The Italian full scale model laboratory: Considerations about some tools for architectural experimentation

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Introduction
The Italian simulation laboratory carries out most of its activity within the experimental programmes promoted by the Ministry of Works. Within this context, we conducted studies based on the topics of EUROPEAN competitions for young architects, built models based on EUROPE programme's projects and analysed experimental projects directly financed by the Ministry (mainly restoration projects).

The experimental activity
In such occasions, the practice in the Laboratory comprises a few steps:

- the direct participation of both architects and clients (i.e. housing associations);

- the pointing out of experimental topics, chosen among the project ones;

- the pointing out of the study programmes in the Laboratory, which consists in building a model of the project (or part of it) with the help of our mock-up system, and studying possible variations, which are of two kinds. On one side variations are oriented to optimise the project solutions and performances, on the other side "free" variations are highlighted which can also modify the logic and the premises inspiring the designing process.

We think that the Laboratory most interesting features in this field of studies are:

- the capability to foresee a spatial idea,

- the degree of abstraction as to reality, which compels to point out the fundamental aspects of the project;

- the direct possibility to verify the variations;

- the range of design hypotheses.

The study of rule evolution
One of the latest and most interesting experiences concerned the study of architectural barriers in bathrooms. Such a kind of study was carried out on behalf of the Permanent Committee which prepares modifications and updating of the Italian regulations about this matter.

In the Laboratory we studied about twenty "typical arrangements" proposed by the Committee, and suggested some variations to modify solutions in order to optimise them.

To do that, we first studied bathrooms in relation to the other housing spaces, then we analyzed the minimal dimensions required to manoeuvre with a wheelchair and systematically tested the typical arrangements and their variations.

Fig. 1.
The Laboratory Programme for the next few months of 1994 includes a study of the development of the Building Regulations of Emilia-Romagna Region, chiefly about some spatial requirements in housing and housing facilities (accessibility, flexibility, furnishing). We will build models of several housing complexes to test them in relation to the rules as well as to requirements in daily use. Besides these tasks, we are working together with the Housing Committee towards a one-year programme for the Laboratory, which would be totally dedicated to define topological and spatial rules to be added to the National Building Regulations for public housing.

All these topics prove that the Italian Laboratory Programmes are particularly dedicated to fix and adjust rules of geometrical, dimensional, perceptive and functional aspects in relation, of course, to the home use conditions and not to the technical aspects per se.

Our experiences produced really interesting results, thanks to the systematical way of carrying out a modelling cycle in particular. This allows us to get results from the experiments which can be scientifically defined both in verifying an existing rule and analyzing a new one.

We differentiated "primary requirements", which have always to be satisfied in a bathroom arrangement, and "secondary requirements", which should be satisfied to obtain a higher level of quality. It is important - in order to define the typical arrangement - to settle the difference between the functional schemes and the real arrangements of the bathroom.
Teaching activities
The teaching activity was done with two
groups of students of the Faculty of
Engineering of Firenze and Bologna. The
topics were the following:
- the study of sample dwellings,
- the design of variations
The two sample dwellings were:
the "Horizontal Housing Unit" designed by
Adalberto Libera in 1954, and
the "Marzetti Housing Complex"
designed by Giancarlo De Carlo in 1976.
Both were considered interesting for the
study of new kinds of housing typologies.
Modelling in 1:1 the original dwellings, the
students could evaluate their quality and felt
the desire to propose some modifications to
fit the dwellings to contemporary housing
needs and standards or to analyze specific
experimental themes (accessibility, flexibility,
perception).

Fig. 4
Research activity on specific topics
The latest six months of activity were dedicated to the topic of restoration. This was a rather new field of study for the Laboratory, but we found it could be an interesting tool. As a matter of fact, one can directly compare the reality with 1:1 models and evaluate very quickly the results of variations and of different design solutions. In a case study the activity of the Laboratory gives responses to such questions as:

- At which level is it possible to conciliate the goals of restoration with the needs of technical and economic feasibility?
- How deeply is it admitted to modify the characteristics of the building to fit it to the new requirements?
- What is possible to modify the building before loosing the original identity, that is before betraying the spirit of the old building?
- How many original solutions can be kept of the building, after a deep study of its real value, of its capability to fit even today the housing needs?

Of course it is necessary that the Laboratory can simulate also the typical features of existing buildings: not standard room dimensions, particularly featured stairs, curved surfaces, windows of unusual forms and dimensions.

Another field of research is that of the so called "weak or special categories", e.g., handicapped people, students, elderly, children, all of which have specific housing needs. On this matter we worked out specific programmes in the Laboratory, which showed its utility in giving rise to a new knowledge of the real needs, perceptions, evaluations of housing for the above specific groups of people: for example we had a short but interesting project to determine the use of home spaces by children. Now we are studying students' housing (an EUROPEAN project in Pavia); at a later date we will study the theme of immigrants (which have really different housing needs and culture), as well as the one of young married couples and extended families. Besides all this we are exploring an other field of interest, i.e., that of specialised facilities in housing.

Fig. 5.
Conclusions
In our opinion, this wide range of activities shows the capability of the Laboratory to deal with different research themes. A limit is given by the dimensions of a model, which don't allow to build more than two medium sized dwellings at the same time. Another limitation comes from the impossibility to...
transfer the experimentation results to the urban planning scale. In our opinion, the activity of the Italian Laboratory demonstrates that the quality of the tool must always be evaluated in relation to the kind of activity and the specific goals.

In some occasions the technical limits of the tool can be totally unimportant; in other occasions they can stop the development of a project. Probably, some characteristics (i.e. the chance of quick modifications of the model are really very important in some occasions and rather unimportant in others. So, both advantages and disadvantages of the tool must be evaluated in relation to a specific programme, after which one can decide whether or not to use the Laboratory.

The laboratory and its relationship with the other tools for spatial simulation

**Drawings**

The traditional drawing technique is used at the Laboratory as a tool to analyze the topological characteristics of housing complexes, buildings and dwellings. It is a good tool for the analysis in the functional, structural and formal field, underlining dimensions, geometry, composition rules, formal structures, shapes of structural models. And it is the tool for the interpretation of the context, of housing and of dwellings at different levels: plans, lay-outs, grids, formal characteristics and styles.

These preliminary analysis allows us to define different models and to evaluate the choices of modification of the project by means of simple schemes, diagrams, plans.

**Computer Aided Design**

C.A.D. techniques are applied in our sim-lab for:

- preliminary evaluation of the technical feasibility of the tools for building models;
- settlement of building phases, evaluation of the kind and number of components;
- design of the model in relation to the other rules of the tool,
- preliminary control of some aspects of housing quality: geometric and

Fig. 8, and 9.

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dimensional parameters related to building regulations, relationship between form and dimension;
- preliminary evaluation of the relationship between the different rooms of the dwelling, relationship between furniture and room dimensions; visual relationship among the different rooms and between the dwelling and its surroundings.

The typical characteristics of the model (i.e. high degree of abstractness, geometric simulation of different components) together with those of CAD systems allow us to get a satisfying degree of similarity between the project and the model.

Rendering
Continuing the use of CAD one can produce images on which it is possible to evaluate the effects of light, colours and textures. Using rendering techniques, indeed, it is possible:
- to process a three-dimension (3D) drawing in which each object has its own texture, colour, shape;
- to set different kinds of light;
- to choose the viewpoints and process a sequence of images;
- to modify the characteristics of the different parts of the future building or to intervene in the illumination (day light, specs, etc.) or to simulate a "promenade" inside the drawing.

The more realistic the simulation can be, the more realistic the final result will be. We use these techniques in the field of environmental assessments, to evaluate how a project fits into a given environment. We are now evaluating the possibility to use CAD also in the Laboratory, mainly in order to study the effects of light, the visual perception, and so on.
Conclusions

The people who study today the built environment can use a lot of simulation techniques next to the above mentioned we can add also endoscopy and virtual reality. If we would have to answer a question as: "which are the most interesting tools for the Laboratory's activity?", we should say a word again about the mock-up system.

From a scientific point of view, the model is something which simulates a real situation and its effects. In other words, the full-scale modelling system is a tool to simulate, to forecast, to evaluate.

None of the simulation techniques which one can use today can be considered totally satisfying. They may be divided into three main groups:

- techniques for visual simulation;
- techniques for global perception;
- techniques for analysis / interpretation.

In the first group, the goal of the tools is to represent reality as close as possible to the original image.

Traditional drawing, CAD, maquettes and rendering stay in this field. Using them, one can get images giving information about formal aspects of architectural objects.

In the second group - the one of virtual reality - all human senses are involved in the simulation process and people are put into a "cybernetic reality". These tools don't need a direct translation to the reality they simulate: they are "self-sufficient". In both cases, none of the tools show something about the structure of spaces and objects. The possibilities of having some interactions are generally limited to the modifications of the subject conditions (points of view, position, etc.) and not of the object.

Into the third group of tools one can find 1:1 simulation Laboratories: their methodology of use includes:

- to select the parameters which describe and qualify the architectural space among the totality of its specifications;
- to build the links between these parameters, following a study of hypotheses;
- to verify and control how deep the correspondence between the conceptual structure and the formal and functional reality of the model is.

Other tools can be complementary with 1:1 modelling, but one has to use them under the point of view of the interpretation of reality, and not only as representation tools. For instance, CAD should not be used only to draw, but also as a tool to read the structural reality of a building or of a project. On the other hand, one can use CAD to simulate in advance a broad range of variations, all of which would not be interesting to be built as 1:1 models.

The same utility can be found in rendering techniques when they are used to study perception phenomena under a scientific point of view, i.e. variation in both natural and artificial light.

Therefore we can say that the qualifying character of a simulation experience is not realism but the capacity to give scientific support to the knowledge of phenomena.

In this way we think that it is possible (and useful) to combine different tools with 1:1 simulation, and it is important to have common evaluation criteria from a scientific point of view.

Conclusive considerations

One of the results of our work is that it is always necessary to evaluate the quality of the tool in relation to the goals and that one can vary its characteristics depending on the study context.

We tried to find out what the position of our 1:1 laboratory should be in the context of different tools and what the criteria could be to define which tools, under which conditions could be usefully combined with 1:1 simulation in order to improve its quality without losing its original feature.

For example, it is important, in our opinion, to improve the links between the simulation tools and the ones of the information processing which represent the structure of reality: geometric, building and environmental data, formal rules, etc.
In this way it is possible to improve the quality of modeling operations especially as a better understanding of the rules which determine the studied reality. In other words, it is possible to strengthen the links between model and reality and the comprehension of the processes causing a condition of variation to influence the other ones.

Closing the report, we would like to point out the theme of analysis and comprehension of the space perception phenomena in contemporary society. Our time is a time of fast changes, chiefly in the relationship between men and their spatial environment.

We are losing the direct experience of the space, transforming it into an artificial relation with a performed reality (cinema, television, etc.). The kind of reality might not have any relation with the physical world what so ever and we accept the fiction play of a reality which is different compared with the daily world. This happens also in the perception of home and city. In the same way, social habits are changing very fast: subjects are changing, lifestyles, and functional needs too are changing.

It is changing the way to live both domestic and public spaces. In our cities we are melting the different cultures, with different systems of values and symbols.

The group of the Italian full scale laboratory is interested in working in this dynamic field, connecting their research with scientists of other disciplines. We would like to have this exchange also at an international level, through our European Full-scale modelling Association (EFA). We trust that by implementing information about the ways of feeling and living space we will also implement the utility of our laboratories in which different tools are used for studying contemporary architectonic space.