complexes of reality, or of using a mixture of new methods which can often not be combined.

If on the theoretical plane, every effort should be made to increase our knowledge of the nature of design, at the practical level, it is essential to continue to experiment with new methods to select the most effective and the least simplified. We should strive to perfect them and make them more homogeneous so that they can be more easily introduced into an increasingly complex but integrated design process. (S. Diema, A. Giangrande, E. Mortola, 1988).

1.4 Drawing and computer graphics

Drawing, in the sense of representation of the mental image of the designer, is closely linked to architectural culture. For this reason is difficult to replace it.

It may be necessary to seek, and to experiment with, a new design process in which drawing, in the sense of representation of the designees mental image, and in the sense of a tool for communicating the phases which can be rationalized in that process, can coexist and interact with the methods and procedures which become necessary.

Computer-aided drawing has been in use for some time, it has now become a viable method from an economic standpoint.

Graphic applications require a processing capacity which until recently was too costly, in respect of the practical results obtained.

Low cost computer graphics, performed on a personal computer, makes it possible to do the equivalent of almost all manual operations, as well as some operations which have no manual equivalent.

The main advantage of these new methods is being able to use different parts of the drawing, over and over again and in various contexts.

When a design is first conceived , a series of elements are defined: structural elements, walls, internal partitions, windows, doors, services , etc.. These can be memorized in a graphic file and introduced into the design each time they are needed without having to be drawn again every time.

Elements may be very simple like a door for example, or a more complex such as 'group" of elements made up of hundreds of lines, arches and alphanumeric characters.

At the design level, being able to construct groups of elements which can be repeated or combined with others is an interesting possibility. A dwelling unit can be designed, for example, by combining basic residential elements (the basic rooms), which can be added to other units of the same kind , or used to make variations of those. In this way, a unit type (row or terraced units, for example) or variations of the basic type, can be created in a short space of time.

Good results can be obtained with this procedure since k is compatible with the traditional procedure of composing" by "parts", assembled (integrated) into a organic who]e. It helps concentrate attention and therefore focus on the details of the parts which are repeated.

Another extremely useful instrument for design is the "layer" (the design level) which allows different levels of the design with different information regarding a project, to be superimposed on the screen. Information relating to inside walls, to the structure, to furnishings, to the plumbing, and the dimensions, can be memorised on different sheets and visualized and printed, at the same time, or separately, according to requirements.

Computer graphics offers another important advantage that of being able to print or draw a design which has been memorized, on different scales using a platter. Any information more suitable to representation on a certain scale can be added on a separate level of the design and called up as required.

With the use of design leve4s (layers) an alteration on one layer, relating to an aspect such as the structure, can be introduced without modifying the structural part of all the layers, as would have occurred were a traditional procedure is used.

The whole correction process in general, from the copying of the designs to the alterations of the form or the thickness of the lines and the patterns, is greatly facilitated and accelerated.

Computer graphics facilitates basic map-making offering extraordinary advantages in drawing scale urban and land maps.

Manual methods require the use of costly photographic techniques to make basic maps at the right scale on which the project drawings are placed. These maps can now be made in digital form, with obvious benefits for successive editions.

Statistical maps and graphs, (pie &arts, histograms and bar diagrams, etc.) and thematic maps with regular grids or irregular areas are also much easier to produce automatically.

Being able to construct three-dimensional models of buildings, parts of cities or an area, is an invaluable aid in design.

The use of three-dimensional models has the impressive advantage of being able to obtain perspectives and then to return to a two-dimensional plane automatically, that is, of being able to move from perspective to a section, for example.

Three-dimensional modelling has many other important consequences such as that of linking requirement specifications to segments of the model in order to check the features of buildings in respect of the environmental parameters as well as that of calculating quantities of materials and relative costs.

An interesting aspect of three-dimensional modelling is being able to make three-dimensional photomontage models of architectural and engineering works in real environmental settings created on the computer.

Computer graphics allows for simulations, until recently, unheard of, making ft possible to create extremely realistic models of projects, to place models in their natural setting and to simulate the landscapes and paths within projects.

Such opportunities cannot but enhance and strengthen the design process. Nor these instruments need necessarily to be used in the final phase of the design or final visualizations, only. They can be employed as the design evolves , for controlling the arrangement of masses and their merging with the environment, which in effect help the designer to form the architectural image in his mind.

2. Teaching CAAD and computer graphics at the Faculty of Architecture of the University of Rome

2.1 Course on the Theory of Design Models and post-graduate course on COMPUTER AIDED ARCHITECTURAL DESIGN

Since 1984 a post-graduate course in Computer Aided Architectural Design has been introduced at the Department of Architectural Design and Urban Planning at the University of Rome. A summary of the programme is shown in **fig. 1** .

PROGRAM OF THE POST-GRADUATE COURSE IN CAAD (1988)

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PROGRAM OF THE POST-GRADUATE COURSE IN CAAD (1988)

1 FIRST DIDACTIC MODULE :
-FUNDAMENTALS OF INFORMATICS (Prof.A.Giangrande-arch.C. Sansoni)

2 SECOND DIDACTIC MODULE :
-QUANTITATIVE METHODS AND INTRODUTION TO GRAPHIC AND ALFANUMERIC DATA BASE (Prof. E. Mortola)
- ENVIRONMENTAL ANALYSIS METHODS (Prof. V. Calderaro)

3 THIRD DIDACTIC MODULE :
-MULTICRITERIA ANALYSIS AND EVALUATION OF IMPACT ANALYSIS (Prof. A. Giangrande)
-THE CAAD IN THE PROFESSIONAL WORK (Soc. BONIFICA)

4 FOURTH DIDACTIC MODULE :
- CAD-COMPONENTING (Prof. P. [illegible])
- THE ABACUS EXPERIENCE (Prof. A. Bridges - Univ. di Strathclyde)
- INTRODUTION TO COMPUTER GRAPHICS (Arch. C. Sansoni)

5 FIFTH DIDACTIC MODULE :
- GEOMETRIC MODELLING FOR ARCHITECTURE AND ADVANCED MANAGEMENT OF CAAD SYSTEMS (Arch. C. Sansoni)
- LANDSCAPE ANALYSIS (Arch. C. Sansoni)
- SOLID MODELLING: THE PACKAGE MINERVA (Prof. A. Paoluzzi)

Fig.1

The list of the teaching modules gives an idea of the breadth and complexity of the discipline generically entitled CAAD. Should the subjects examined in this course be limited exclusively to a post-graduate course, one might ask, at least in our university system where there is just one degree level, or should they not be gradually introduced into the normal curriculum?

In fact for more than 10 years the course in the Theory of Design Models , Design Methods and the course in Electronic Processing in Design have been the first efforts in this direction. Unfortunately, in compliance with the latest Faculty Statute these courses have had to be relegated to the fifth year with the result that they cannot be taught gradually over a three year period as the former regulations allowed. The recently introduced course in Computer Graphics is the latest effort in this direction.

An attempt was made within the framework of the course on design: one seminar of the course on Interior Design was dedicated to CAD-Componenting and the course of Design II included an additional course on the Computer Graphics . Other experiences are in the form of theses on CAD (Giangrande, Coppola Pignatelli, Mortola). Probably these various experimental endeavours should receive more recognition and CAD should be accorded a more prominent position in Faculty programs.

2.2 Degree Theses in the Theory of Desktop Models

Studies and experiments for theses required considerable application and commitment.

Fig. 2 show the thesis by A. Bartolucci entitled 'A Methodological Experiment in Computer Aided Design in Housing construction". The thesis aimed at developing a methodological process carried out by designexperimentation on PEEP project (low cost housing).

In the beginning phase it was decided to follow a traditional approach so as to underscore the architect's role in the development of the initial architectural idea The management of the design process was conducted through the construction of the specific models which could encompass and schematize the different aspects of the integrated design in the specific case of the graphic model, the parametric model and the technological model

The graphic model (developed with AutoCAD) consists of a series of drawings relating to some significant stages in the design process which can be worked out and modified interactively by the computer.

Drawings produced by the interaction with the results of other models are the partial and final results of the phases of the entire design process.

The parametric model is based on a procedure which by using macroinstructions on a spreadsheet (Symphony) makes it possible to check the typological-distributive characteristics of the design so as to cheek how they correspond to some dimensional and distribution standards.

The technological model makes it possible to assess the design in respect to the technological factors such as day light, heat dispersion and impact of solar heat.

3. Teaching research: a design interface

3.1 Why use an inteface to design.

The students were offered an interactive tool, that is a very simple machine user interface, to help the designer in the first stage of the project, that e, the stage when the project is being set up.

In particular the interface must have the following features:

1) it should be user-oriented. ensure the user can control the

process and can choose the sequence of the phases and interactively the parameters of the design using a language to communicate with the model and using all graphic features.

2) it should be a support to the designer and not attempt to suggest solutions but rather provide precise information on the solutions, worked out by the designer.

3) it should be able to integrate the multidisciplinary aspects

of the design process and should help the designer to improve the project.

It is assumed that, from the beginning of the design process the various component aspects of the design are addressed. Each phase indicates in the third column of Fig. 3 represents a module, a probiem area, as the project advances and is controlled.

The sequence of the phases is not predetermined and the designer or designers (or even sector experts) can choose phases most useful to them and, if they wish, propose others.

The interface proposed is chiefly a teaching tool, intended for students of architecture with no or little design experience, and as the dual purpose of introducing them to Design Methodology and to computer techniques which can be applied to design.

For expert architects methods like AIDA for shaping, generation. comparison and choice are more suitable.

While an expert designer might consider a defined linear iterative process too binding, d has an educational function in the classroom, because it highlights the complexity of design components and helps to identify problem areas, and helps the student to make use of available methods and design-oriented software

To develop the Interface for Designing, the Hypertalk language of the Hypercard programme is used.

From the first card of the "DESIGN" stack, the user can pass to other cards relating to each problem area in which procedures are presented for the student to develop.

It is also possible to change the phases and their sequence.

Some procedures are developed using Hypertalk, others using standard programmes which can be called up using the "button".

For example, the geometric model of the project is developed with standard programmes such as Architrion or Dimension.

With MULTIFINDER of MAC II, the HYPERCARD environment and the graphic programme environment can be shown w the screen at the same time in different "windows"

The facility to transfer data from one module to the other is necessary to guarantee easy communications between the different modules of the interface. If the system is to work well, this feature is essential.

For the designer, studying and investigating interface proceeds hand in hand with the study of the design methods. In regard to this see the publication by Nigel Cross of the Open University (Cross, 1984). It is a collection of basic essays on this topic written by those who have been involved in the field, from the beginning of its development in the early sixties to the present.

This examination is essential to ensure critical control of the phases of the process both when k is applied in its original form, as when it is modified, by choosing some of the modules, or making partial alterations.

3.2 The Development of an interface

At the moment, the interface is in the process of development. The reader will notice that some modules are less elaborate than other but that does not mean the author considers they have less weight. It simply means that they have not yet been developed, They are mentioned however to underline the complexity and the characteristics of the programme.

Some modules are described in detail, others, just touched upon, could constitute a research programme which may be developed as part of the teaching and research activities of the professors and researchers of the CAAD section of the Department of Architectural Design and Urban Planning.

At the present time, it is the main topic being studied in the ERASMUS Interuniversity Cooperation Project (ICP-88-0087-1) between the Dipartimento di "Progettazione Architettonica e Urbana" Università di Roma 'La Sapienza" and the Department of "Architecture and Building Science-Strathclyde University (ICP-88-0087-1). In Fig.4 are shown some drawings generated using programs Viewer and Vista (illustrations produced by Erasmus students: Anna Gadola e Francesca Castelli).

3.3 The phases of the design process

3.3.1 The tasks of the design

According to H.A. Simon (1973), the architect begins to design with global-type data and general features; through experience he acquires an organizational capacity for planning his work.

Initially the architect works on a poorly structured problem which, as work proceeds, a design gradually evolves ; this normally occurs after he has dealt with various problems relating to the components of the design.

Beginning with the main objectives and the main constraints imposed by costs, regulations and the environment, the designer works out, on the basis of these, some of the overall features of the project, as for example, the area or the cubic measurements. The task "in designing a house or school" elicits a list of attributes which must be specified right from the beginning of the design procedure: the characteristics regarding the land where the building is to stand, the general formal features, whether it Is to have one or more storeys, the type of structure, the material, and the technologies to be used.

'The task will also evoke from memory some over-all organization or executive programme for the design process itself" (H.A.Simon 1973).

Methods like brainstorming and the construction of a "Project objective hierarchy" may be useful at this point.

The programme MORE may be used to manage the tree of design ideas or the tree of objectives (Fig. 5).

Some ideas or sketches may be more easily inserted by hand. In this case a free hand drawing programme like SUPERPAINT, for example, may be used, or a programme suited to drawing digitized pictures with a scanner if some picture from a book or magazine is particularly suitable for clarifying or helping to form a mental image Fig. 6).

The process of forming a mental image by comparison with already existing images does not necessarily have to refer to architectural images but may refer to images of very different natures, taken from the natural world or a great variety of contexts which can stimulate the process of the generation of architectural form.

3.3.2 The land form and the historical and environmental context

This stage is very important for the evolution of the design.

Relations with the historical and environmental context usually demand considerable commitment on the part of the designer, especially when the context is special and subject to constraints.

Even the land form is important from both the viewpoint of the geometry and form of the architecture and from the viewpoint of the construction aspects.

A graphic progamme can be used in this module to simulate the land model, and any nearby building, on which, and near which, the geometric model is to be built in the next phase. This assesses the possible visual impact on the surround (See Giangrande et al., 1988).

3.3.3 Definition of the activities and space units.

Defining the design activities and translating them into space units with the specifications required, initializes the design process, and at this stage the first mental images are being formed.

Translating the activities into the space units ensures that the design process is concrete. Starting with the activities makes ft possible to investigate thoroughly the needs of the users, apart from the codified types. Introducing the space units is the equivalent of putting the main functional, physical and dimensional data into the process. The space units are considered to be a given whole of parts defined separately according to a functional profile (each with its own function). To construct the abacus each activity and each group of activities must be closely related to a space unit, represented by a series of graphic and numeric data. The optimal dimensions and the requirement specifications are defined and expressed in quantitative terms.

Each unit should be represented by a general with indications regarding the space that the equipment occupies, the furniture elements and the way the space is to be utilized by those who are to use it.

The services in terms of requirements can be defined for each unit, in particular, requirements relating to the distribution and size, requirements relating to furnishings, protection and safety, and requirements relating to the physical environment (Fig.7).

To define the space units the designer can use the already existing graphic files or charts for specific cases

3.3.4 Relations among the space units.

The methods based on activity or space interacton and grouping analysis are a sub-category of problem structuring methods (Bullock et al. 1968), (Builock, 1974), (Milne, 1971), (Tabor, 1969, 1970a, 1970b. 1970c, 1976). These methods makes it possible to visualize the structure of the relations between activity and space (as place designated for the performance of certain activities), through schemes guiding the designer in his choices.

Unlike other methods like permutational procedures, (Armour, Buffa, 1963), (March, Steadman, 197 1) or additive procedures (Whitehead, Eldars, 1964), they do not automatically generate a layout from activities, but rather identify a relational structure which does not restrict the designer too severely and can also stimulate his imaginative capacities.

Cluster analysis has a central role in many based on interaction and grouping analysis. This mathematic tool includes in fact a great variety of techniques, each of suitable for specific types of problems (Mitchell 1977).

3.3.5 Geometric Model of the Project

- Construction of the two-dimensional and three-dimensional model of the project.

For the construction of the geometric model of the project one or more two-dimensional and three-dimensional graphic programmes are used.

For the two-dimensional drawing programmes Mac Draft, Draw II, Versacad or Architrion programmes in order of increasing complexity can be used.

The last three offer the very important layer option and therefore make it possible to construct plans on layers of work, which can then be put together (combined) freely, according to need.

For the three-dimensional drawing programmes, in order of increasing complexity, Space Edit and Dimensions programmes can be used.

The choice of programme for the creation of the geometric model of the project is very tricky and depends essentially on the software suited to the problem which is available on the market.

In fact for most of the technical and environmental checks on the project data on the geometry are required, even if simplified, in terms of coordinates of the inside and surfaces describing the project.

A problem is the fact that the data necessary for one type of check are not the same as the ones necessary for another type of check.

This means that all the physical-technical, environmental, structural and normative checks must be made by using different geometric data concerning the project, required to carry out the calculation for each type of verification, for every programme used.

Transfer the project geometric data from one programme to another is difficult and certainly limits the generation of an interface for designing which is efficient and easy to use.

3.3.6 Other interface modules

Other interface modules are presently in the research stage', in particular, a programme using the HYPERTALK language of HYPERCARD can be developed for checking constraints and norms **(Fig.8).**

Checking can be done in an interactive way, in the form of questions which the programme asks the designer, or in the form of calculations on the quantitative data of the project.

This check can also be made by using a spreadsheet in whose cells calculation and control instructions for interactive verification of the norms and constraints are entered.

Structural control and physical-technical environmental check can be made by using standard programs or programmes in HYPERTALK. Cost control, too, can be done using standard programmes or by making a new one in HYPERTALK.

This check, like the preceding one, may be made at different levels of accuracy remembering that the process considered concerns the first phase of the design, normally called the preliminary design.

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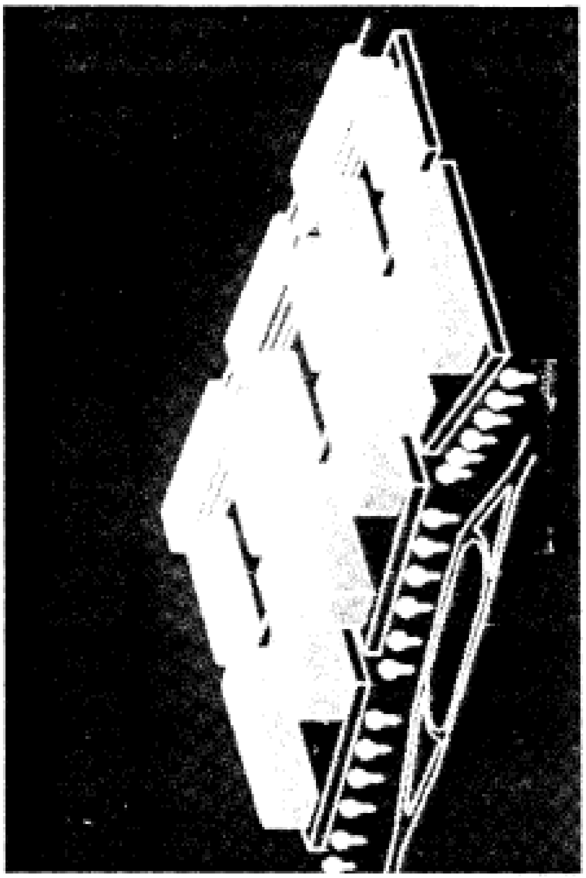
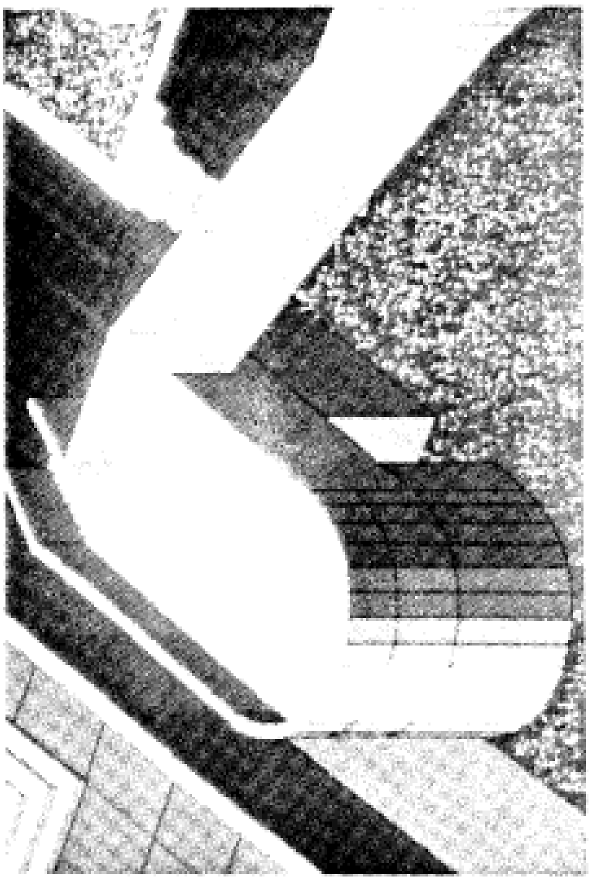
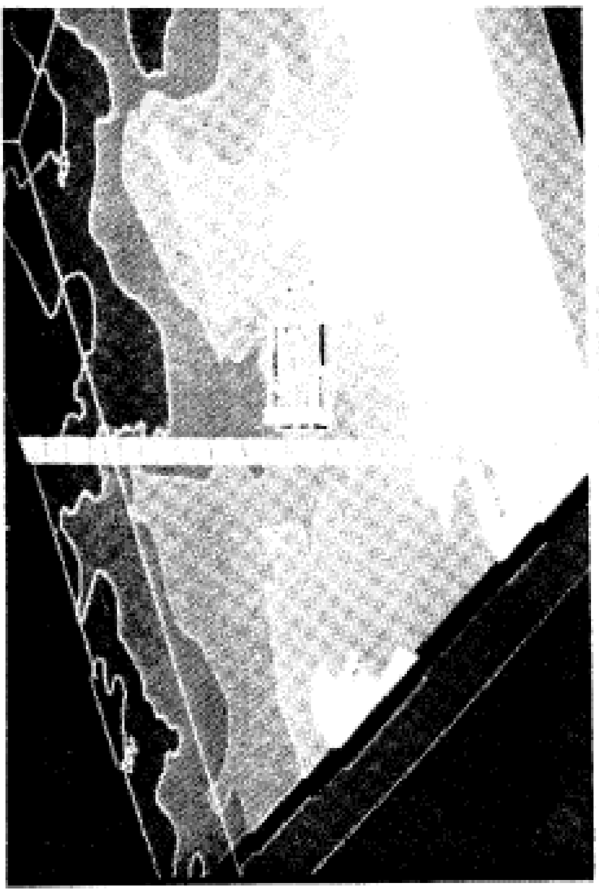
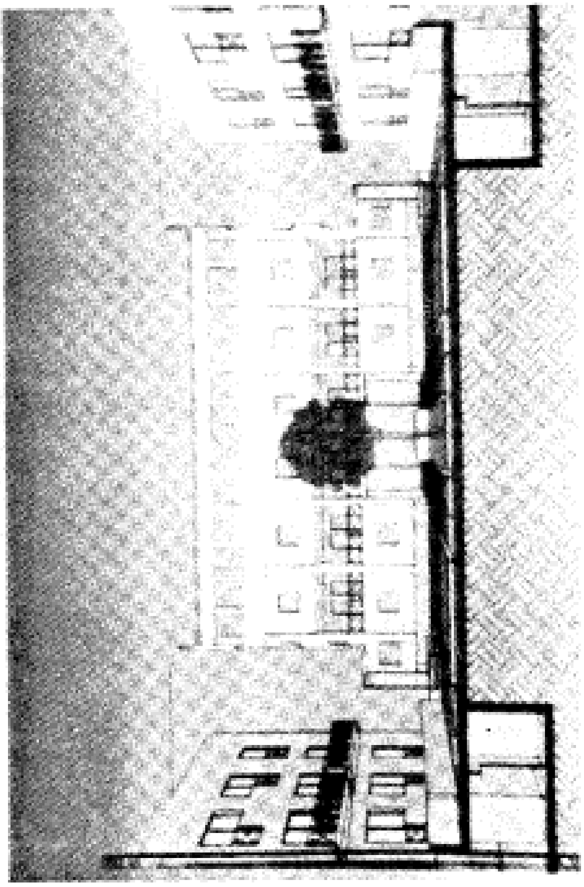
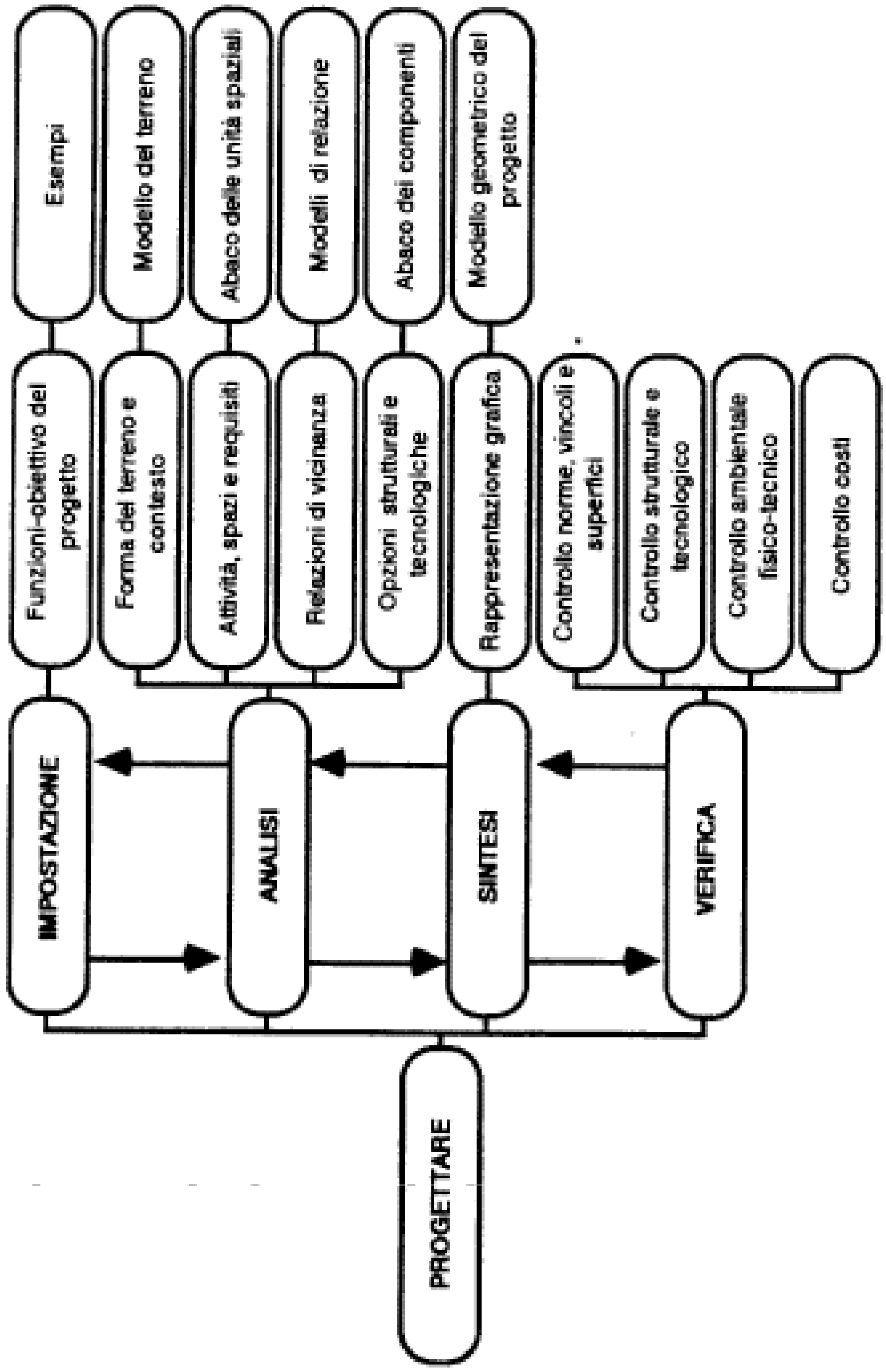
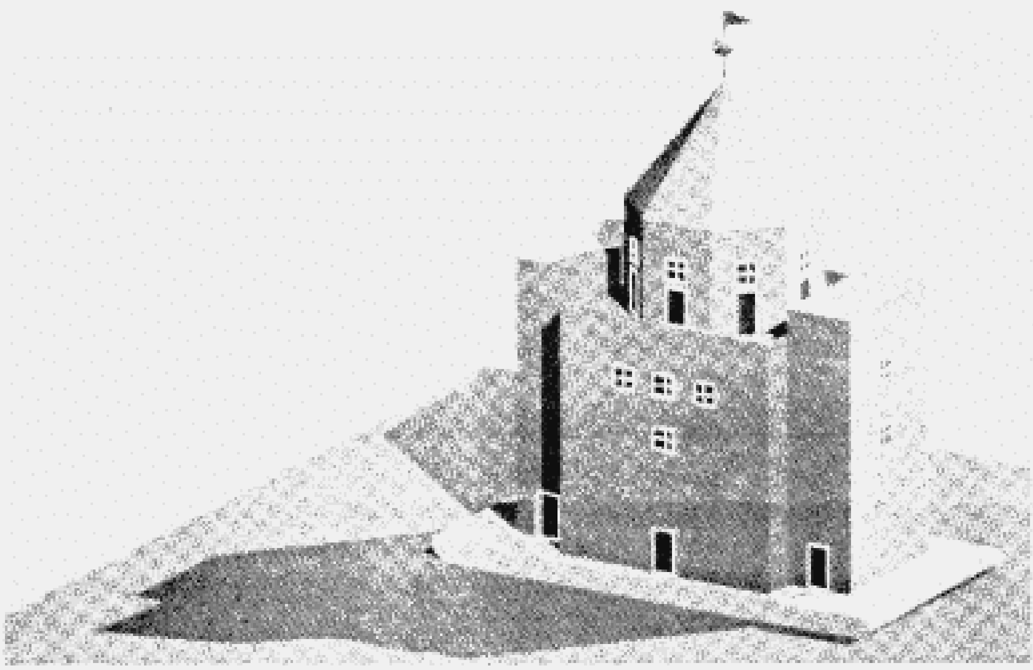


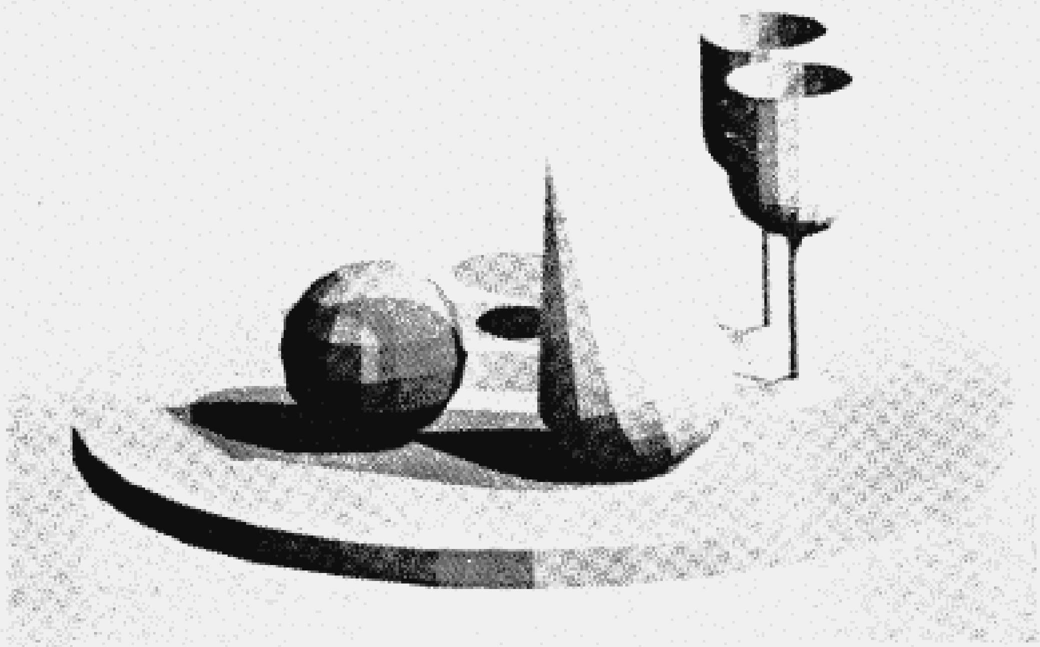


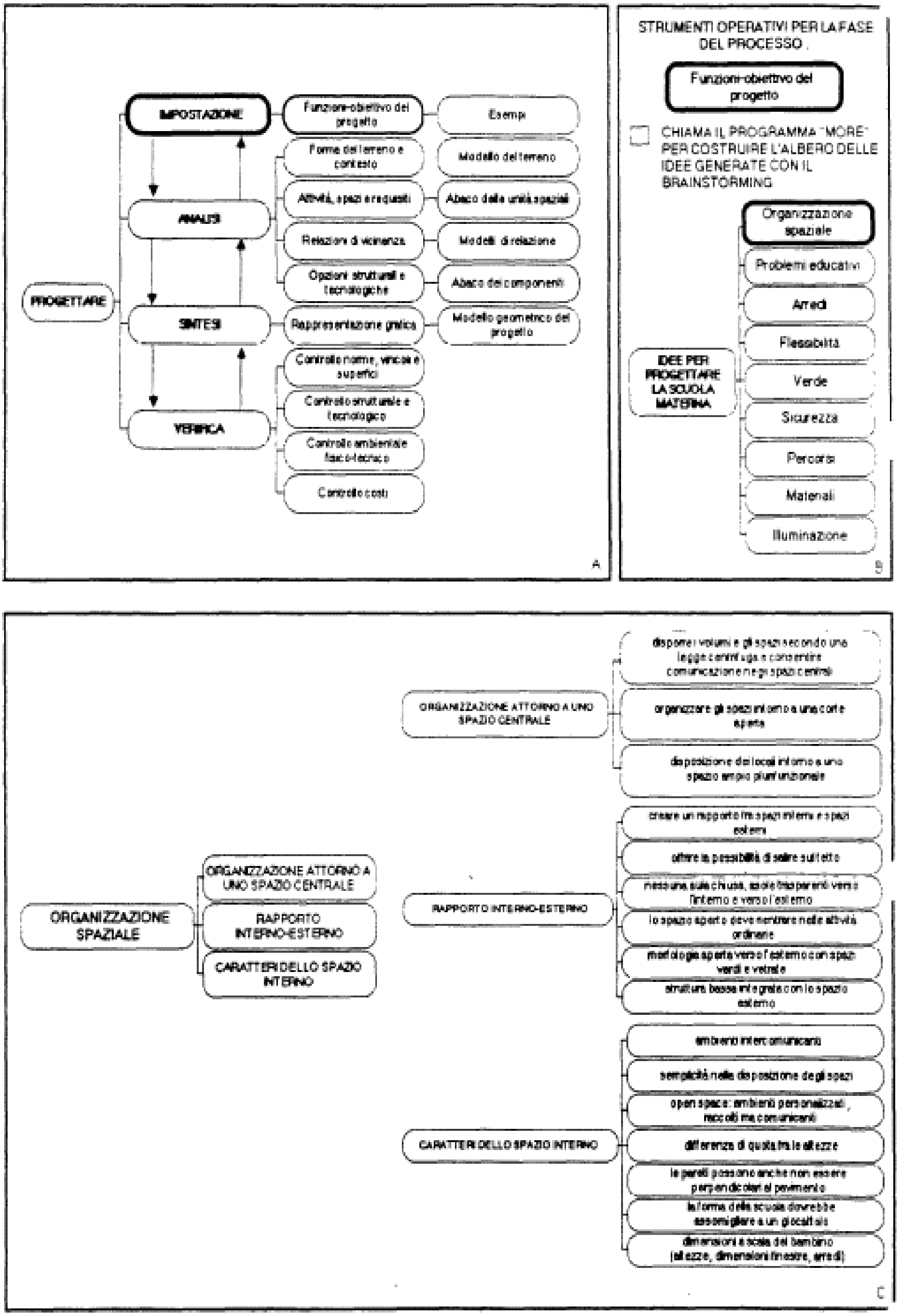





PROGETTARE
IMPOSTAZIONE
ANALISI
SINTESI
VERIFICA
Funzioni-obiettivo del progetto
Forma del terreno e contesto
Attività, spazi e requisiti
Relazioni di vicinanza
Opzioni strutturali e tecnologiche
Rappresentazione grafica
Controllo norme, vincoli e superfici
Controllo strutturale e tecnologico
Controllo ambientale fisico-tecnico
Controllo costi
Esempi
Modello del terreno
Abaco delle unità spaziali
Modelli di relazione
Abaco dei componenti
Modello geometrico del progetto






STRUMENTI OPERATIVI PER LA FASE DEL PROCESSO .
Funzioni-obiettivo del progetto
CHIAMA IL PROGRAMMA "MORE" PER COSTRUIRE L'ALBERO DELLE IDEE GENERATE CON IL BRAINSTORMING
PROGETTARE
IMPOSTAZIONE
ANALISI
SINTESI
VERIFICA
Funzioni-obiettivo del progetto
Forma del terreno e contesto
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Controllo costi
Esempi
Modello del terreno
Abaco delle unità spaziali
Modelli di relazione
Abaco dei componenti
Modello geometrico del progetto
A
IDEE PER PROGETTARE LA SCUOLA MATERNA
Organizzazione spaziale
Problemi educativi
Arredi
Flessibilità
Verde
Sicurezza
Percorsi
Materiali
Illuminazione
B
ORGANIZZAZIONE SPAZIALE
ORGANIZZAZIONE ATTORNO A UNO SPAZIO CENTRALE
RAPPORTO INTERNO-ESTERNO
CARATTERI DELLO SPAZIO INTERNO
organizzare gli spazi intorno a una corte aperta
disposizione dei locali intorno a uno spazio ampio plurifunzionale
creare un rapporto fra spazi interni e spazi esterni
offrire la possibilità di salire sul tetto
lo spazio aperto deve rientrare nelle attività ordinarie
morfologia aperta verso l'esterno con spazi verdi e vetrate
struttura bassa integrata con lo spazio esterno
ambienti intercomunicanti
semplicità nella disposizione degli spazi
open space: ambienti personalizzati, raccolti ma comunicanti
differenza di quota fra le altezze
le pareti possono anche non essere perpendicolari al pavimento
la forma della scuola dovrebbe assomigliare a un giocattolo
dimensioni a scala del bambino (altezze, dimensioni finestre, arredi)
C

Fig. 5

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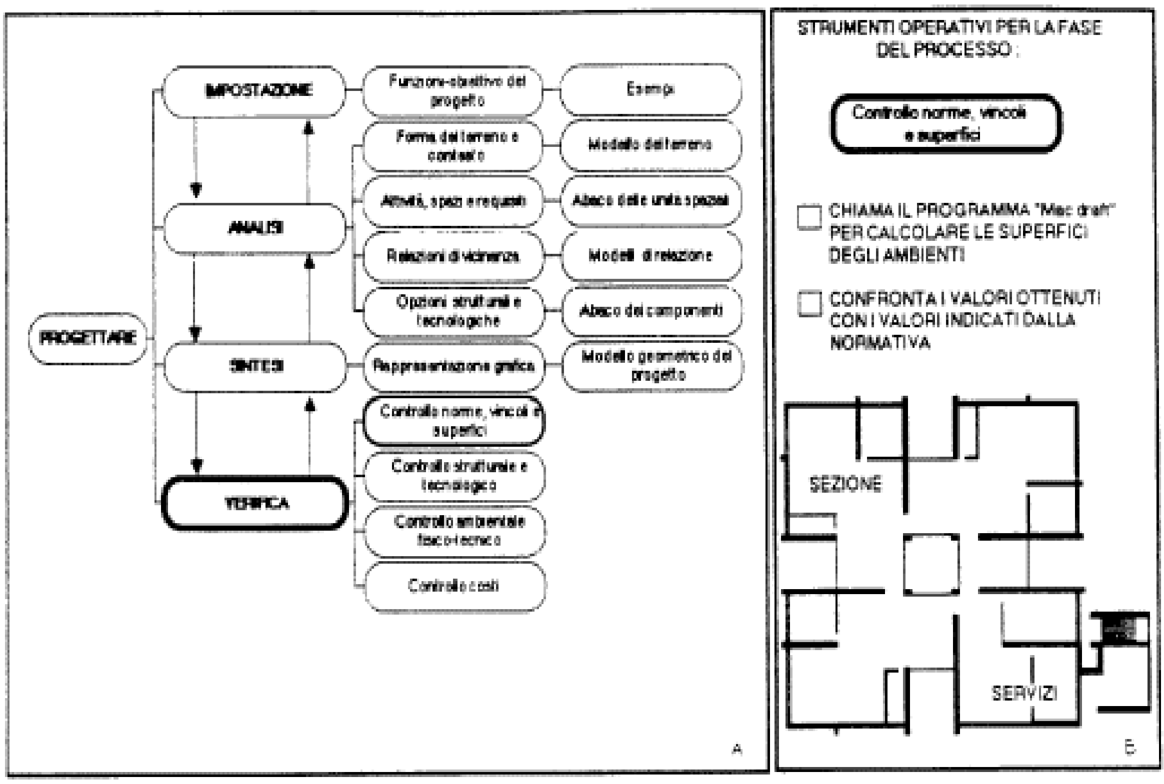
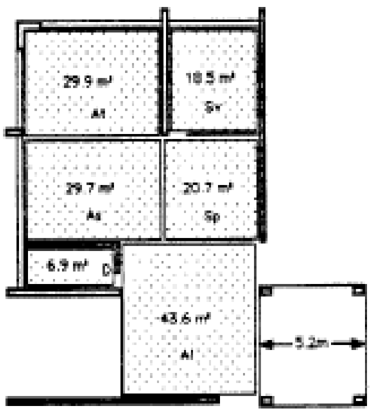
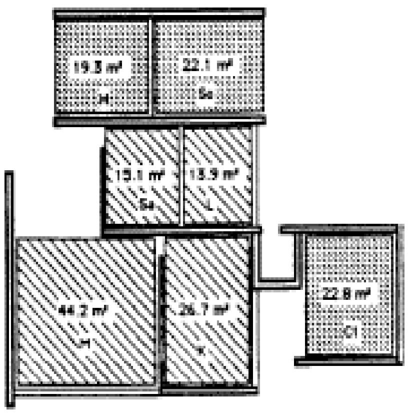




SEZIONE

		SUP	SUP TOT
ATTIVITA' ORDINATE	At -Att. a tavolino	29.9	89.7
	As -Att. speciali	29.7	89.1
ATT. LIBERE	Al -Att. libere	43.6	130.8
ATTIVITA' PRATICHE	Sp -Spogliatoio	20.7	62.1
	Sv -Lav. e servizi	18.5	55.5
	D -Deposito	6.9	20.7



SERVIZI

		SUP	SUP TOT
MENSA	M- Mensa	44.2	44.2
	K- Cucina	26.7	26.7
ASSISTENZA	Sa- Stanza Ass.	15.1	15.1
	Se- Spogliatoio e s.		
	L- Lavanderia	13.9	13.9
CONNETTIVO E SERVIZI	H- Atrio	19.3	19.3
	Sc- Spazi coperti	22.1	88.4
	Ct- Centrale ter.	22.8	22.8

C

Fig. 8