Plan evaluation by simulation

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**Introduction**

The full-scale model in Wageningen was developed some 35 years ago and has been in use ever since. In a recent brochure about our mock-up system you will find four applications of our model: education, research, consultancy and information. In this paper some information about these four subjects will be presented in the sequence just mentioned. First some general information will be given about the system and about the methodological aspects of the use of our model, named the Structural Space Planning Method.

**Full-scale model and other aids**

Our mock-up system was developed at the end of the fifties and used for the first time when the Dreijenborch - the building where the conference took place - was opened in 1961. The initiator was prof. Hendrik van Leeuwen and the technical realisation was done by eng. Willem van Ingen. The system consists of hollow wooden blocks from different sizes, all based on the module of 12.5 cm. This was taken from 'Bautenwürfel-lehre' of Ernst Neufer. The ten centimetre module is a development of more recent date. In the years after the initial phase the system was moved: real doors, instead of hardboard turning circles on the floor, were introduced. And a ceiling construction was put in place.

In 1962 we started to make simple furniture. Ten years later a system was developed that consists of panels which, when assembled, produces volumes. The idea was that the furniture should just represent the space needed and should not refer to any special lifestyle. Therefore it is called 'functional schematic furniture'.

The initial phase started in the Dreijenborch sim-lab of 9×9×6 m, in 1975 we moved to a larger hall with more facilities and returned to the sim-lab in 1989 due to budget cuts by the university board.

Our mock-up system is one of the aids - or tools if you like - which have been developed at our department for academic teaching and scientific research in housing affairs. From the beginning of his work at this University in 1955 Van Leeuwen was convinced of the importance of aids - other then drawings - for the student to read and understand architectural plans. For an optimal understanding students should not only discuss the plans but work with it in three dimensions. They should not only do so with models on a smaller scale, but also on a realistic 1:1 scale. In application of these teaching facilities the students are expected to develop their imagination, especially with a view to the impact of an architectural design on the future users. Therefore we cannot separate the mock-up system from other aids, in particular the smaller scale models. The use of the full-scale model is part and parcel of a process. In order to systematize the design, building and maintenance process we developed the Structural Space Planning Method.

**Structural Space Planning Method and Education**

The method is a systematic development with a final result: a model for a house, or a neighbourhood, based on activities in the house or the neighbourhood. When I started my work at Wageningen University in 1967 students got the opportunity to build directly a small-scale model - a structural model - for a referent household. An important problem was, that our students did not know how to take decisions for an other household. Moreover, they possessed no guidelines to build up a model in a systematic way. So we started to develop a guideline for them. Later on we decided to work from the point of view of each student's own household situation and activities to improve the sense of reality. Ultimately we ended up with the following step by step exercises in the method.

1. Establish an inventory of the household activities and/or desirable activities in the (future) house and in the private spaces connected to the house (balcony, garden).
2. Analyze the spatial consequences of the activities defined under 1.

3. Start the spatial planning of the various activities in the house which leads to a relation-scheme.
Example, see Fig. 1: each card represents an activity.

The student has to organize these cards according to their wishes to organize the space for activities. We have divided the household activities in the following categories: communal activities, individual activities, physical care, communication and transport. In the scheme one can see how people organize those categories in relation to

![Diagram with legend]

**LEGEND**

- communal activities
- sleeping of one person
- individual activities
- care for house and furniture
- care for meals
- care for the laundry
- use of means
- personal care
- space for one activity
- activities outside the house (balcony, garden)
- two activities within the same space
- two activities within the same space - spatially separated
- two activities in two spaces with a direct connection between the spaces
- two activities in two separate spaces
- two activities in two distinctly separate spaces
each other. Are communal space and individual space mixed or do people prefer a clear separation between those two areas? Do they see a kitchen as a separate area or is it no more than a facility in a large living room, and so on. The relation-scheme gives, so to say, the basic scheme for developing the house.

4. Build a model on small-scale, the structural-model. This model is more or less the spatial translation of the relation-scheme.

5. Evaluate the structural model with the support of building a full-scale model, followed by simulation games in that model.

The students build a model on real size. During the building process they see the space develop in the model and they are faced with conflicting points. So, when the 1:1 model is ready it is possible to discuss the experience of the students so far. Staff and students decide together, which problems have to be retrieved in the simulation games.

In a group of students (20 at the most) there are players and observers of the simulation game. One of the staff members formulates the rules of the simulation games, which are everyday situations, and also formulates the questions for the observers of the games. The games are recorded on video by a technical assistant, i.e. Henk Karsh. Afterwards the video replay is been evaluated.

In our teaching programme, we mainly use the full-scale-model for evaluation of a structural-model. The method mentioned here has been published as the Structural Space Planning Method. It has been developed for our students with the main goal to help the students to realize what their needs are and their preferences will be for housing. Building a 1:1 model - on limited square meters - makes it necessary to compromise. Students working in pairs have to negotiate among themselves about priorities and about preferences. That is more or less a simulation of what people do in real design and building practice. They take their decisions on priorities and preferences, about the place where they are going to live, together with the other members of the household they are belonging to.

Premises
The structural space planning method is based on the following premises.

1. The household or household situation is the unit of analysis and not the individual wishes of the persons who play the game. Of course the individual wishes of all household members are important. But when there are limited financial resources - and in social housing there always are - these wishes have to be negotiated.

2. Simulation of the process of building your own environment. The mock-up system gives the opportunity to do so and rebuild the model as often as necessary. Building a model together is part of the realization process.

3. Phased decision-making. The idea is, that everyone can take the decisions on his or her own level. But the household does so as far as the household is faced with consequences of the decisions. The individual can do the same but only about his or her private part in the house.

Decisions about the neighbourhood remain out of the discussion in this paper, c.f. Beatrice Kesler in these proceedings.

4. An ecological approach of the built environment. This can be described as the relationship between man and the man-made environment. In our terminology: the relationship between the household and the built environment. Acts of people in relation to the acquisition, use and maintenance of housing accommodation can be understood in a perspective of household activities.

I pay so much attention to the structural space planning method to point out that building on full-scale is no separate activity,
but - an essential - part of a process. We see our mock-up system as an aid for evaluation of structure models, namely feed back on the small-scale model, on the relation scheme and on education in the principles of space use for household activities.

**Participation procedures and consultancy**

In the seventies a wave of citizen participation went over the Netherlands. That was as well participation in decision making procedures in the social housing and spatial planning as participation in design processes. In Wageningen we were at that time mostly interested in the latter one. Van Leeuwen developed his ideas about the dialogue between user and architect. The structural space planning method was adapted for supporting people to realise their housing needs and preferences, mostly by making small-scale models. Making such a model is a realization process. The model itself is more or less a visualisation of the needs and preferences. From that model one can make a list of demands and give that list to the architect to be used as a basis for the design. Our mock-up system was frequently used by laypeople (future inhabitant groups) - mostly guided by graduates from our department - for plan evaluation. From that practice we have learned that building on real size is an useful guide for prospective users to read and understand the plans, and an excellent tool for conflict management between the future user and the architect. If there is a disagreement about the size of different rooms or about the lay-out of the house it is worthwhile building it on real scale and bring the problems up for discussion right in the middle of the full-scale model. It is then possible to try out different solutions. In that situation a real dialogue can develop because the architect as well as the prospective users are motivated to bring the problem to a solution together. Dialogue is more then a discussion. It means, that the future users know what they want and are capable of challenging the architect. That, probably is an idealized picture. It does not always works out that way, because sometimes the intensity of participation is not that high that a dialogue can develop. Or, because the future users are too obedient, they want to have things explained and then make their choices, but they do not want to fight for it. Sometimes the architect operates as a leader because he does not really want his design to be discussed. So he or she starts telling people 'what their wishes really are' and 'which decisions are good for them'. You probably recognise what I mean.

In citizen participation procedures building real size models is also part of a procedure. There is always quite a long history before people finally come to our department. They have had already discussions with the architect, they have seen already drawings of the design.

Either it is planned that the conceptual design should be built on real size as part of a citizen participation procedure, or this is not planned, but later on when the conceptual design is in discussion and questions cannot be solved one may decide to go to the full-scale laboratory.

That means that full-scale simulation games are always a phase in a process and only an aid for people, no less no more.

**Intermezzo**

When in the eighties the economical recession came through, this caused quite some changes in social housing procedures in The Netherlands. There was neither time nor money any more for large and well organized participation procedures. This caused a decreasing interest for our full-scale modelling. In addition, due to economization within the university we had to reconsider our own options.

Now, there are still possibilities for people to use the model provided they pay for it. But the tariffs nowadays are more real cost based than they were before. Our main goals in the department are as ever: teaching and research. The teaching programme on the structural space planning method still exists.
The method has also been copied by other training institutes for example Academies in Household Sciences and an Academy for Ergotherapy. Some of them also use our sim-lab.

Research and/or consultancy
In the sixties some research has been done on space and behaviour. Because this is long ago and as it is not my expertise I will not discuss it here. In the seventies there were several Masters-thesis about citizen participation projects, but they don't imply any results of evaluating the use of the full-scale model. Most of our research has to do with evaluation of special projects such as social housing plans, a prison cell, a waiting room and a surgery for a family doctor, a bathroom for physically handicapped people who need technical assistance and personal care. In such projects the full-scale model is used for plan development and plan evaluation. Our department gave the technical assistance and some methodological guidance when asked.

The results of these projects are never systematically documented. Neither was there any evaluation published of the usability of the mock-up system.

The research we execute always has to do with the plans which are evaluated and not with the method of simulation games itself. Of course there are interesting methodological questions for example, whether or not you need a ceiling, what is the meaning of the functional schematic furniture, do ordinary people need more reality oriented interior design?

As you know you can only start a research project if there are practical reasons for it. There was such a reason when we needed to do research on the usability of the entroscope. Bouman wrote his PhD-thesis on the subject of a comparison of the usability of different aids - drawings, scale models, and so on - in relation to the entroscope. His main conclusion is, that the entroscope is only worthwhile in combination with other

1 A combination of lenses in front of a camera. If you use the camera with the lenses as a small-scale model you can obtain a picture as if of real scale on the in screen. How realistic this picture is depends on the reality value of the scale model. W.J.A. Bouman: De waarde van het gebruik van de entroscope in relatie tot onder meer presentatiertechnieken voor de gebouwde omgeving, thesis, Leiden, 1979. Study of the value of the use of the entroscope in relation to other presentation-techniques for the built environment.
information. It gives you something extra and is not a replacement for other aids.
More recent I have guided and supervised a field-study about the space-use and functioning of a wheelchair in the bathroom. Within this study the full-scale model is used for the evaluation of three prototypes of a bathroom used by actually handicapped people sitting in a wheelchair. After the simulation games the respondents are questioned about their favourite prototype. The research pointed out that the lay-out of the bathroom is as important as the available space.

Information
Finally the fourth topic: information sec. We have used the system to inform people about new building projects. That means, that we build for instance a house, put real furniture in it and give the opportunity to people to have a look around. About the house in display we are gathering data through a questionnaire for the visitors in which we collect their thoughts about the project. I don't say this is worthless but you probably understand it is not my favourite way of doing research. I am very convinced about the importance of a realization process and think that visiting a full-scale model is not enough. The system has mainly been developed to work with it, to feel it yourself.

to solve conflicts with other participants within the model.

Conclusion
My conclusion can be short. We took the full-scale model for granted and did not do any research on the model itself. We always use the full-scale model for developing or evaluating of either conceptual designs or models, prototypes and the like. We did not even think of doing research on the usability of our mock-up system itself because we had no reason to do so. However, living some 35 years after the technical development of our mock-up system, there certainly are new techniques these days. The system we have is still useful for teaching and research. But, I would prefer to get the opportunity - that means the money - to update our materials.