# SUPPORT / INFILL HOUSING
# and
# OPEN BUILDING

## Papers on Principles and Practice

**Volume 1 Principles, Methods and Studies**

Volume 2 Support / Infill Projects and Commentary

Volume 3 Open Building Principles and Practice

edited by
Stephen Kendall

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# Volume 1

# Principles, Methods & Studies

# Introduction

These three volumes contain a selection of papers, articles and reports on the subject of Support / Infill housing and Open Building. They date from the early 1960's and include discussion of principles and methods, projects and products. Most of the projects shown and discussed are European. The volumes are:

**Volume 1 Principles, Methods and Studies**
**Volume 2 Support / Infill Projects and Commentary**
**Volume 3 Open Building Principles and Practice**

A separate document exists on Developments toward Open Building in Japan (Kendall, 1995). It discusses 24 built projects or planned developments and products in the period 1989 - 95 in Japan. Much work preceeded that period and is unfortunately not well documented in English.

The intent of the selection is to make available in one place a body of work to give those interested in further developments in practice a good grounding in what has been done to date. It does not intend to offer specific guidance in methods in the design of supports or infill systems. The book to study for the design of supports is Variations: The Systematic Design of Supports (Habaken) (MIT Press, 1976). No specific text exists to guide developers in the design and manufacturer of infill systems. However, the work of the OBOM group at TU Delft, while mostly in the Dutch language, provides useful background. Some is included in this collection.

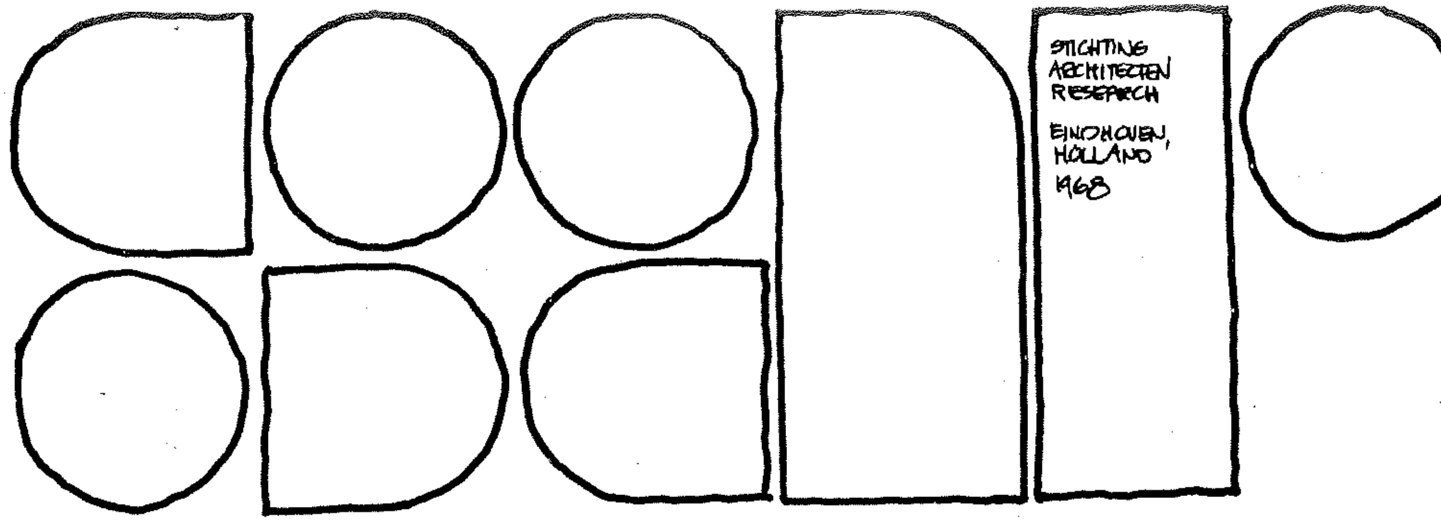
Excluded from this collection is the extensive work on the subject of TISSUES. While Support / Infill concerns the level of buildings and their (mostly interior) infill or fit-out, TISSUES concern the larger context of the urban fabric: the form and space "rules" within which individual buildings can be realized by different parties while still offering a stable, coherent context.

No effort is made to present studies related to Tissues/Support/Infill in developing countries, of which there are many. These can be found most readily in the journal Open House International.

Further, in the sphere of professional education, few published articles exist and those that do are not presented here.

# Volume 1
# Principles, Methods & Studies

## Contents




# BRIEF OUTLINE OF THE SAR PRINCIPLES & METHODOLOGY

## A.o the philosophy

In the process of mass housing as it is universally known today there is no scope for the participation of the individual dweller. This process can only operate if the non-participation of the dweller is accepted. On this principle mass housing has its logic. But if we think that the occupant should have a role in this process the logic disappears and we should therefore have to re-think everything and work out a new logic and a new process.

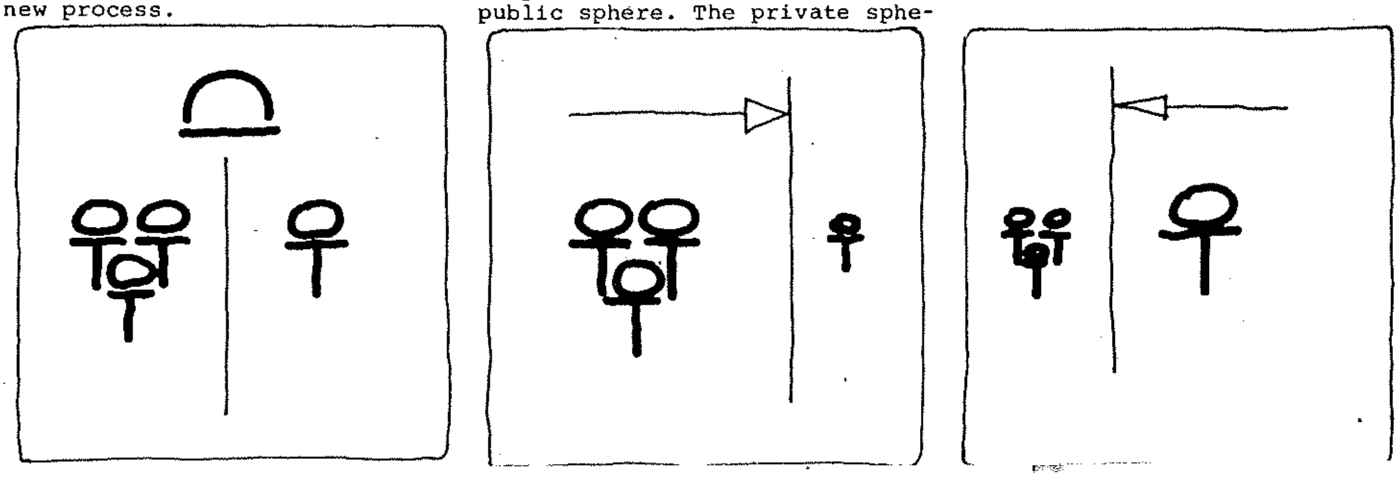
That is what SAR is concerned with - a new housing process where no dwelling will come into existence unless there is action by the dweller himself.

A dwelling always exists in two spheres, the sphere of the community and the sphere of the individual; thus we talk about a public sphere and a private sphere. We must first of all recognize these two spheres. Each sphere gives possibilities for action. Each sphere gives possibilities for production. Today, in the mass housing process everything is decided in the public sphere. The private sphere is non existent. There is no scope for the individual to exercise his opinion and take action concerning his dwelling. The result is uniformity. Where the individual is left out of the process the result is uniformity.

Conversely when everything is decided in the private sphere a kind of shanty town comes into existence. Where there is no communal role the result can be chaotic and inhuman. Somewhere between these two extremes lies a balance between technical provision on the one hand and possibilities for individual action on the other.

This is an organisatorical problem not a technical one. Uniformity in mass housing is not the result of the application of industrial methods. If we really had been able to use industry in an efficient and human way we would at least not have housing shortage; the uniformity in mass housing is the result of the elimination of the individual from the housing process.

That is the tragic condition of human settlement today : for the sake of mass production the individual has been enslaved but the possibilities of industrial production have not been gained.



# A.1 the concept

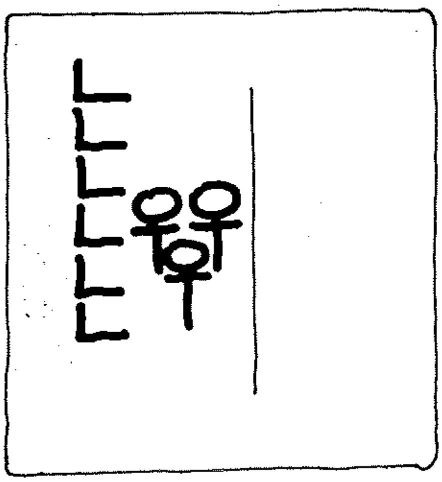
Supports and detachable units recognize the two spheres. The support is the product made in the public sphere and is made for the community. The detachable units are products about which the dweller can make decisions.
Thus, the definition of the word "support" and the word "detachable unit" is not a technical one. It is a definition based on a division of the decisions to be made. If the individual dweller can make decisions about an element of his dwelling, then this element is - by definition - a detachable unit. Regardless of the question whether this element is industrially made or not. If the dweller as an individual cannot decide about an element in his dwelling then this element is part of the support.

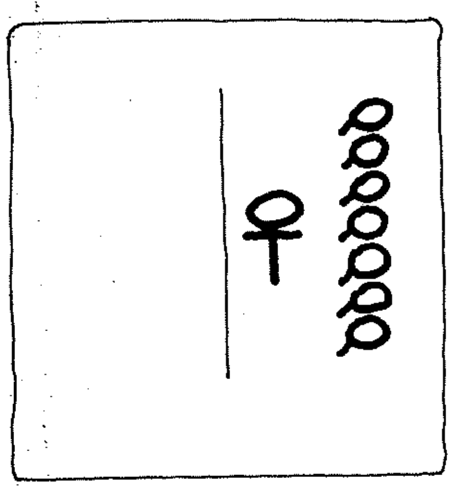
If we want to make supports and detachable units we must start with a philosophy that tells us where the decisions to be made in the public sphere will stop and where the decisions to be made by the dweller begin. Only then we can start with the design problem.

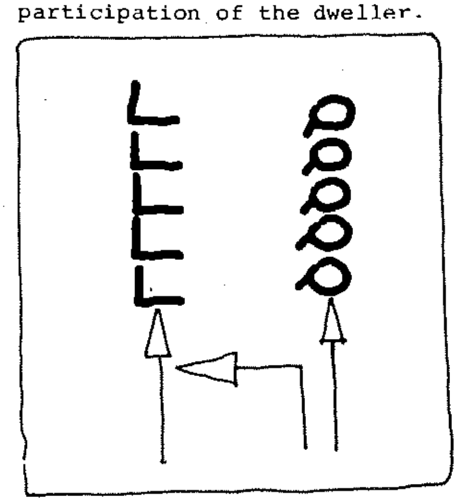
The support therefore is a piece of real estate. It is the result of a design process in the public sphere. It can be a prefabricated, but it can also be built in traditional building methods.

When the support is finished the dweller can make decisions concerning the detachable units which he would like to use to make a dwelling in the support structure.
Only then the dwelling comes into existence. Without the dweller no dwelling will exist. A dwelling is not a product to be produced. A dewlling is not a thing that can be designed by architects or anybody else. A dwelling is an act. The act of the dweller.

A detachable unit can be made as an industrial product. It can be considered as a durable consumer good.
Therefore supports and detachable units represent not only two spheres of responsibility. They are also the result of two spheres of production. The production of real-estate and the production of durable consumer goods.
In both spheres the methods of industrial production can be applied. In the building of supports the industry can produce prefabricated elements out of which the support can be built. In that case the industry serves the building trade.
In the production of detachable units the industry serves the dweller directly. This gives a relationship between producer and user that until now has been unknown in the housing process; yet this producer/consumer relationship is very well known in the field of durable consumer goods.
In the new housing process the architect should stop producing dwelling.
A dwelling is not a thing that can be designed or can be produced. Architects should design supports and detachable units. Builders should build supports. Industry should produce detachable units. The dwelling will be a result. The result of the participation of the dweller.







# B.o the methodology

To make supports and detachable units today or to give the dweller the possibility to act is not really a technical problem. In the first place we must be willing to reconsider our role as specialists in the housing process. We have to face the fact that the specialists (architects, builders, industrials, lawyers, investors, public servants) will have to make other kinds of decisions than the ones they are used to making today. Only then will supports and detachable units come into being.

The specialists must be able to communicate about the design and production of supports and detachable units. Therefore SAR has developed a methodology for the design of supports and detachable units.

This methodology is based on two sets of rules. The first set has to do with the position and dimensions of materials. The second set has to do with the position and dimensions of space.

Of course material and space complement each other. In certain situations we have to consider the dimensions, positions and the properties of materials. In other situations we may concentrate more on the dimensions, positions and properties of space. Some specialists are more occupied with the material side, others are more occupied with space. Anyone taking part in this decision making process has to deal with the fact that material and space complement each other.
How do we make decisions about materials and space? When we consider the design process we can recognize some characteristics that can give us an indication.

Firstly we may see the design process as a process in which human needs, ambitions, dreams, intuitive and instinctive values and social conventions are translated into precise inform-

ation about the way specific materials and elements have to be put together. Dreams and ideas may be (indeed must be) the starting point. But the end is a clear specification of what shall be done.
So the first characteristics of the design process is that it runs from the intangible to the tangible.

Secondly, when we start putting down our decisions on paper - whether it be in drawings or in writings - we will first work in general terms and from there go into specifics.
We make sketches and general dispositions of spaces and material. Later we will make precise plans and detailed drawings. At the outset we will consider for instance dimensions of bays and determine the places of load bearing elements.
We will initially designate areas for certain kinds of spaces and later we will determine the dimensions and positions of one particular space.
Therefore, in the design process we will work gradually from the general to the specific. This does not mean that the specific will not be considered from the beginning. But in the process itself the general arrangement proceeds gradually to the more specific final decisions.
These two characteristics of the design process: that it proceeds from the intangible to the tangible and from the general to the specific should be kept in mind if one aims at a truly workable methodology.

The first characteristics mean that in the course of the design process we gradually gain a better understanding of what we want.
The intangible qualities become more and more tangible. This means that the process itself is one of continuous re-evaluation of our aims. We cannot formulate in the beginning all the requirements to which the design should give the answer.
The requirements themselves are designed together with the building!
This means that evaluation of what we want as well as evaluation of what we will do is one and the same thing. To design is a continuous evaluation process in which the yardstick is only known fully when the design is finished. The notations that we make in the course of the process - in drawings and sketches - are therefore instruments that help us to evaluate the standards we want to use.

These documents are not unfinished plans of what will be done but a series of notes which through the evaluation process acquire a dynamic aspect stating more and more precisely the outcome of that process.

If we recognize this fact the drawing becomes a means of communication in the first place. A means of communication between all the specialists involved in the design process. These people can communicate with each other through the notations about the position and the sizes of materials and spaces.

A methodology for a dynamic design process should therefore be based on concepts and definitions that make communication possible about the positions and dimensions of all the elements that we may consider in this process.

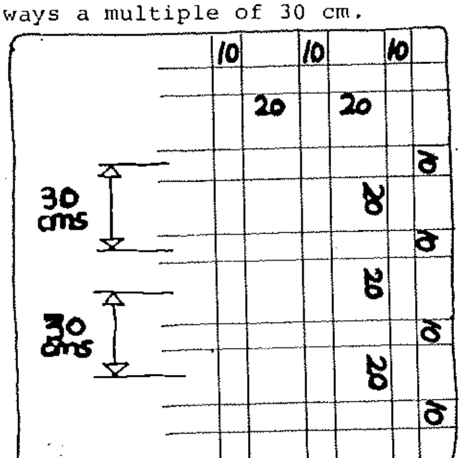
We need a language that makes statements possible about positions and dimensions of elements. In accordance with the second characteristic of the design process it must be possible to make not only specific statements but also we must be able to make general statements about the positions and dimensions of elements. Elements that can be material as well an spatial.

These observations become more valid if we consider the design of supports. In a support all different arrangements for floor plans of dwellings should be possible. This means that we cannot evaluate a support on the basis of one or two possible floor plans alone. When we design a support we have to deal with general statements about possibilities. The support have to be judged on thede general possibilities. To be able to do that we need tools to notate such general statements in the process of design.

# B.1 modular coordination size and position of material.

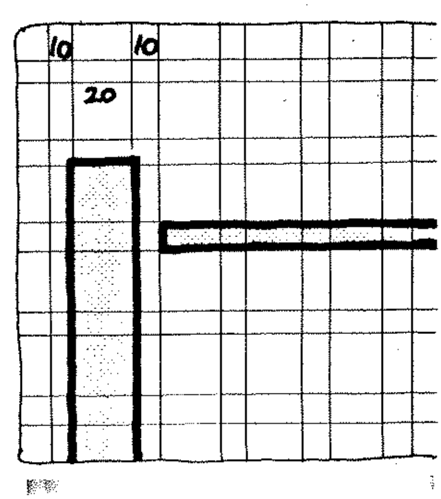
SAR considers rules for modular coordination to be useful as means for communication.
Modular coordination has too much been seen as a means for standardization of elements.
Standardization of elements however cannot be the goal of a design process. It can be the result of many well-coordinated design processes together with well-coordinated production processes. But to reach that stage we first need better means of communication. Therefore modular coordination has to be used as a means for communication and as a tool to notate design decisions. The modular grid can be a means to notate the position of elements in a very clear and understandable way. Regardsless of the question whether these elements are "modular" or not. The internationally accepted basic module of 10 cm and the prefered module of 30 cm are very useful vehicles for the communication about dimensions.

SAR uses these modules in a tartan grid of 10 cm and 20 cm bands. In this grid the centre to centre dimensions of two bands of the same width are always a multiple of 30 cm.




The tartan grid offers the possibility to make rules about the position of material in a general way. Many different rules are possible. But SAR proposes one main rule for the design of supports and detachable units.

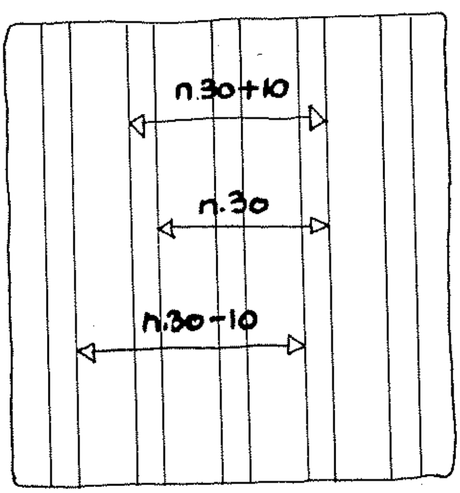
This rule states that material shall end in the 10 cm band and applies to the material of the detachable units and the suppor structure.



For the positioning of support material this rule will always be convenient. In the case of the detachable units where at present traditional materials are the main available solutions, the adherence to this rule may not always be possible. Furthermore the characteristic of "on-site" solutions make it unnecessary to comply with this rule, but in the future as and when industrially produced detachable units are readily available their installation and co-ordination with existing support structures will be immediately possible.

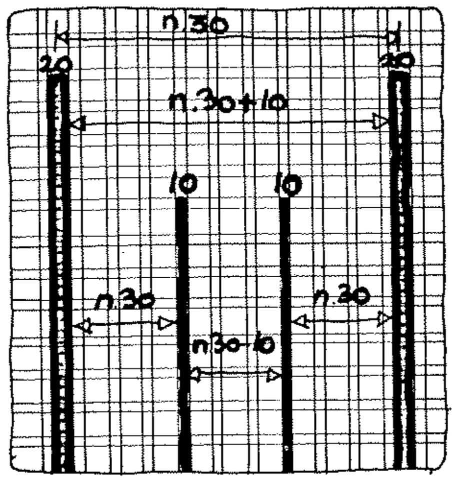
This rule also enables us to decide about the position of materials in a clear way even before we know what will be the exact dimension of an element.

For example: A load bearing wall as part of a support can be places in such a way that the material ends in two successive 10 cm bands.
The thickness of the wall in that position can be varied from a minimum of 20 cm to a maximum of 40 cm.
A wall placed in that position can still have a range of dimensions. The exact dimension can be decided upon in a later stage. Thus the 10/20 cm grid with the rule that material ends in the 10 cm band makes it possible to distribute material in space in a general way with the possibility to foresee the range of dimensions that can be choosen in a later stage of the design process.

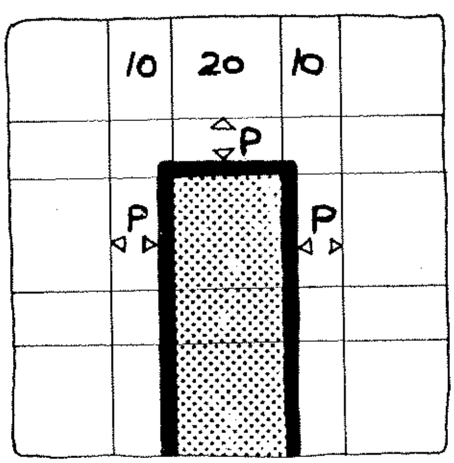


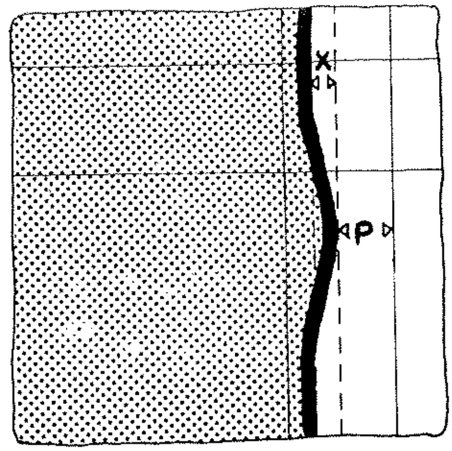

The advantage of the tartan grid is that it allows for thickness of material at a stage where the designer is mainly occupied with the distribution of spaces. He knows that the space that results from the placing of material (e.g. walls or columns) will be between n.30-10 cm. and n.30+10 cm. Thus he can work with nominal space dimensions of n.30 cms.

It follows from this general rule that the distance between two grid lines can be n.30+10, n.30 and n.30-10 cms. and the size of material and space follow the same dimensional pattern. The designer, probably preoccupied with the distribution of space can be assured that at a later stage when the exact dimension of the material is decided upon the minimum available space will always be n.30 -10 and the maximum possible space can be n.30+10.
Even in a rough sketch stage the 10 cm band rule makes the handling of material, space and measurement a very clear and easy process.



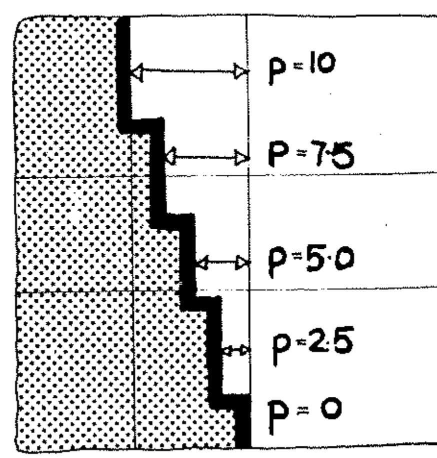

By the previous rule that material ends in the 10 cm band the general position of the material is known.
Eventually the exact position will have to be designated. This means that eventually we will have to give information about where the material exactly ends in the 10 cm band.
To do so the concept of the "fitting dimension" is introduced. The fitting dimension is the dimension from the material to the next grid line. The fitting dimension is always free space. The tolerance needed for production and positioning of the material lies outside the fitting dimension.



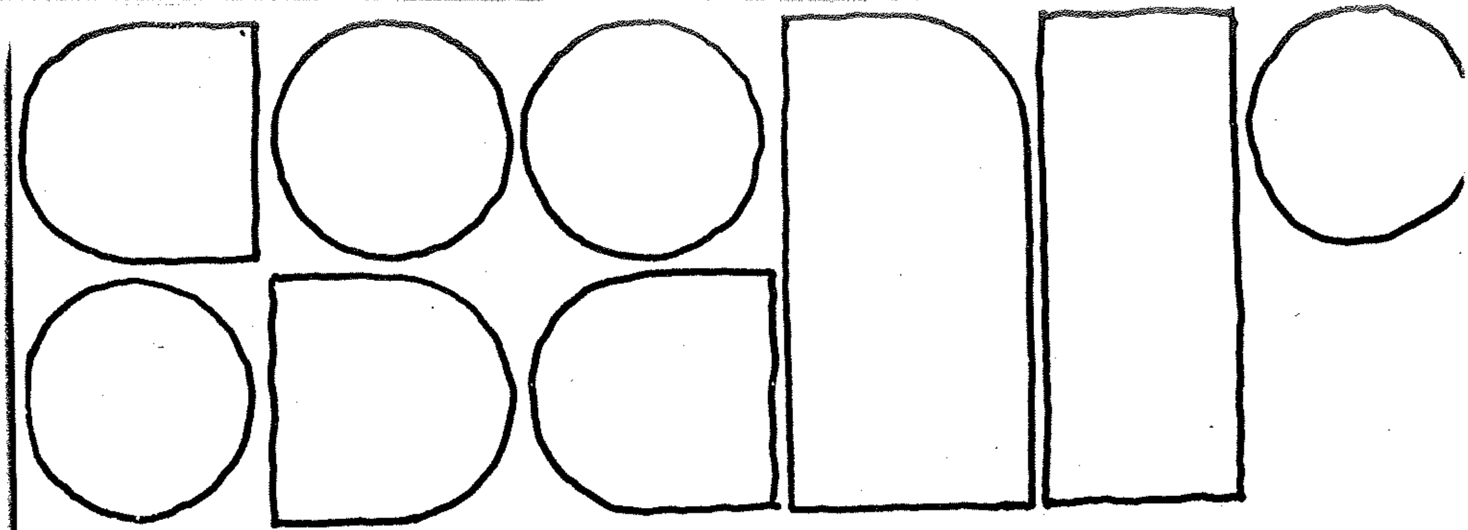




With the rule that the material ends in the 10 cm band we know that the fitting dimension will always be between 0 and 10 cm.
If we design supports and detachable units the fitting dimension is a necessary tool.

The designer of a support does not know what detachable units will be placed by the dweller in his support. The designer of a system of detachable units does not know in what supports his detachable units will be placed. But he knows that all supports will give fitting dimensions between 0 and 10 cm. With this knowledge he will be able to work out a system that will eventually fit in any support with the least trouble. Of course the rule that the material ends in the 10 cm band does not solve any problem for the designers involved. But it locates the problem and thus makes a systematic solution possible.
It would be a great advantage if from this general rule an agreement could be reached on a set of preferred fitting dimensions.
E.g. 0, 2, 4, 6, 8 and 10 cm, or 0, 2½, 5, 7½, 10 cm.




But such an agreement can only be the result of further coordination of the parties involved. The important thing is that we can use rules of modular coordination as a means of communication, that facilitates the design process.



# B.2 zones and margins size and position of space.

With the design of supports the designer has to make decisions about the position and dimension of material without knowing the floor plans that eventually will be found in the support. This means that he can not make his decision about the material of the support on the basis of a floor plan. He has to work from <u>possibilities</u> of floor plans. To be able to do so he must be able to make general statements about the possible distribution of spaces in the support.

The concept of zones and margins has been developed to make general statements about the distribution of spaces visible in a support structure design.

A zone is an area in a support to which rules are attached concerning the position and dimension of spaces and functions allowed for in the support.

The principle is as follows. First of all types of possible spaces or functions are determined. Secondly zones are defined that give possible situations for spaces. Finally rules are formulated about the position of spaces in the given zones. In any given dwelling three types of spaces can be found.

1. general living space
2. specific living space (e.g. bedrooms, study, kitchen etc.)
3. utility spaces (storage, bathroom, etc.)

These three kinds of spaces give some kind of hierarchy in each floor plan. Generally speaking it might be said that utility spaces serve specific living spaces and that specific living spaces are distributed in relation to general living spaces. Experience shows that the specific living spaces are the elements that determine the floor plan. Their patterns designate the pattern of living in the dwelling. They are the spaces for specific use.

The activity patterns in the dwelling are reflected by the relationship of these specific living spaces.

In a support structure four zones can be defined.

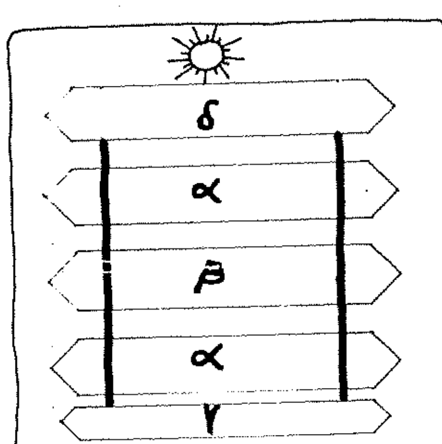
$\alpha$-zone : inside space for private use with relation to outside space.

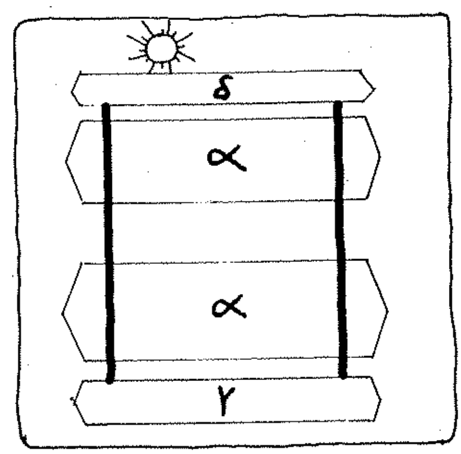
$\beta$-zone : inside space for private use without relation to outside space.

$\delta$-zone : outside space for private use (balcony, garden, loggia).

$\gamma$-zone : space for public use (circulation) either inside or outside.

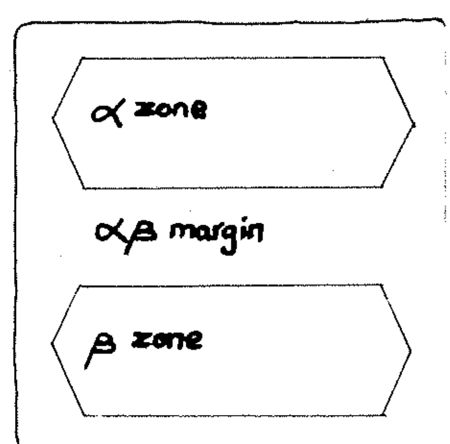
In different climates different zonings may be necessary. In example 2 most of the inside space for private use has a relation to the outside space.



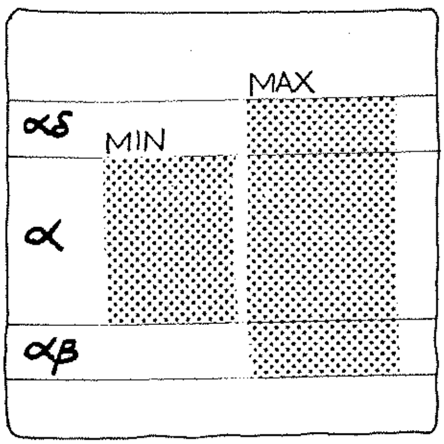

In fact any type of dwelling can be defined by its particular arrangement of zones. The relation of an arrangement of zones therefore can be seen as the notation of a type of dwelling without giving a floor plan.

Between two zones will be a margin. The margin has the properties of the two adjacent zones. It derives its name from these zones. (E.g. the margin between the $\alpha$- and $\beta$-zone is called $\alpha\beta$ margin.



Now the elements out of which a floor plan is made are known (the 3 types of spaces) and the areas are known in which these elements can be found (the zones). Next we have to regulate the relation between the spaces and the zones.

To do this SAR works with one general rule: specific living spaces will end in two successive margins.
This rule means that the dimensions of specific living spaces are related to the width of zones and margins. The width of a zone will always be the minimum depth of a specific living space located on that zone. The width of a zone and the two adjacent margins gives the maximum depth of a specific living space located on that zone.




By giving dimensions to the zones in a support the designer makes a statement about the dimensions of specific living spaces that must always be possible in the given support. Consequently the zones give information on two things:

1. the general pattern of possible distribution of spaces that can be deducted from the arrangement of zones (type of dwelling)
2. the minimum and maximum dimensions possible for the specific living spaces.

Thus, if a support is designed on an arrangement of zones an evaluation of that support is possible.

We can "read" the possible dimensions and distribution of spaces and compare them with any given set of standards we want to apply concerning these properties. For that reason the zones also are an expedient for the design of the support itself.

The designer of a support uses an arrangement of zones as a base to draw conclusions in the design process. The zones enable him to find the best location for ducts, openings in floors or walls, places to connect wiring and piping from the support to those in the detachable units and so on.

At the same time the zones allow him to judge the implications of these decisions on the possible arrangements of spaces left. One might say that each decision that adds elements to the supports will limit the number of variations possible in the support.

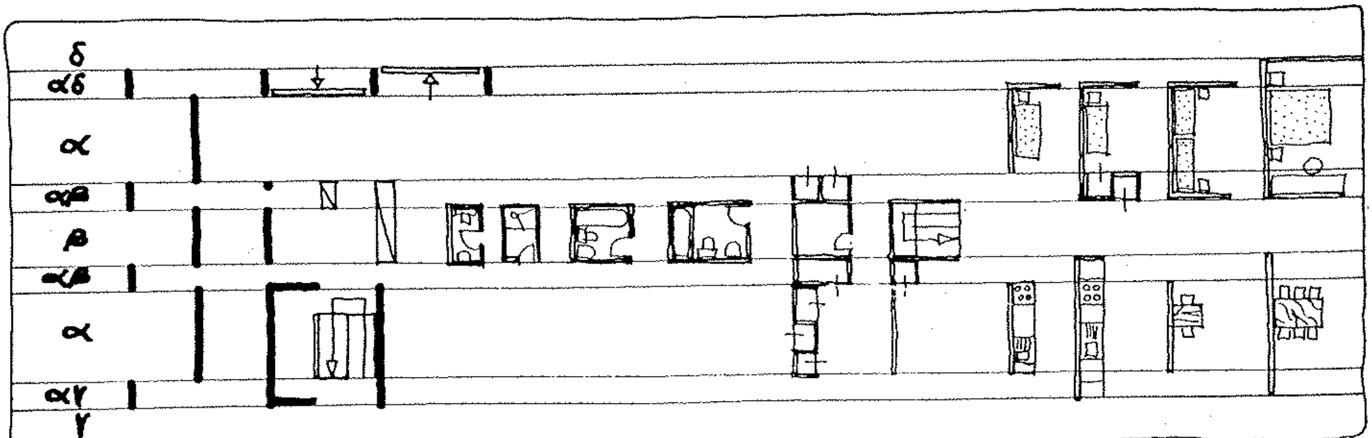
Each decision in the design of a support must therefore be judged on its impact on the possibilities it gives and the possibilities it eliminates. In other words : the zones are a tool that enables the designer to relate each technical decision to possibilities of use and vice versa to relate each general requirement of use to its technical implications.

The general rule formulated above, that specific living spaces should end in two succeeding margins leaves so much open that designers will feel the need to add other rules in the course of the design process. Such additional rules can be a great help in further organisation of a support system and give the parties involved in the design process the means to translate more specific requirements into the same language.

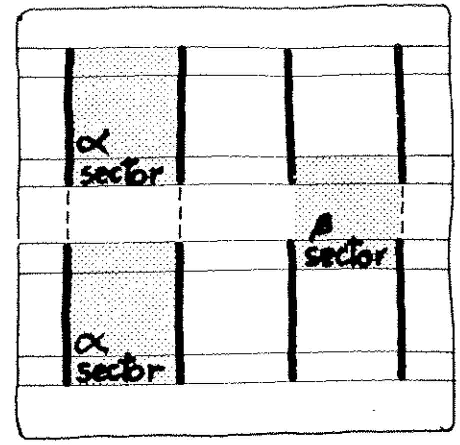
Examples of such additional rules could be:
- sanitary celle will be found only in β-zones
- or: sanitary cells will be found either in β-zones or αβ-margins
- bedrooms will be found only in α-zones.
- load bearing elements will not be found in α-zones
- vertical ducts will be found only in αβ-margins

It is precisely this possibility to add specific rules as the design process develops that makes communication possible. Each general decision can thus be formulated and its implication can be studied by the parties involved.

Several other concepts related to the use of zones and margins have been introduced by SAR. They all aim at further evaluation of a support design. In this brief introduction of the methodology two must be mentioned as an example.

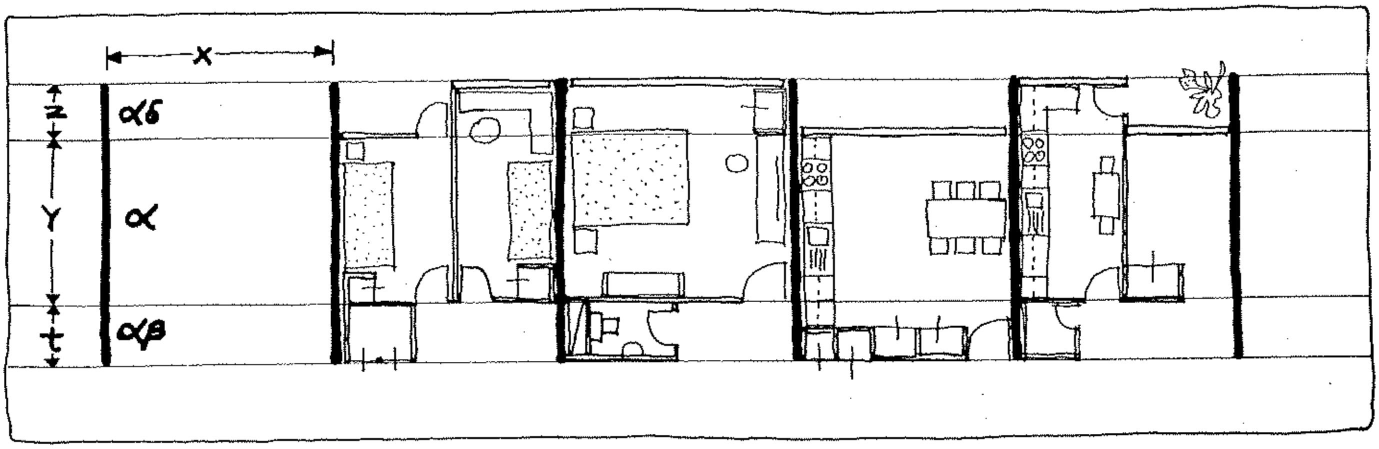


# B.3 sectors




A sector is a certain free length of a zone with its adjacent margins. Thus the space between two load bearing walls in a support can also be called a sector. As a zone gives only one dimension the sector gives two. A sector can be analysed on its possibilities of use for different combinations of functions. As most supports will give material that intersects the zones the analysis of the resulting sectors is an important exercise in the evaluation of a support design.

The sectors in a support are the built spaces given to the dweller for further partition or combination into a specific dwelling. It might be said that a dwelling in a support can be seen as a sector group. In principle each group of adjacent sectors in a support can be a dwelling.




# B.4
# basic variants

If a given sector group can be seen as an area for a dwelling then a great many possible floor plans can be expected.
Even if one only considers the floor plans according to the rules on which the support is designed in most cases the number of possible variations is very great.

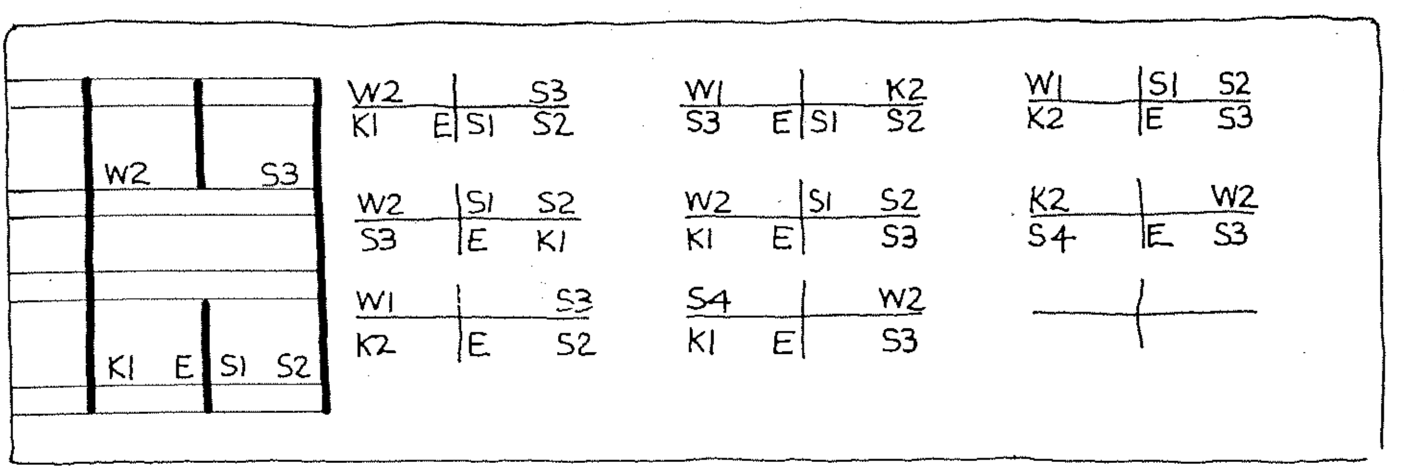
To get an idea on the number of variations in a given sector group the concept of the basic variation has been developed.

A basic variation is a notation of the position of functions for specific living spaces and general living spaces. The different functions attached to the spaces can be coded. In the sectors the codes for the space functions are notated. This notation does not give the dimension of the space required.

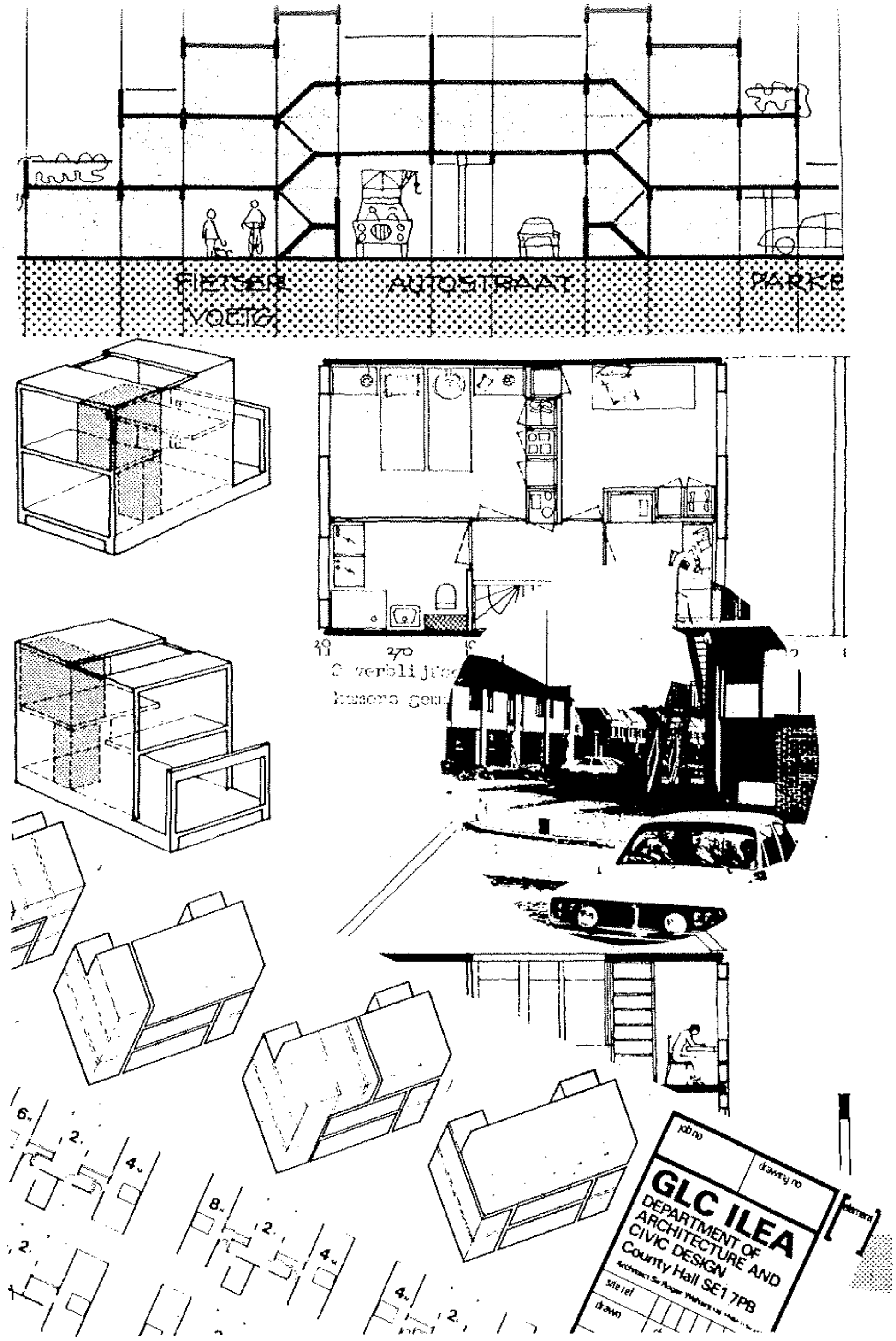
It only states that the function stated can be located in that place. Such a notation in the area of one dwelling (sector group) gives a basic variant.

In any given area in a support the series of possible basic variants can be written out. They give a considerable amount of information on the different living patterns possible in the given area.
Each basic variant gives a great many possible sub-variants that is: Specific floor plans that all have the same function pattern.

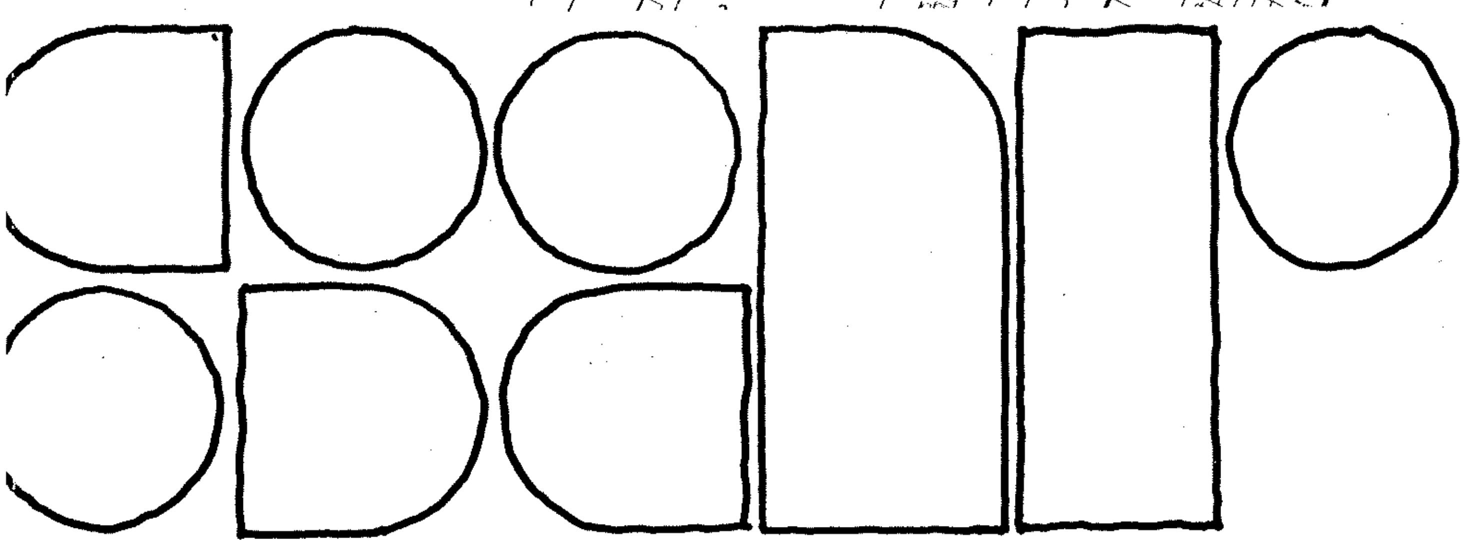
An analysis of the basic variants gives valuable information on the properties of a given support design.



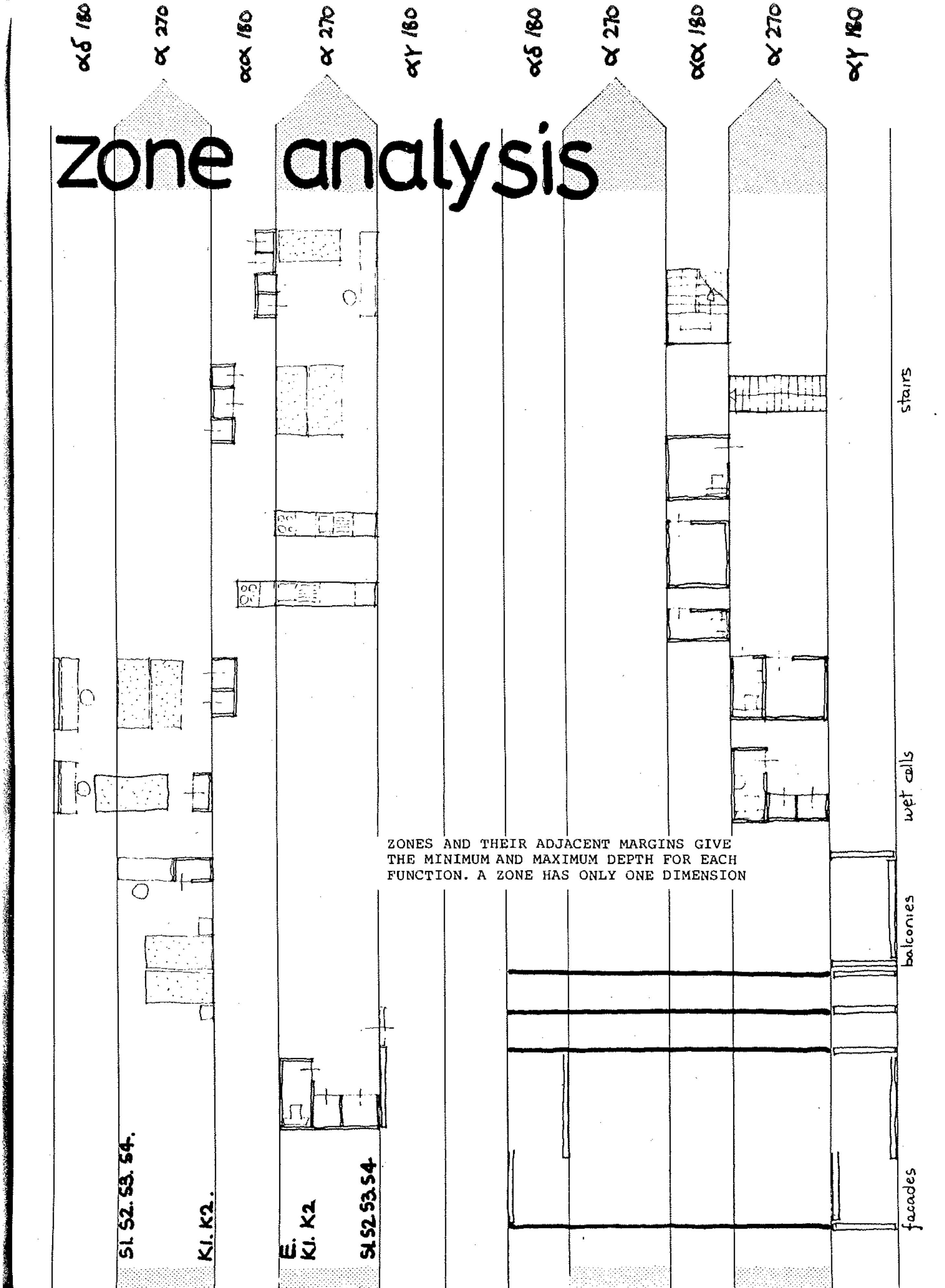
This is the end of the introduction to the SAR philisophy and the SAR methodology. Perhaps it's best to concentrate first of all on the philosophy because the design methodology is only a tool to further the starting point of the SAR philosophy namely to change the housing process in such a way that the individual occupant is once again introduced utilising industry in a much more efficient and human way. Of course the design methodology can be used as such as a tool in any other kind of design process, but in our opinion the design methodology of SAR can best be used for this very special purpose of designing support structures and detachable units. Thus furthering not only a better design process but also a better housing process.




SAR
postbus 429
eindhoven
tel:040 43 36 16

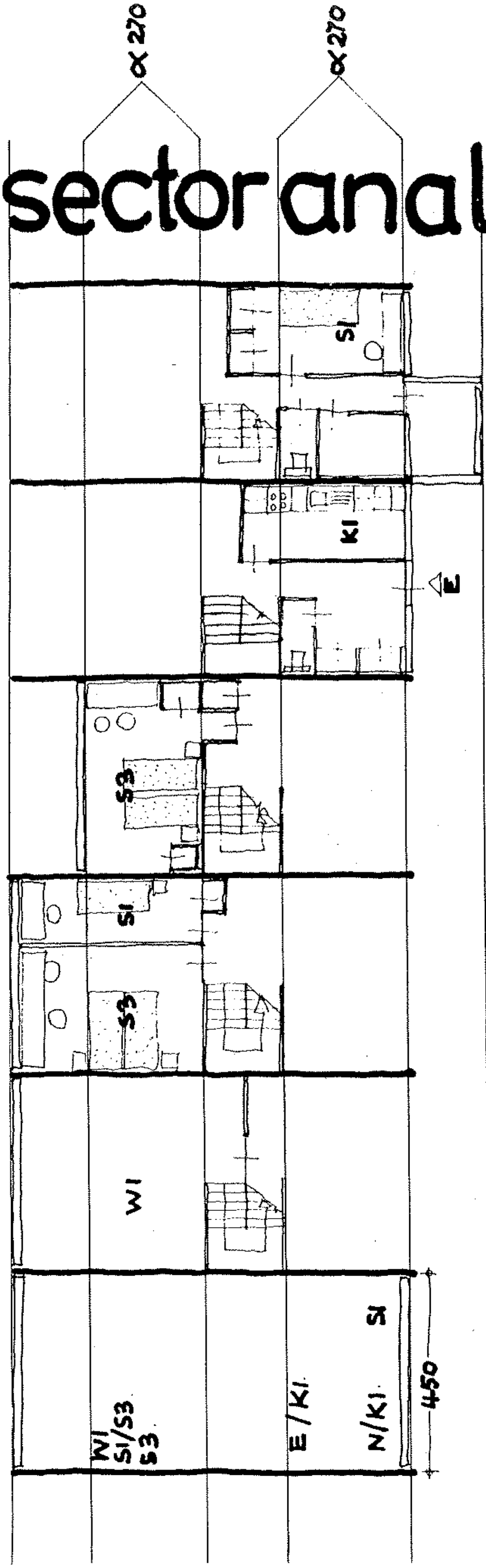


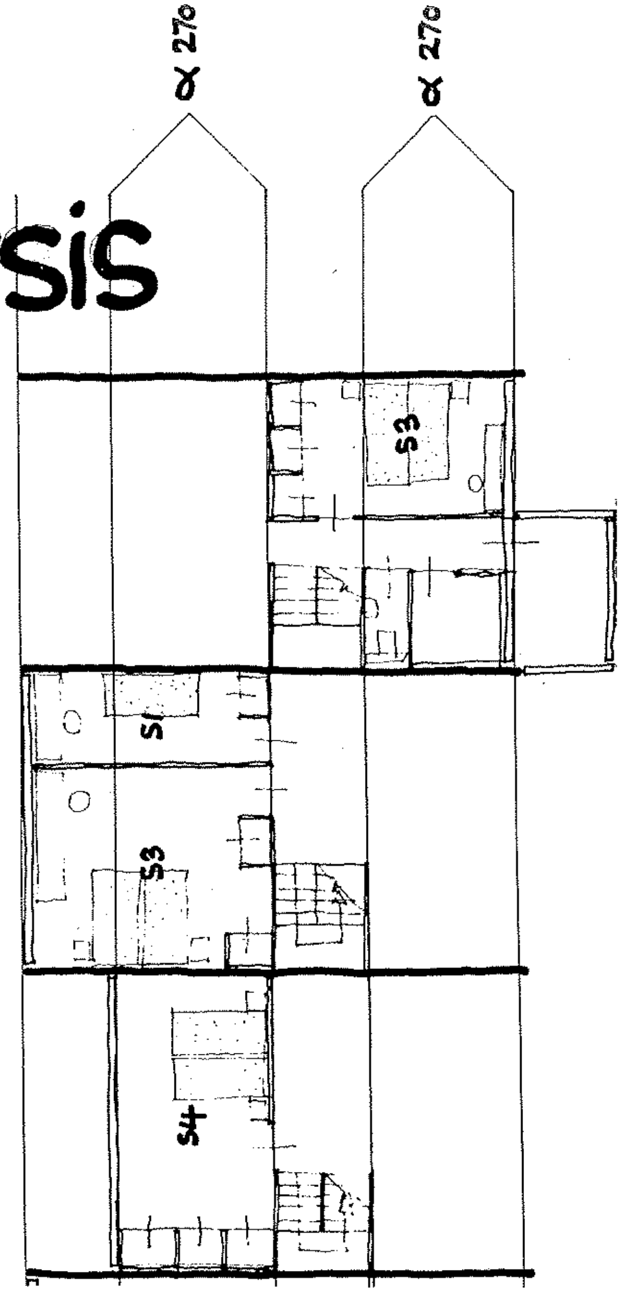
# zone analysis



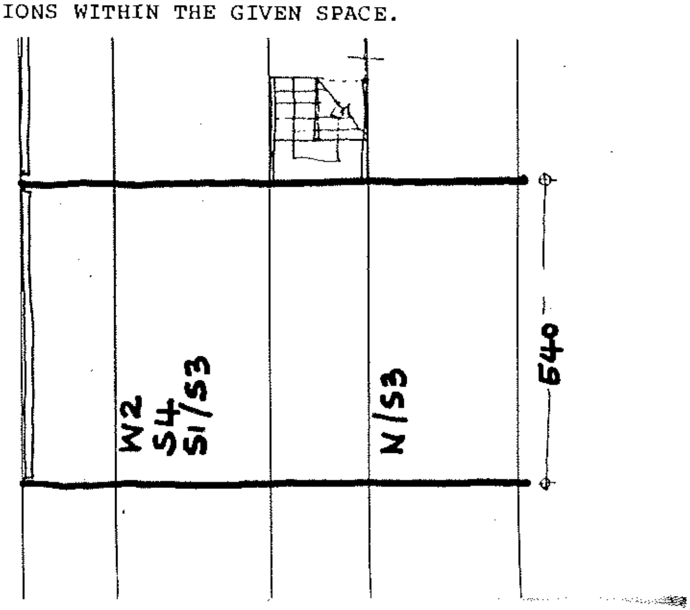

ZONES AND THEIR ADJACENT MARGINS GIVE THE MINIMUM AND MAXIMUM DEPTH FOR EACH FUNCTION. A ZONE HAS ONLY ONE DIMENSION

# sector analysis

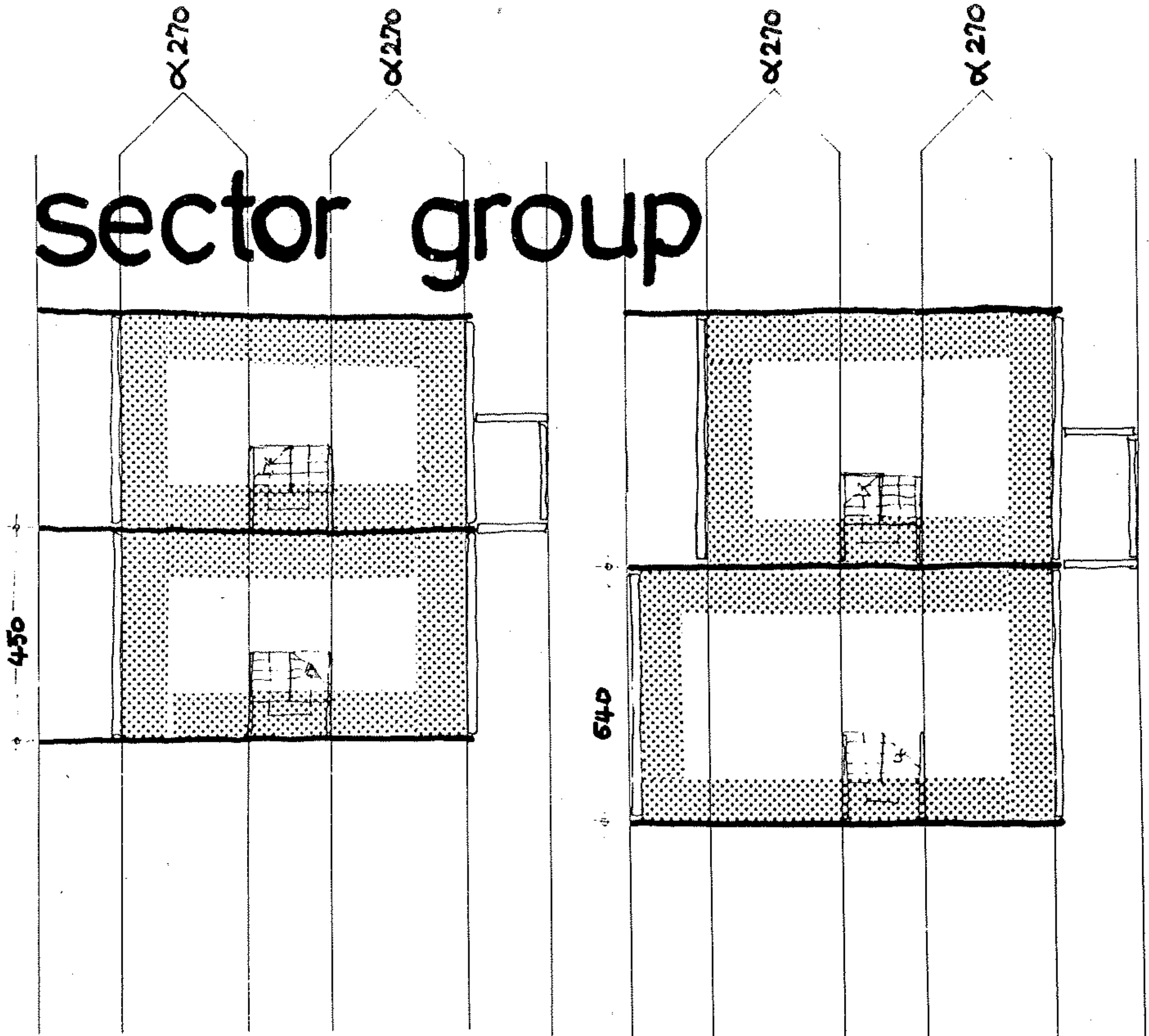


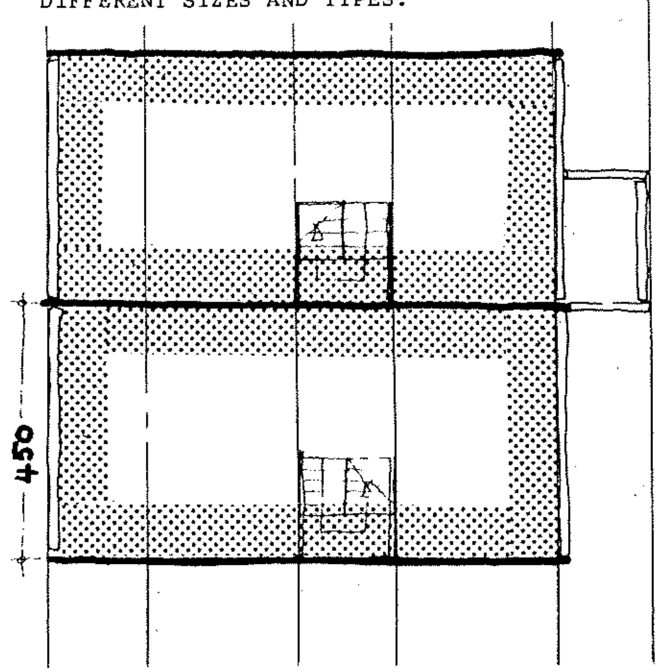

ON THE BASIS OF A ZONE ANÁLYSIS SECTORS ARE ESTABLISHED. THE SECTOR INTRODUCES A SECOND DIMENSION IN WIDTH. THE SECTOR ANALYSIS DESCRIBES COMBINATIONS OF FUNCTIONS WITHIN THE GIVEN SPACE.

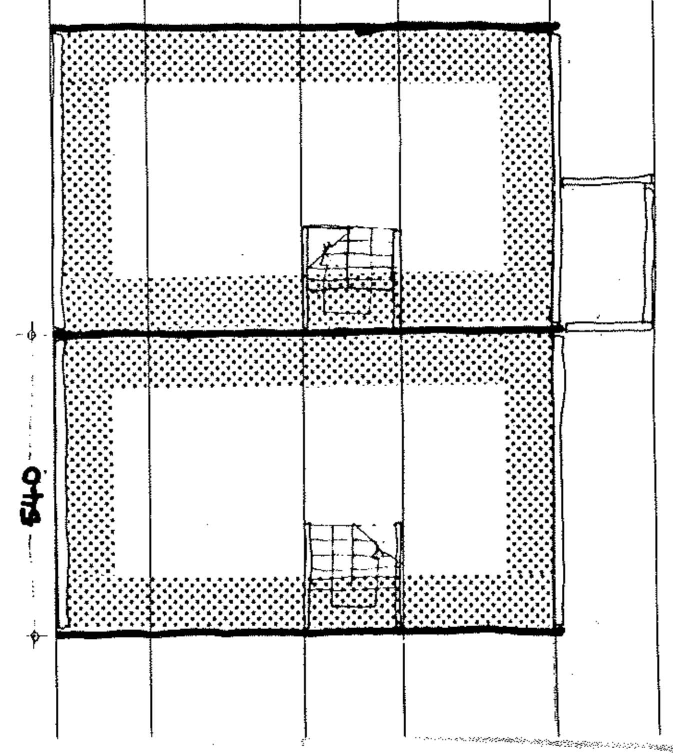


# sector group




A SECTOR GROUP DENOTATES A DWELLING.
DIFFERENT SECTOR GROUPS ESTABLISH
DIFFERENT SIZES AND TYPES.



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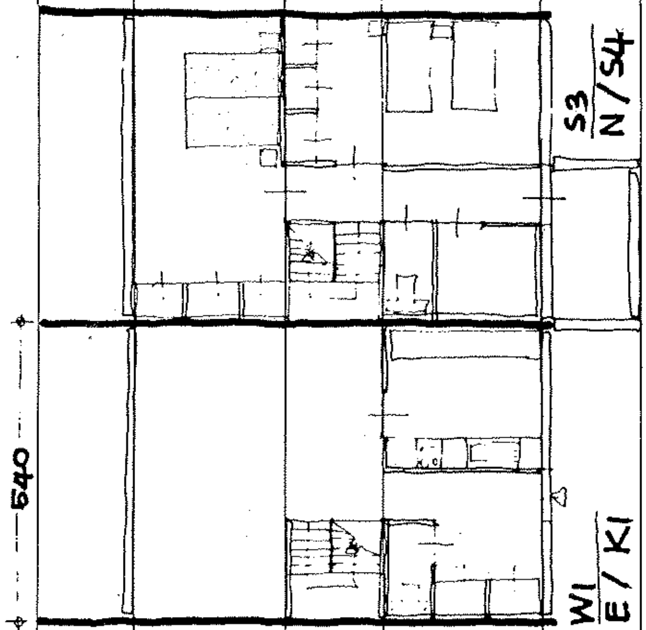
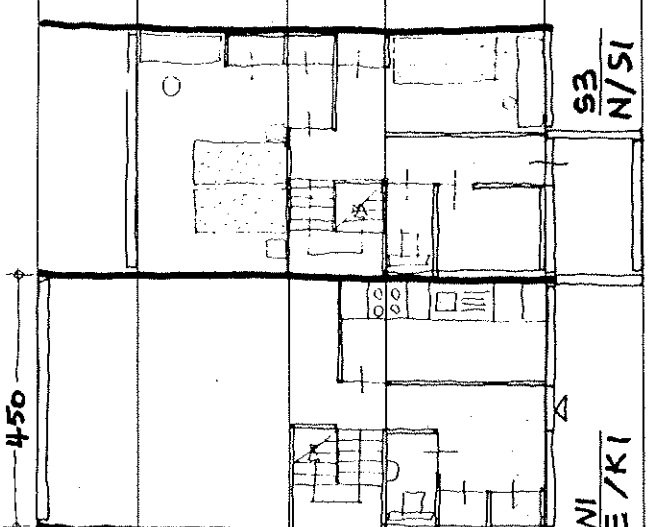
# Sub variants




A SUB-VARIANT IS A FLOOR PLAN IN WHICH THE POSITION OF THE FUNCTIONS CONFORM WITH THOSE OF THE BASIC VARIANT.

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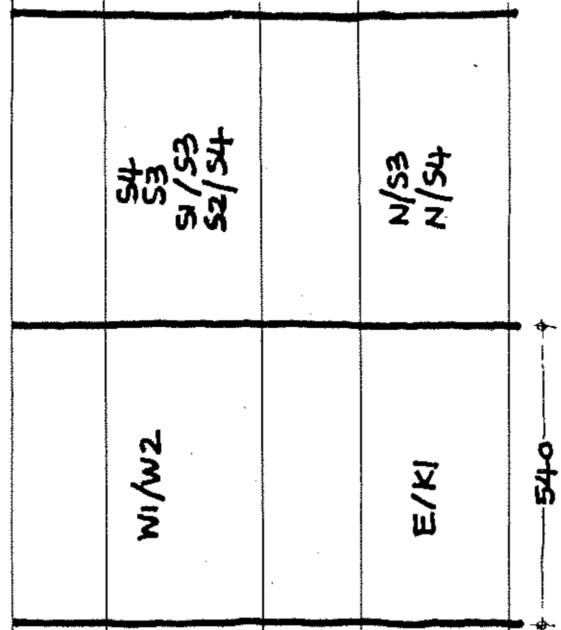
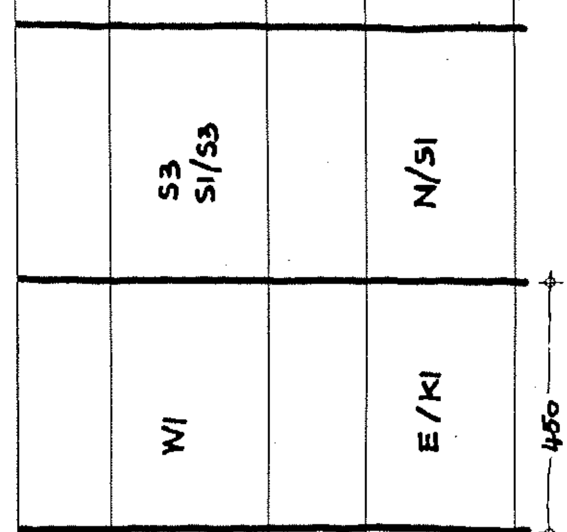
# basic variants




BASIC VARIANTS GIVE THE POSITION OF THE MAIN FUNCTIONS WHICH CAN BE LOCATED IN THE SECTORS OF A PARTICULAR SECTOR GROUP



Quality and quantity
The industrialization of housing
Habraken
Forum XVIII - nr. 2 - 1964
pp. 1 t/m 22

Owing to various events public attention in Holland has more than ever before been focussed on the housing-problem. In 1962 the Economic Institute for the Building Industry published a building-note containing a great number of data concerning building and housing. It appeared from this that, before that time, Holland had had a building policy without being possessed of the most elementary data. In the note an attempt was made to determine what the dwelling-requirements would be for the next decennia. In doing so it was assumed that a population increase was to be expected and that the average family would become smaller. To many the outcome of this extrapolition was a great surprise. The true arrears in housing with regard to the need, proved to be much greater than was generally assumed and the capacity of the building-industry was so slight and showed so little tendency towards a sound expansion, that it took a great deal of optimism to expect an early end of the housingshortage.
At about the same time the millionst postwar dwelling was finished and handed over to the occupants with the usual formalities. It seemed the right moment to look back on what had been achieved. This retrospection was disappointing. Not only too little had been built, but the quality of what had been built was bad. The desiderata as to the dwelling and the views on housing and dwelling had changed so rapidly, that in too many cases the groundplan, the details and the townplanning situation of the dwelling of some ten years earlier made a hopelessly outdated impression. Of course there were some favourable exceptions but nobody could console himself with the thought that the only thing we had to do was to proceed with greater speed on the path thusfar followed. Since 1945 not a single aspect of housing, neither the technical and architectural nor the financial and administrative aspect, had developed in a direction which held out any hope for truly new possibilities in the future. Wat made the retrospection most disheartening was indeed that it offered so few attractive prospects. Little else was offered than a reproduction in enormous numbers of what even now was hallmarked as inadequate.
Possibly as a reaction to all this a new minister for Housing and Building came into office. With great energy and equal self-reliance he set himself to find a way out of the deadlock, with as his first and foremost object an increase in production. All this gave rise to a widespread feeling of discomfort and a suspicion that the whole trend in housing was rather towards lowering than towards rasing the standard of the dwelling. This feeling of uneasiness was not allayed by the new drive for stepping up the rate of production by making use of all available means. The thought that combatting the housing-shortage should imply that the endless rows of buildingblocks in the polders are to be multiplied in the shortest possible time, is gradually becoming unbearable. Especially among architects it is feared that in an atmosphere in which the thought of productivity is so predominant, there will be neither money nor interest for research to find out what the prerequisites are for a fundamental improvement in dwelling- and housingconditions and that, in the long run, the housing industry will be restrained rather than stimulated. These

facts have made it clear to anyone, if it had not been clear before, that building in Holland is wanting in quantity and in quality. Everybody is now convinced that this time we are faced with a problem which does not solve itself as time progresses and which is not merely caused by negligence, obstinacy or ignorance. This does not imply that the general prospects have become less hopeless. The fact that people have become aware of the emergency as such, has, alas, not yet given a clearer insight into the problem. Remedies, if ventured at all, get bogged in mere formula's such as, organization, normalization, industrialization, better financial control, planning, etc. But on the whole the insight is lacking that, because it is a problem embrasing so many factors, the core of the problem must lie in a faulty interplay of all these factors, or rather, in a lack of interplay, which makes all work done ineffective.

This must not be taken to mean that there is no will to coordinate, to cooperate, but that all attempts in that direction are fruitless. If this is so, it becomes necessary to give thought to what the laws are on which the complicated process which we call building, is founded, or should be founded.

**A Choice which is not necessary**

I think that the most important aspect of our housing-problem is to be found in the fact that we are faced with a deficiency in quality and quantity at the same time. We not only have too little but what we have is also not good enough. It would be a mistake to think that we are faced with two problems, each of which can be solved seperately. The deficiency in quality and the deficiency in quantity are both aspects of one problem. There is, therefore, no sense in urging the solution of one of the aspects. Nay, it is of the greatest importance that the correlation between these deficiencies is investigated.

As long as this correlation is not clear, a minister must inevitably think that he can give priority to the quantative aspect. Under these conditions he may be able to step production a little by makeshifts, probably at the cost of other aspects of the country's political economy, but his endeavour must of necessity result in the wrong kind of dwellings and consequently in establishing the wrong kind of machinery for producing housing.

On the other hand a drive for the improvement of the quality of the dwellings to be built cannot be effective if it is done on the lines of a warning that in this materialistic world there are things of greater importance than mere number and quality. And the architects cannot be exonerated from this moralistic attitude. In the altercation about production and efficiency the architect is inclined to champion 'more' and 'higher', so, quality, though he is often at a loss to explain what may be understood by it.

Something thrown in free, in the manner of the 2 percent for the monumental arts, can only yet further obscure the problem. It is indeed necessary to give attention to quality, because too many people only think in terms of quantity and only take quantitative measures. But if so, there is only one way of discussing it. **From the start it must be clear that it is impossible to build a sufficient number of dwellings as long as the ones**

**that are built are not considerably better.** We have a housing-shortage because we build the wrong kind of houses, and because they are of the wrong kind, they are bad in all respects.

A subjective concept as quality of course requires some elucidation. But I shall refrain from trying to give a definition or even a description. Such an attempt seems rather fruitless and can only lead to discussions which are not to the point. If the relation between quality and quantity is under discussion here, it will be wise to get an insight in this concept of quality by studying the above mentioned relation, for, cannot we also learn to understand a person by studying his way of dealing with others? When we consider the relation between quality and quantity, the most striking thing we notice is that when people think of building they evidently take the two concepts to be in contrast to each other. It is almost taken for granted that a better quality has an adverse influence on the quantity and the other way about. This almost proves the proposition that the building trade still lives in the past. For formerly it was indeed necessary to choose between these two. In the past it was usually impossible to make large quantities of anything of good quality; quality was something unique and never found in things produced in large quantities.

That was before the advent of the machine, before the industrial productive process had been established, by which human making is now governed to such a large extent. Wherever the influence of industrial production is noticeable, it is possible to step up quantity and quality simultaneously and to the same extent. Now it is possible to manufacture things of a very high technical perfection and a very high use-value in large quantities and in a very short time. In daily life the motorcar, the refrigerator, the washing machine and the wireless-set are some of the but too well-known examples of this remarkable phenomenon. Is not it, after all, a fact that wherever industrial production is in full operation, we sooner have overproduction than shortage.

This is one more argument proving that there is no question of industrialization in housing. The method now adopted for mass-producing dwellings is based on a repetitive performance of certain actions on the building site, and takes the necessity to choose between quality and quantity, for granted. It is a way of producing which owes its existence and standards to the relations which existed before the industrial revolution. Mass-housing chooses quantity.

There is sense in all the measures which go with mass-housing as long as the only aim is stepping up production on the building-site. That is to say, if factory-production is only thought of in the second place. The industrial methods of producing in factories are only applied in so far as they support a traditional method of building, producing a traditional form of dwelling. There is, however, no attempt whatever to create a method of building and a form of dwelling which fits in with the industrial machinery. This outdated method, therefore, automatically leads to the maxim that a choice must be made between much and good.

But outside his home modern man is used to having great quantities of good things offered to him and he instinctively rebels against this choice. We may perhaps rightly say that this resistance is

based on the dream of prosperity of our modern time. But this does not make this resistance less real, for if we do not succeed in giving our dwelling a form which is taken for granted, it will be wanting in quality, even when the workmanship is perfect.
The thought in itself that a choice should be necessary between quality and quantity is outdated and static. It is based on the idea that somewhere there is some total which the sum of quality and quantity cannot exceed. Proceeding on the assumption that there is a certain amount of productivity with which we must content ourselves, we come to the conclusion that we have to choose between much and bad or little and good. But after all, the most important characteristic of the machine is that it can continually raise our productivity. Since a long time production has not depended any more on the number of people available for labour. Industrial production is expansive and bent on making ever more of what is good.
Seen in this light the outcry that the builders should work with more efficiency to help us put an end to the housing shortage, sometimes even accompanied by an appeal to the patriotic feelings of these labourers, is a pitiable show of romanticism. In former days there may have been some sense in pushing the labourers because their numbers and the pleasure with which they worked determined how much was produced. Now there is only sense in giving more thought to the actual potentialities of the industrial machinery.

**The Primary Standard of quality**

This leads directly to the overfamiliar fact, too often stressed, that it is imperative that our housing should be industrialized. It evidently is the only way in which quantity and quality can be made to go hand in hand. But if this is the case those who think in terms of quantity are evidently right, for they have been the first and most obstinate advocates of the industrialization of housing. That is indeed true but thoughts which only go into the direction of quantity evidently erect at the same time an unsurmountable barrier to the realization of this so eagerly sought for industrialization. **For the very reason that industrialization is primarily seen as a means to achief a quantitative improvement in the housing situation, all endeavours in that direction fail.** For if the only object is making a great number of dwellings it means that we aim at making the dwelling as we know it now, which is the form of dwelling of the mass-housing-projects, along industrial lines, in factories. But the form of dwelling we know now is a non-industrial form with all aspects of it determined by this fact, and therefore totally unsuitable for industrial production. We are not concerned with the dwellings we know now and which are subject to so much criticism. Why would we produce them along industrial lines? We expect much more of the industrial machinery. We expect it to give us a form of dwelling which is much richer and has many more possibilities, a form of dwelling in short, which is of a much higher quality and we moreover except that this form of dwelling shall be produced in abundance. Let us assume that a manufacturer puts himself to manufacturing 19th century coaches on the assembly belt. Let us assume that he succeeds in producing large quantities of handsome little coaches, complete with spoked wheels and brass lanterns. It can even be imagined that this factory should succeed in producing more coaches of better quality than could ever have been thought possible in the 19th century. Yet anybody would agree that as a means of transport the vehicle would be unacceptable. The means of transport belonging to the industrial machinery is the motorcar. The primary qualitative justification of the car is that it is inconceivable without the industrial machinery. Therefore the car of average quality ranks higher than a perfect coach. One can disagree about the relative quality of the various car-makes but there is no doubt as to the fact that the first quality car is preeminently the means of transport of our contemporary industrial apparatus and that for this reason it is an integral part of our time.

The first thing we may demand of our presentday dwelling is that it is inconceivable without an industrial machinery. This is a demand as to quality and not as to a certain technical constructional perfection. It its based on the assumption that the machinery of production which we have at our command implies a form of dwelling which is in keeping with it. This demand as to quality is the link between the form of dwelling and the way in which it is made. It is also the link between the way in which we live and the way in which we create our material environment. Every machinery of production creates its own product to satisfy a certain human want. This want may be basically unchanging, but the way in which it is satisfied depends entirely on the method of producing which is available. Our sense of quality is also formed by the means which we have at our command. We may expect that in a given era, with a given technical skill, under given economic conditions, the highest achieveable is achieved. If this expectation is fulfilled our sense of quality is, in principle, satisfied. This sense is linked with an intuitive feeling of what is the highest standard which can be reached. There is, therefore, no sense in measuring our material conditions by the standards of the past. Of course we have more than in the past. But with material wealth all around we can truly say there is a deficiency as long as more seems possible. In this connection the real improvement in housing in the recent past is therefore irrelevant; we have failed to keep pace with the possibilities.

So, industrialization of housing is not only necessary because there are too few dwellings, but also because only the industrial machinery can produce the form of dwelling that is in agreement with our presentday sense of quality. This quality is of an entirely different order than the quality which can be ascertained by measuring and counting. This latter quality, the banal technical quality, can only be taken in consideration when a form of dwelling that is taken for granted, is looked upon as of this era, is within everybody's reach. Therefore there is no sense in listing dwelling requirements and desiderata, hoping to contribute something to the solution of this problem. Such a list could only be based on the present conditions and it is this very basis which is wanting in quality. It is not so difficult to keep apart the two kinds of quality which must be recognized. The one is decided by the way in which a certain procedure that is taken to be right, is applied. The other depends on the crucial question whether the right procedure is followed. We could call them a secondary and a primary standard of quality. The problem under discussion bears upon the primary standard of quality. The primary standard of quality as formulated, demands a form of dwelling that can only be realized by taking full advantage of the modern industrial machinery. What is this form of dwelling? When can we say that full advantage is taken of the industrial machinery? How are we to find this form of dwelling? To ensure quality and quantity in our future housing we must find the answer to these questions.

**A Matter of Relation**

By this 'new form of dwelling', is, of course not meant a 'form' or 'shape'. No object is meant by it. Today it is possible to find thousands of new 'forms'. If this were the problem, there would not be any problem. We must therefore not set ourselves to designing dwellings in order to find the new form of dwelling. But what must we do? The 'new form of dwelling' is used as a term to indicate that there must be a way of living and making which is sure to make man live in harmony with the time lives in and with the environment which results from it. Of course the danger of such a formulation is that the whole problem may be drowned in generalities which nobody can understand. Yet is must be stated that the primary standard of quality demands that man live in harmony with his environment and era. And this statement offers more hold than may appear at first sight. Did not it first become clear that the primary standard of quality demands that our housing can only be conceived as a product of the technical skill and the means of production of the time we live in. This only means that quality and quantity depend on the relation between dwelling (the product) and the way of making (the productive resources). So the standard of quality required is based on a **relation** between two quantities. There is also an indication of relations in the demand that man live in harmony with his material environment and his era, viz. the relations between man and his dwelling and man and his productive resources. So, our attention is drawn to the interrelation of three quantities in all; man, object and method. If we succeed in bringing about the right kind of interrelation, the result will be the contemporary form of dwelling.

Seeking this form of dwelling means investigating into the interrelationship of these three quantities.

When in this three-polar relation one of the poles changes, the balance can only be restored by adapting the other two poles to the new situation. If we have true industrialization, the introduction of the industrial production machinery into the method of building means a fundamental change in this method. But in order to keep the three poles; method, object, man; harmoniously in equilibrium the way of dwelling (man) and the shape of the dwelling (object) must also change.

Finding new contemporary methods for satisfying the unchanging daily wants of man, is one of the most difficult tasks man has

set himself. Perhaps because in trying to do so, we must always visualize forms and constructions (visualizing them in relation to man) which no-one has ever yet beheld.
Yet, this is the task continually set to us. Man is the only being on earth to whom the task has been set to find ever new forms in ever changing circumstances in order to safeguerd his being and well-being. In order to stay alive he must be constantly creative.
Man can adapt himself to each new situation because every time again he can change and rebalance the triangular relation under discussion. His primary sense of quality is a kind of safety-signal which gives warning when he fails in his task. This signal is in no way connected with property or comfort in the materialistic sense. The sense of primary quality is a standard of value telling us when we fail in our task to make today what is wanted today. That is the law underlying our housing and building problem.
The engineer who does not think beyond reproducing a form of building which he happens to see about him, in large numbers, will never solve the problem.
He will get entangled in constructing traditional housing-blocks, using ever bigger industrially produced units. Or, if he wants to be progressive, he cannot design anything but a dwelling which is manufactured on a conveyer belt like an enormous refrigerator. The architect who can only think in vague terms of 'more' and 'human' and 'better' end 'different' cannot solve the problem either. The only thing he does is plead for a dwelling which is only more expensive, or he loses himself in phantasies which are only interesting as material for publication. It is, therefore, not very surprising that the problem has not yet been solved.
This coherence between our sense of quality and the relations existing between man, his material environment and the way he gives shape to this environment, also explains why technical skill, material prosperity or resources at our command, are quite irrelevant to the essence of the primary standard of quality. It is not the magnitude of these quantities which matters but their position in the interrelationship with man. Seen in this light there certainly have been higher dwelling-qualities in the past than we have now, even if we could not feel at home in these forms of dwelling if they were offered to us now. The recent interest in "primitive" forms of dwelling from the past is an indication that we have a feeling that they are the result of a well-balanced relation between man, material environment and method of production, the lack of which is so sorely felt in our own time. The primary standard of quality is better reflected in the wholeness and finish of the towns of the middle ages and in the settlements of the Dogon and the Pueblo Indians than in what we ourselves have built. If then it must be said, we can say that the pattern formed by the abovementioned interrelation reflects the essence of human culture; for the very reason that this pattern of relations is the decisive factor, irrespective of the standard of knowledge, of resources and of technical skill.

**Way of building and Industrial Product**

If the primary standard of quality demands that the presentday industrial technique of producing is fully applied in housing, it does not imply that the dwelling of the new form of dwelling must be industrially produced in all details. It would be over-simplifying the problem if we should say that, as quality and quantity go hand in hand in the industrial product, all we have to do is to put the dwelling on a line with any other industrial product. The dream of the 'machine a habiter', sometimes interpreted in this sense, belongs irrevocably to the romantic past of our modern era. The 'only' prerequisite is that the new form of dwelling be inconceivable without the industrial production machinery. This raises the question as to what part the industrial production machinery must play in the attempt to house man as befits him. How does the modern industrial machinery of production fit in with the pattern formed by the relations of man, method and matter in our era?

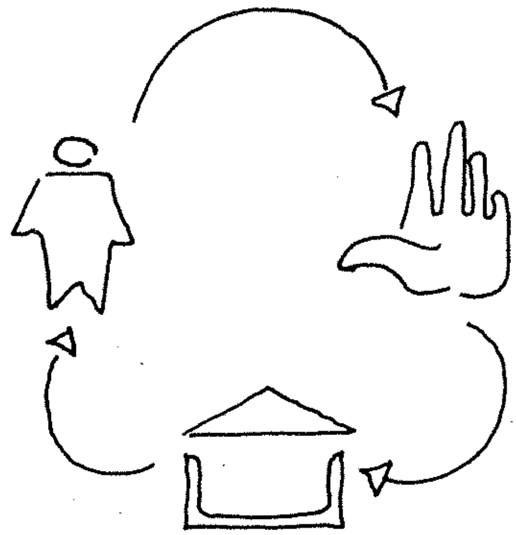
Building is an essential and irreplaceable human activity for which mechanical factory-production cannot be substituted. What is 'built' can never be the final result of an industrial process. It is possible to think of the industrial product as being a component part, or if desired, an element in the building activity. As such there is no difference between it and the non-mechanical but factory-made brick. It is evident that the principle of using structural parts which are manufactured elsewhere, as building-stones' is very old. As long as the manufacturing industry confines itself to manufacturing such parts for buildingpurposes, we cannot speak of a new relation at all.

Building itself is always making a new environment. I.e. making at a given moment, in a given place, for a given situation. Place and environment always influence the decision as to what shape is to be given to what is built. For this reason building is always a unique act, which can never be exactly repeated in another place at another time. In building something is recorded in the same sense as something is recorded in writing.

It is not an absolute act, if such an act is possible, but an attempt at formulating, leaving a track, confirming our existence. Indeed, **building is a irreplaceable human activity. No reflection on mechanical industry and production can be fruitful if this is not realized.**

Let us on the other hand consider the industrial product which is not meant to be a building component but an independent finished article, finished and complete in itself, as we come across in so many forms. No greater contrast can be imagined than that between the built form and this industrial finished product. This latter product is not bound to any particular spot, it has come off the conveyor belt and remains movable, it is movable property. It never betrays any direct marks of having been made by man, because by definition the accidental imprint of human hands is foreign to it, as it is always made by man by means of the machine. So, as regards the method of production it is only indirectly related to man and therefore the industrial finished product can only very generalizingly be called a symbol of human activity.

The built form and the industrially produced object also differ in their relations to time. The way in which an industrial product



1 There is no specialised craftmanship. Individual man builds his own dwelling.

is used determines its life. The durability of the materials used and the soundness of the construction employed are chosen to fit the time that the object is expected to be used. It is made to be replaced. This possibility of quick replacement, so typical of the industrial product creates an entirely new relation between man and this product. It is the relation between man and the object made by him, which largely determines what picture man has of the industrial product. The dream of the industrial machinery producing in abundance, putting on the market ever more goods which are all intended to enrich our daily life; a machinery moreover which permits us to consume the goods at whatever rate and in whatever quantities we like, nay, continually tries to entice us to use ever more and to consume ever faster, is the dream of modern man, living in an industrial abundance. In so far as this dream is true — and even perhaps to a large extent in so far as it is believed in, even if it is not true — the relation between man and his material environment is very special and entirely new. It is, moreover, very largely a relationship between **man as an individual** and his **individual** material environment. The industrial finished product by which the dream is best symbolized, is the product designed for man as an individual. The motorcar, the wireless-set, the refrigerator, the television-set, the washing machine, are all products which appeal directly to the consumer. It is therefore understandable that many compare the dwelling itself, which is after all also produced for individual use, with these products.

But the built structure, as we know it, has its own relation to man. Even when something is built for a special person, to meet very individual requirements, it is an action which concerns the community. There is no getting away from the fact that building is always adding to the landscape made by man, to the communal environment. Therefore the relation between building and time is always attuned to the community. Even if we should become so rich and so clever that we could replace our towns as quickly as we can replace our motorcars, we would not do so, because the relation between man and the building is a different one. That which is built has a longer life span than man. It links the generations rather than belong to one single generation. What is built a continuum. Every building-activity is only adding to or altering the continuity. Building is essentially continuing to build on what is there, it is an activity in an endless chain of building activities, not a single link of which can be considered by itself. What is built is always a legacy handed down to posterity.

This legacy, however, is not handed down only to be preserved. In the face of all attempts of the Society for Preserving Ancient Monuments we must state that altering and adding to what exists is inextricably linked up with building.

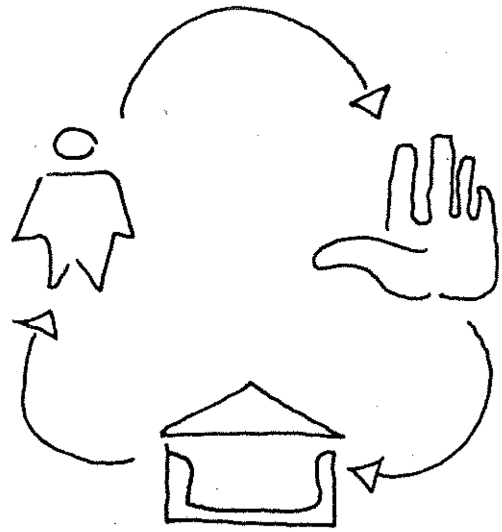
Altering and adding to what exists are the means by which we become reconciled to what previous generations have handed down to us and by which the legacy becomes acceptable and valuable. This shows another difference with the finished industrial product, which cannot be altered, which can only be replaced.

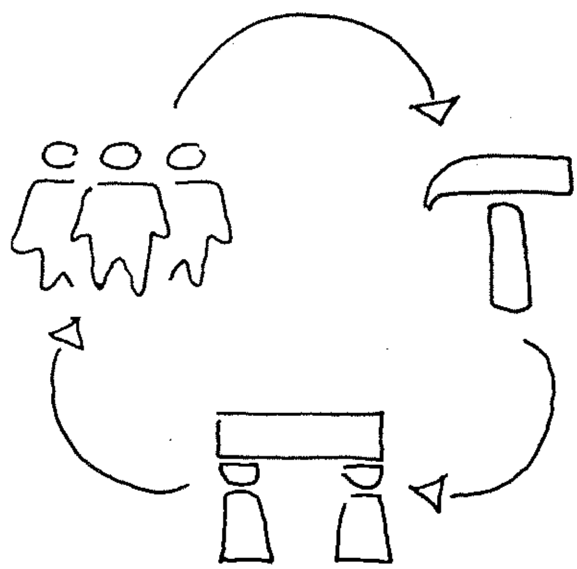
With the machine an entirely new kind of things has therefore come into man's environment. Before that time everything, from the building to the simplest utensil, was man-made in the same sense. Everything was of the same order. The machine has put an end to this. Building is still the same: a form of making which requires man to act from place to place and from moment to moment. By its side the Industrial product has appeared, or rather; by its side there is now the manufacturing machine, the industrial machinery which, once put in motion without any apparent effort turns out an endless flow of products.

When we contrast the industrial product with the building, we can only take the finished product into consideration, the product as offered to man in his everyday life. Of course our industrial machinery manufactures innumerable objects which serve as semi-manufactured articles with which other articles are in their turn manufactured. Building is largely based on judiciously assembling such industrial manufactures. Yet the result of this work is unmistakably 'built' and its relation to man is quite different from that of the independent finished industrial product. This contrast is of the same order as that between the motorcar and the traffic-bridge or road. There is indeed a great contrast between these two kinds of products. When we try to specify it, we discover that this contrast can be recognized in the entirely different relations which exist between man and these two kinds of products. If therefore an attempt should be made to classify the things surrounding us by the standard of the relation between these things and man, at least two classes could be distinguished, the class of what has been built and the class of what has been industrially manufactured. Everything belonging to the first is also adapted to the community, the things belonging to the second class are most effective when they are brought to bear on the individual person. The first kind of things spans more than a generation, the second never spans more than but a part of one man's life. The one is continually altered and added on to, the second can be discarded and replaced. The one is of a relatively simple construction, the other is a complicated an relatively fragile piece of work. The one forms man's environment, is man's environment; the other constitutes the things with which man surrounds himself, which he chooses to have about him.

**The dwelling a dual unity**

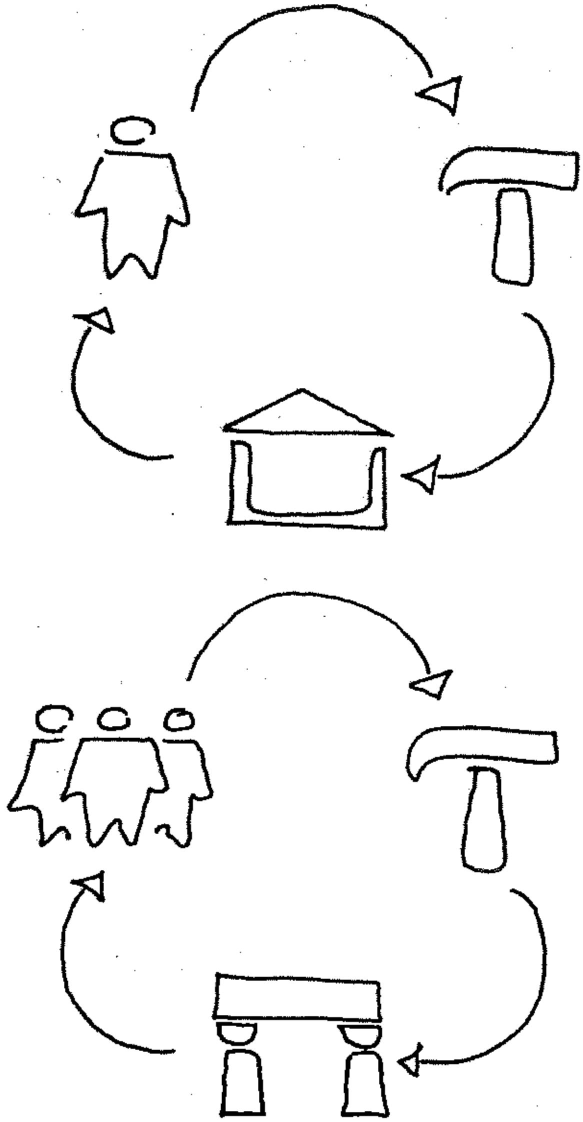
Man will always build, as he has always built, making towns, streets, squares, churches, halls, stations, shops and also his dwellings. But this does not imply that what we do, for our housing today, after the advent of the machine, must exclusively be the result of the human activities as described here. Studying our relation to our dwelling we recognize more and more elements in that relation which are characteristic of the relation between man and the finished industrial product. All the modern appliances and conveniences which can be found in a dwelling, belong in our opinion exclusively to the sphere of the industrial product. Kitchen, bath, heating, ventilation and numerous items like doors, windows, lighting ornaments, and finishing materials are so evidently products of the industrial machinery, that we have the feeling that a large part of the dwelling must be judged by the same standard as any other industrially produced article of utility which we





2 The specialised craftsman works at collective projects only. Two different patterns of interrelation exist side by side.

have at our command in daily life. It is by that standard that we make our demands, and we demand the replacebility, the finish and, above all, the free choice in buying which is offered by the industrial article. Another important factor is that the entire interior of the dwelling, the arrangement of the rooms and their finish, are so much part of our individual life, that today it seems unacceptable to us that all this should not adapt itself in appearance and life span to the rhythm of our lives, in the same way as so many other industrial products all about us adapt themselves to us and enrich our lives.
So, there are many things in our modern dwelling which could be made to have the same relation to man as the finished industrial product; so much so even that people are sometimes inclined to feel the superficial wish that it be possible to manufacture dwellings in the same way as motorcars. On the other hand little observation is required to come to the conclusion that our entire method of building is adjusted to the fact that the dwelling is exclusively seen as something built, and is offered to the occupant as a product of building. In other words; all our work aims at making the relation between man and his dwelling quite similar to that existing between man and building. The dwelling is still in all respects a building, this has not yet been changed by any industrial machinery. Moreover, because of the ever increasing number of semi-manufectures used in the dwelling, it has become an increasingly more complicated building. If we only think of all the ducts and conduits for gas, electricity, water, heating, and of all the industrially manufactured articles like doors and windows and finishing materials, which are carried to the building site in bits and pieces, there to be integrated in the indiviaible whole of the dwelling as a product of building, we shall no longer be surprised about the fact that that work is not very productive.
To this must be added another important factor. Today's dwelling in all its complexity, is offered to the people as something built. The relation man-building, as mentioned earlier, has therefore been declared to be the only one possible for the relation between man and his dwelling. But the rigidness and uniformity in housing and the complexity of the structural building today render it impossible for the individual to make structural or other alterations in his dwelling. In the past, change in the relation building-individual was the chief means by which the individual could reconcile himself to the building left to him by previous generations. We hardly have the possibility anymore of keeping the man-product relation harmonious in spite of changing times, while, on the other hand, the present-day rapid evolution of usage and custom convinces us of the necessity that this possibility of adapting the material environment to the individual be greater than ever.
Both because the people persist in seeing the dwelling purely as a built structure, and because at the same time building becomes more and more complicated, considerable violence has been done to the relation between man and dwelling. Does not everybody know that as regards housing, the individual is absolutely helpless? It is clearly a matter of a strained or severed relation.



3 The craftsman works also for the individual. There are still two different patterns of interrelation.

The primary quality has by no means come up to its standard yet. But is it so strange to see the dwelling as something built? It cannot be denied that the dwelling has always been a structure that was built. We may even say that the concept of building is derived from the making of dwellings. Before the development of the industrial machinery of production it would, moreover, have been difficult to imagine the dwelling to be anything but a built structure. If the dwelling may not be a built structure and it can neither be a industrial product like the motorcar, what strange and amphibious thing must it become then?
Yet, in terms of relations, the dwelling has always been characterized by some sort of dualism. The dwelling has always been the everyday environmant of the individual and has always been meant for individual use, but on the other hand it has always been part of the environment too; a cel in the permanent tissue of the town. The dwelling was turned inward towards the individual and outward towards the community. In this way it partook of two rhythms, the life rhythm of the individual and that of the community, of the home and of the town. It was adapted to the fashion and taste of the living generation, but being part of the built environment, it bridged the gap between past and future.
The dwelling has always been present in two worlds. It marked the boundary between these two worlds or rather was a margin between them, a playground in which the world of the individual and that of the community built up a relationship.

**Two relations become independent**

So, the two relations we observed, that between industrial products and the individual and that between building and community, have in principle always been present in the relationship between on the one hand the dwelling and the individual and on the other hand the dwelling and the community.
The relation between the individual and the finished industrial article, which has evolved in our modern time, is so to say a relation which already existed in the relationship individual- dwelling, become independent. The built structure, now standing over against it, has therefore become the other aspect of the dwelling, become independent. In so far as the dwelling is part of the total of the built environment of man, in so far too as the individual meets the community in or via his dwelling and joins in the communal life, in so far the dwelling is still a built structure, also for the individual. The development of the industrial productive machinery has made it possible for relations between man and matter which have always existed, to make themselves more manifest. But if we wish to profit from this, we shall have to make the relations between the individual and the industrial product and between man and building also grow as independent as possible. But if this is the case there is no sense in trying to look on the dwelling as merely a built structure, neither is there any sense in declaring it to be an industrial product.
The dwelling as a single, non ambiguous object which can be produced as a selfcontained form, has lost its sense with the development of the methods of industrial production. The main problem is verbal. We always say 'to build houses' which auto-

matically suggests that it is a matter of making 'things'. Things which are selfcontained and recognizable, and which can be offered quite finished to the consumer. But if we should not speak of building dwellings but of 'producing for the sake of man's housing' it would make it a little easier to say that today there is a dual production for housing; industrial production and building activity. It will then be easier to understand that the product of the building activity has its own relation to man, entirely different from that of the finished industrial product, and that therefor the distinct relations determine in what way industrial product and built product must be made to fit in with each other. So, in our housing it is a matter of how to combine judiciously that which we build and that which we produce industrially. If formulated in this way it may become clear that the two kinds of products both remain independent. For the primary standard of quality demands that the relations of man, method and object be as harmonious as possible. Now there are two distinct methods of production and it is our task to try and make both methods establish their own relations to man and to the products. How that will have to be done is still to be found out but it is clear, however, that in itself it is not a sound principle to incorporate ever more industrially produced parts in a built structure. In so far as these parts and fixtures are in any way connected with the relation between the individual and his dwelling it is wise to try and make the industrial product as selfcontained as possible. It goes without saying that building, regardless of what is built, will always benefit by the use of industrially manufactured products, aparetuses and building units. But this does not imply that everything our factories can produce to enhance man's comfort and to improve man's environment, must be used as a building unit and incorporated in the structure. Seen in this light we can say that we must endeavour to make the industrial product selfcontained, which at the same time implies making the part that is built selfcontained. Thinking further on these lines we must indeed characterize the contemporary dwelling as an **arrangement of industrial products in a built environment.** How will it in actual building be possible to make what is built and what is industrially manufactured independent of each other.

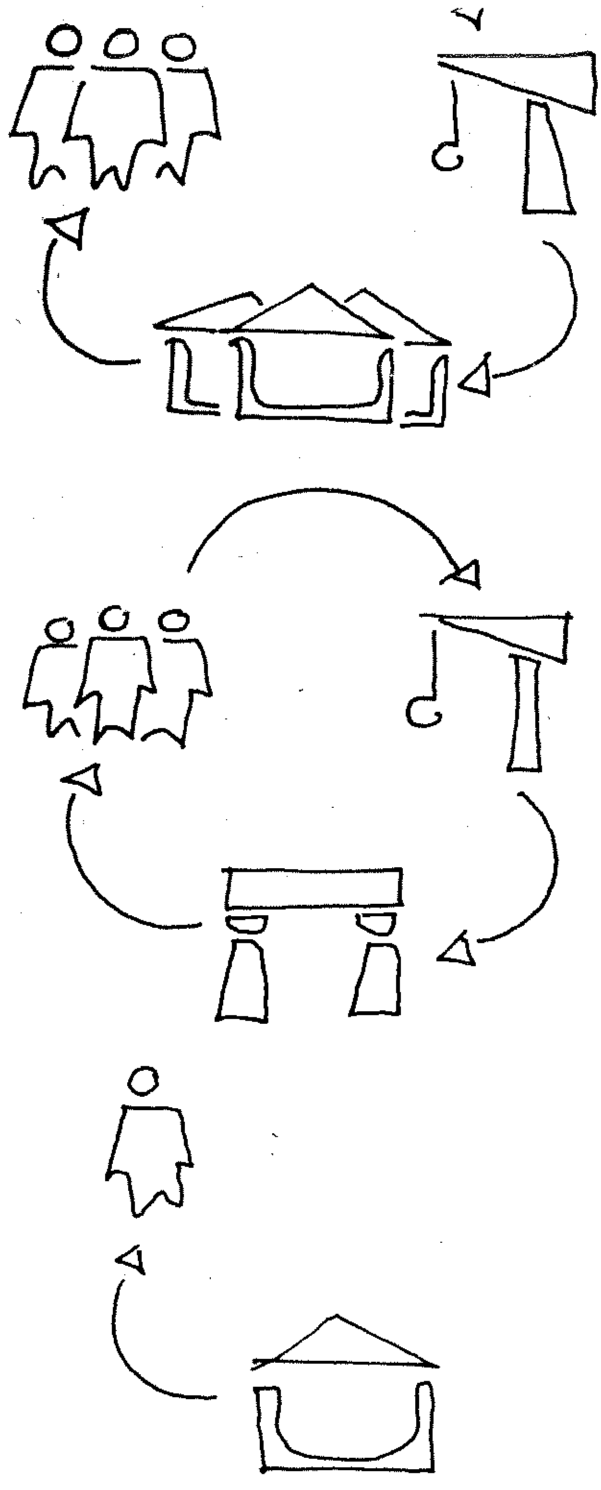
**Making what is built independent**

In principe the practical consequences of this theory are not new. We must begin by making structures, indeed completely built structures, in which it will be possible to make dwellings by combining and joining industrial products. This principle has come to be recognized by many. Some time ago I myself stated that divorcing the supporting structure from what constitutes the dwelling proper is essential to the construction of a dwelling which befits man and is therefore of an acceptable quality. For the supporting structure I chose the name 'support'. By difinition a support is a structure in which one or more dwellings can quite independently be built, rebuilt and demolished. The independence of the dwelling was necessary because only thus the relation between man and his dwelling could be made to function naturally. That 'natural relation' between man and his dwelling is necessary because it is an essential component of any housing-process. The independent dwelling which we desire can, of course be fitted in various ways in the support structure. It can also be made of brickwork. But it will be clear that the becoming independent of the industrial product, as discussed, runs fairly parallel with it, and that for this reason too the support becomes the built structure made independent. I am still convinced that making the dwelling independent is the main thing we must do as to our housing. But it now becomes clear that thinking in terms of available means is synonymous with making the dwelling independent. Building supports is no luxury but a necessity, seen from the productive angle as well as from the point of view of man. For that matter, the primary standard of quality does not differentiate between the two but shows that the relations are always basically the same.

The structure that may be called 'support' needed a name of its own because, after all it is a structure with its own typical function. This structure is a selfcontained and finished object and therefore needs a name of its own to distinguish it from other kinds of structures. Consequently a support is a different thing from a skeleton of a (tenement) building because a skeleton is always an integral part of a bigger thing and can only be measured by the standard of that object. One can imagine some builder building supports without needing to bother about what later will be added in or onto them by others, just as some roadbuilder can build roads. It is also possible to imagine a townplanner designing supports in the same way as now he lays out streets, squares and canals. On the other hand it is hardly possible to imagine someone only building skeletons. The support is the built environment made to be a selfcontained unit, in which is it possible to arrange an industrial product. In order, however to attain this independence it will be profitable to speak of constructing skeleton-like structures. For if today, at this moment, under the present circumstances, we wish to achieve a differentiation between the built structure and the industrially manufactured product, the most practical thing we can do is begin with the skeleton.

If in today's housing we could bring ourselves to make the skeletons of the housing projects into selfcontained units, if, in other words, we could bring ourselves to building supporting structures fit for universal use, so, standard skeletons which are independent of groundplans for dwellings, the first, all-important step towards the development of a truly contemporary dwelling would have been taken. In the first place it would then be possible to make the dwelling independent. Without using new techniques and industrial products yet, it would become possible to build dwellings which can be built, rebuilt and demolished independently. The relations of man, method and dwelling would then at least be restored in principle.

This relation can then be improved by increasingly using selfcontained, industrially produced parts for the making of dwellings, and by making the standard skeletons grow more and more into complete and independent support-structures. All this can come about gradually; it is a matter of evolution. But in order to set this evolution in motion, it is necessary that the first fundamental



4 An organised building trade becomes more and more unable to serve the individual directly. In reality only one pattern of interrelation remains in which there is no place for the individual.

step be taken. That step must be: giving independence to the minimum that can be made independent in a built structure; and that is the skeleton. We can begin doing so now. Such a standard skeleton gives considerable scope to the groundplan of the dwelling which is to be made in it. For this reason it is possible to apply all now existing and known methods of building in (and against the outside of) the skeleton. The skeleton itself can easily be constructed in large numbers. No new calculation and detail-drawings are required for each separate skaleton before it can be constructed. Measurements and the production of parts and shuttering can be normalized. The initiative for building and carrying out the plans can be taken by any group, or person in any way concerned with housing. The authorities, architects, townplanners and manufacturers will all benefit by it if a beginning should be made with the building of standard skeletons.

The architect gets something on which he can base his plans and which at the same time gives him free scope for his architectural and townplanning activities. The standard skeleton releases him simultaneously from the necessity of starting, for each project again, with designing the basic structure, of making the detailed drawings of it, and of submitting the plans for approval to ever so many official bodies. With the standard skeleton he sets out from a generally accepted basis. The authorities get in the standard skeletons a means to setting new standards which offer more scope for a future development of the notorious labour-saving methods of building. Because the realization of standard skeletons will automatically stimulate the industrial production (as will be shown later) it will be the foundation for truly effective 'saving of labour in the building industry', and on the building site. The skeleton is the basis for normalization and standardization. Not the normalization of dwellings nor the standardization of groundplans, but normalization of control, financing standards and organization. The townplanner gets in the standard skeletons a fundamental datum on which he can base his work. By reckoning with the standards and the requirements as to the construction of the standard skeletons, it becomes possible for him to decide the townplanning structure without trespassing on the field of the architect. The standard skeleton is automatically the meeting place for the activities of the architect and the townplanner.

And last of all the manufacturing industry profits most from the standardization of skeletons. It can easily be understood that, once normalized structures are built, it becomes attractive for the manufacturing industry to build elements which can be used in and on these structures. For the manufacturer it is important that he can produce without knowing beforehand what exactly will be the architectural form that is built with his product. He will always try to find a universally applicable product. The introduction of standard skeletons will enable him to supply much larger numbers of such products. It will then even be possible to compose complete dwellings out of such industrially manufactured products in the skeletons.

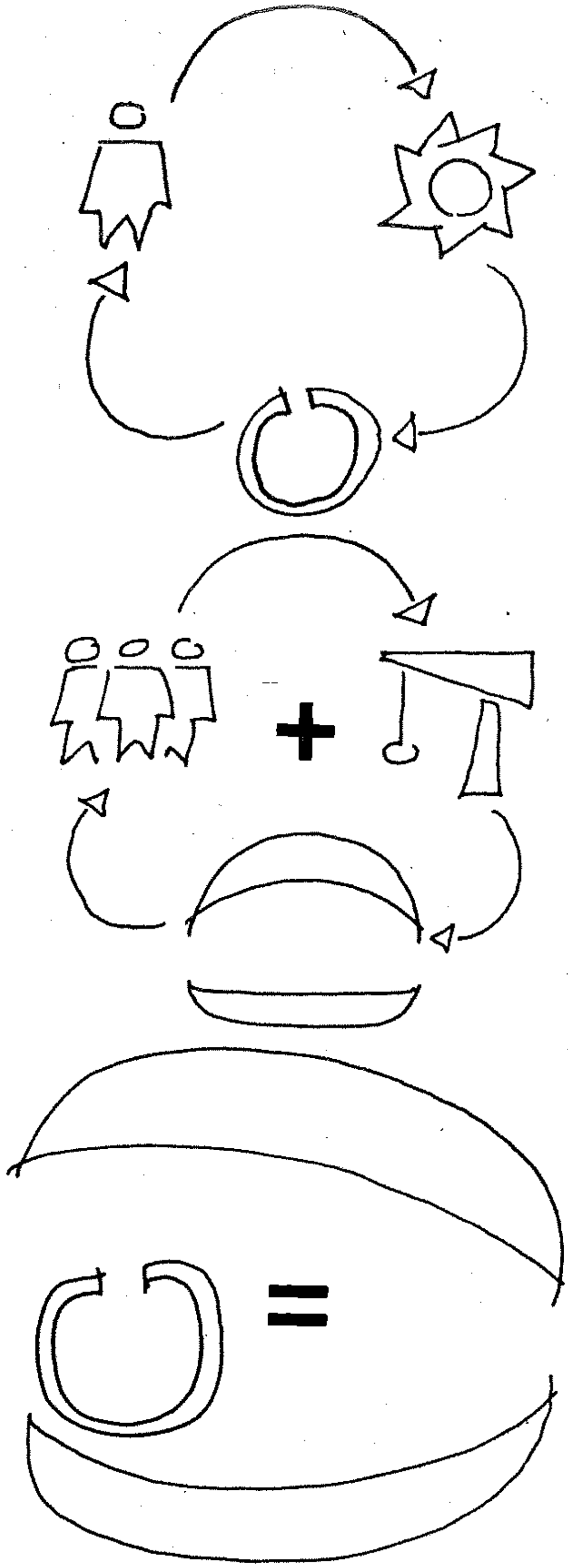
**Making the Industrial Product Independent**

In order, however, to learn how a skeleton can become a support, and what the main difference is between these two structures, we must go back to the industrial product and first put the question what exactly must be understood by making the industrial product independent. In how far can this idea be made concrete. A beginning in this direction has already been made in the various attempts which have been made during the last few years, to construct units in which the parts of a dwelling which require much labour — bath, toilet and kitchenequipment — are combined in one aggregate to be completely finished in the factory and afterwards put, as it is, in the dwelling. The bathcell produced as a complete unit is wellknown.

Such units have never been used on a large scale in our presentday housing projects, in which they were foreign elements. They were too far removed from building-stone and although from the point of view of industrialization they seemed to be very rational and attractive, there was no room for them in the existing way of building. They were too much selfcontained. But this is the very reason why they give us an indication of what may be possible, as placing self-contained industrially produced units in a built structure is just what we aim at. The units will then make up that part of the dwelling which is complicated and requires much labour and time when constructed on the building site, where the conditions are unfavourable. As costs of labour rise it is therefore very sensible to remove such activities from the sphere of building to the sphere of industrial production. But such a change can only be successful if it is made as part of a well defined program for industrial production, in order that an uninterrupted production and a universal applicability may be ensured. In the method of building followed up till now, is no room for such a program. The making of standard structures however, would supply the framework it so badly needs.

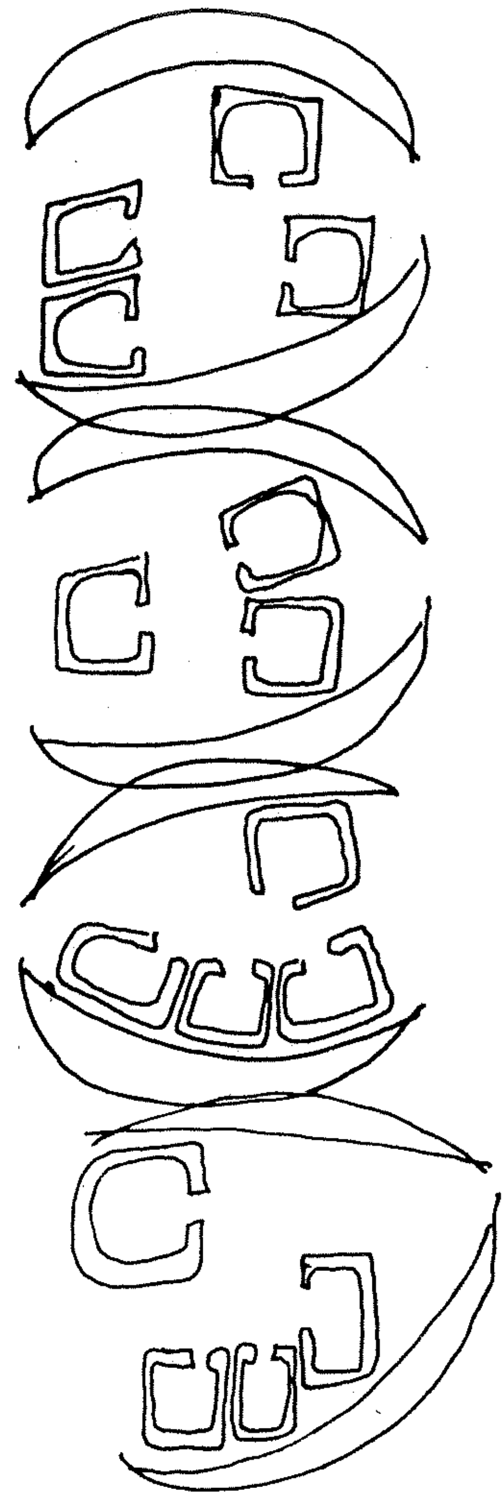
So, from the point of view of industrial production, it would be sensible to make all those things in the dwelling which are complicated and require a lot of time and technical machine-work, into units or cells, which are offered for sale like any other product. And making a built structure that is not subdivided and fit for a wide range of uses, would make the use of such products possible. But thinking on these lines we proceed from the assumption that the dwelling (which here is the dwalling to be constructed in the skeleton or structure) can be taken apart in units which can be manufactured separately.

That, of course, is the consequence of making the industrially manufactured product selfcontained, but it is worthwhile to investigate in what way this taking apart can be done. In what **parts can a dwelling be divided?** Setting out from the premise that in a support a dwelling must be made by combining and joining industrially mannufactured objects, we find ourselves confronted with the question what these objects may be? This question makes us think almost automatically of wall-elements. Since Corbusier found out the difference between the supporting skeleton and the wall to be placed free and non-supporting in the skeleton, constructors and architects have been busy designing industrially manufactured wall-units, out of which walls can be made at will in a given space. In officebuildings such movable walls have



5. True industrialisation gives again two new patterns of inter-relation. Together they ensure the individual housing of modern man.

already been generally accepted. It is Konrad Wachsmann who has most thoroughly investigated this idea with regard to building housing.
Yet it may be asked if a wall-unit is the most appropriate element for assembling a dwelling in the built structure. I have the feeling that accepting this premise shows a kind of automatism in thinking. Of course throughout all ages dwellings have always been made by making walls. Making an enclosed space has always been identical with making walls and therefore it is not surprising that, when we are concerned with applying the industrial way of producing, our first thought is for making industrially manufactured wall-elements. But this thought has its draw-backs.
In the first place there are numerous technical drawbacks, because a wall-element which is fit for universal use, tends to become extremely complicated, apart from the fact that it is difficult to get sufficient sound-insulation, and last but not least, because the principle of separate elements implies seams in the walls. These are technical objections and we may assume that in our present age they can be eliminated. But there is more. A wall belongs by nature to two separate spaces. This implies that by erecting a wall or wall-element, two spaces are determined. Either the finish must be the same in the two spaces, or the finish must be different on the two sides of the wall. If we need the latter kind of wall we cannot speak of a universal wall-element; there will soon be a large number of kinds. Moreover, making a dwelling, or a space for living, is more than just making walls. Apart from ceilings and floors which may also differ from room to room, there are also technical fittings for lighting, electric current, watersupply and sewerage. All these must be laid on separately and if necessary fastened to or on the walls, ceilings and floors. And it is the construction of these wirings, pipings and conduits that requires so much laborious and costly work on the buildingsite. It is not possible to think out a universal wall-element with all these things worked into it. Wall-elements which can be interjoined offer only a partial solution of the problem for the very reason that a dwelling is made up of much more than only walls.
So, with a view to this, it should be realized that a dwelling is not made up of walls; a dwelling is made up of enclosed spaces. Such a space is an independent part of a dwelling. It is, moreover, an organic part of it. In its finish and details and in the way the services such as electricity, water, heating and ventilation are grouped, it is a selfcontained unit. A division in spaces for living-purposes is the only division which is feasible without at the same time demolishing the dwelling. Would it, therefore, not be sensible to try and produce completely finished selfcontained rooms if we aim at industrially producing independent parts of a dwelling? **Why do not we make room-cells completely finished with all conduits, wiring, finished floors, ceilings and walls, which can be placed in a built environment in more or less the same way as a caravan is placed in a garage?** In this way the dwelling could be made by combining a number of such units in a built structure.

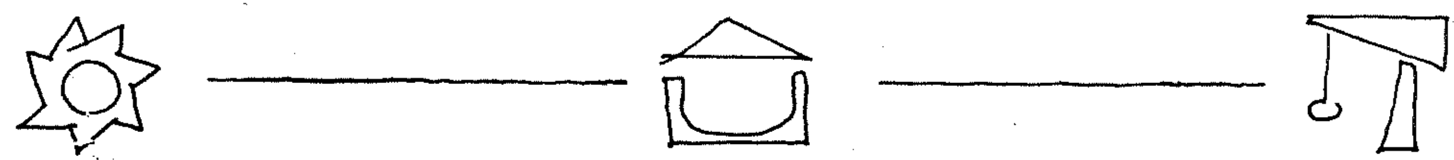


Such units contain the greater part of what requires much labour and time. They can be produced quite independently and can be industrially manufactured, which means that the first requisite for applying the industrial machinery efficiently, has been fulfilled. Moreover, in the dwelling as a whole, they are logical, self-contained units.

**Between two Poles**

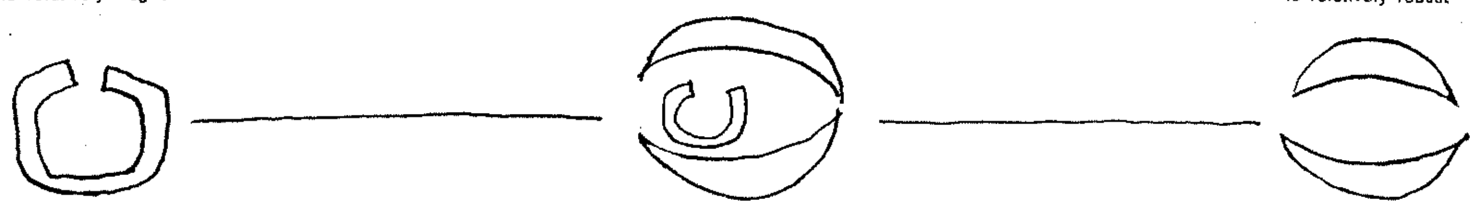
Yet the production of "cells" forming selfcontained finished apartments out of which a dwelling can be built up, need not imply that the dwelling must consist entirely out of a combination of such cells. For apart from these industrial products, there are the built structures. These give the industrial product a built environment. This environment can vary from a naked skeleton to an entirely closed architecturally finished space, with all the variants which can be imagined between these two. So this built environment can indeed take the part of the garage mentioned earlier, while it would not be wise to fill this built space entirely up again with industrially produced rooms. This is a field in which the merits of various possibilities can be balanced against each other. After having investigated the principle of making the built structure and the industrial product independent of each oth we can give our attention to the composition of the dwellings themselves. It was stated that these would be made up by judiciously combining the industrial products in a built environment. A general rule as to how this is to be done cannot be given but we can give some indications which will always be of value in the future, when the industrially produced room-units must be 'placed judiciously' in the built structures. So, it is possible to imagine that after the industrially manufactured cells have been placed, some room in the built environment is left. And this is very desirable, for if all rooms in the dwelling would have to be made like boxes, it would considerably limit the possibilities. We cannot get way from the fact that, with a view to the manufacturing- and transport possibilities, the measurements of such boxes would be subject to certain restrictions. Indeed our manufacturing industry is not interested in manufcaturing transportable rooms. Its interest is directed towards what is complicated and requires a great deal of time, if manufactured on the site. So the units which are to be industrially made cannot be too voluminous but must at the same time contain as many of the technically complicated fittings of the dwelling which is to be built, as possible. This is an indication that it would be sensible to manufacture those rooms of the dwelling which have a clearly defined typical function and which inherently require a great deal of labour, as factory produced units which are to be placed in the built environment. In this respect we can think of toilet and bathrooms, kitchens, cubicles for technical aparatuses, storerooms and also smaller bedrooms and studies or workrooms. If these last three are made as industrial products they can be given a better sound insulation than would otherwise be possible.

By the side of these spaces we have the living space proper, which, because it is indeed space to live in, has no specific



**What is produced by Industry.**
is quickly obsolete
exists as long as we want to use it
is mass-produced
is movable
is part of a series
is produced for the individual
is part of mans personal environment
is a relatively intricate piece of work
is relatively fragile

**What is built.**
takes a long time to become obsolete
is used as long as possible
is produced as an individual project
is unmovable
is a unique thing
is made for collective use
is the environment of a community
is a relatively simple structure
is relatively robust



function but whose primary requirement is that it be spacious and capable of all uses which may be required by our way of living. This space will almost automatically come into being when the built cells are placed in the built environment, when the caravan has been put in the garage. In this way the contemporary dwelling can be visualized as a built environment in which are placed a number of cells which are industrially produced to meet specific functional requirements. Pondering on this setup some characteristic qualities and possibilities present themselves.
In order to prevent this talking of forms and rooms, without illustrating them in any way, from becoming complicated, it may be advisable to stick to the figure of the caravan in the garage. It proved to be desirable to place the caravan in such a way in the garage that only part of the floorspace was occupied by it, because the remaining space could be livingspace proper. Let us assume that such a caravan contains kitchen, bathroom and toilet and some smaller bedrooms. These cells are connected with the main conduits for electricity, heating, water and sewerage, which are present in the built environment or are laid on in it. The remaining livingspace still offers all sorts of possibilities. It may, for instance, be divided into two livingrooms by means of wall-elements (which here, because it is indeed only a matter of partitioning, are in their right place) or by means of a wall of cupboards. The space can likewise be divided into livingroom and a large bedroom, as is already done to some extent in present-day housing. It is also possible to visualize the remaining space of the garage as becoming open-air space. It would also be possible not to use a kitchen-cell but to place a kitchen-unit, made up of sink with everything pertaining to it, in the large livingspace. This unit too could be a selfcontained industrial product. Of course the remaining livingspace can be finished in all sorts of ways, from traditional, plastered walls and boarded floors and ceilings to the most complicated mounted panels.
The theme of a built environment in which space-cells are placed and which for the rest is completed by adding whatever is offered by the entire range of known finishing materials, fronts, walls, cupboards, etc., allows of and endless variation, both in the shape of the built environment and in the choice of cells.
It would not be so difficult to design a series of roomcells which could be manufactured in a factory. If for instance, we start from eight variously sized cells, each of which is capable of six kinds of uses (for instance kitchen, bathroom with toilet, or shower-room with toilet, bedroom, storeroom, study or workroom, and entrancehall with cloakroom or toilet and storage, we get a choice of forty eight cells. If, moreover each cell of a certain size, meant for a certain use has three possibilities as to arrangement, we get a choice of one hundred and forty four cells. The industry producing such a series could have eight basic frameworks which could be covered and finished with parts of standardized measurements in such a way that the one hundred and forty four units would in their turn be built up out of a certain number of parts; more or less in the style of a box of bricks with which various objects can be made. The frames could be fully finished on a production line. The cells made in this way could be supplied

complete with lighting fixtures, built-in cupboards, all conduits, finished floors, walls and ceilings, sanitary conveniences and whatever else could be thought of.
Because the cells contain the greater part of what makes the constructing of housing costly and slow, the built environment, with or without the fronts, finishings and other furnishings, would be relatively cheap. This would result in a new relation between cost and space. In the building industry it is customary to base the cost of a building on a price per cubic metre. Although the relation is, of course, never a direct one it is customary to stick to the rule that the dwelling becomes more expensive as it grows bigger. In the abovementioned system this relation would become a bit different. It would be possible to adopt a certain basic cost-price per cubic metre of the built environment. The price of the dwelling which would come over and above it would depend entirely on the kind, quality and number of cells placed in it. In this way it would be possible for dwellings of the same size to show considerable differences in price. The most important thing would be that the consumer himself, by his choice of cells, could largely influence the price. This would offer a better possibility for everybody, rich or poor, to get the same space. Such a possibility is quite in keeping with the relations in our society. After all, as to quality in housing, it cannot be denied that the most important and highest quality a dwelling can have is to be found in its space. **We must build big, cheap spaces which are to be filled by the occupants, according to their own needs and tastes, with industrial products which can be unrestrictedly bought.** By giving the manufacturing industries the possibility of making selfcontained "dwelling products" it becomes possible to restrict the building activities to merely supplying architectural space of liberal dimensions.
It is possible for a young couple to begin with having this space finished and with placing a single bath- and toiletcell in it, with a simple kitchen-unit in the livingspace. For the rest they may divide this space by means of cupboard-walls. As the family grows, and, as we may assume, the income becomes higher, or something has been laid by, more cells can be added. The single illustration of a relation which can easily be pictured between the individual and his dwelling, shows what can be achieved if the relation between man and industrial product on the one hand, and the relation between man and the built environment on the other hand, are separately studied and stimulated. It need hardly be said that in this way quality and quantity can go hand in hand. With such a general and great demand it will not be difficult for industrial factories to build up a manufacturing mechinery which can produce in enormous varieties as to arrangement and finish as many cells as can be sold. The work required for constructing the built environment in which the cells can be placed, is simple and can be conveniently organized. Full use can be made of every conceivable means for normalization and standardization. Prefabricated parts can be used. The measurements and constructions of the spaces, or if desired, structures, can be completely standardized and normalized. In spite of this standardization the variations in groundplan and style of living

in the eventual dwellings are in no way restricted. The building activities on the site can be considerably speeded up.

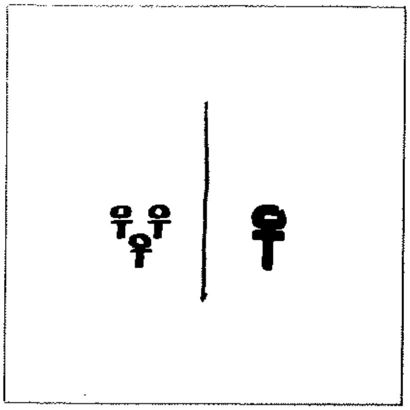
The time-relation between man and his material environment is also clarified. The industrial product, and with it the arrangement in the dwelling, will be used as long as it fills an everyday requirement. The replacement depends on the relation of individual-method and product. The built environment will be used as long as the community wishes to do so. It can be altered, it can be partly demolished and something can be added to it. The entire continuous process of the evolution of man's built environment can be accomplished in harmony with the relation community-method-product. The liferhythm of the community and that of the individual are given their full value in their relation to the material environment.

If the above-described dwelling is defined by saying that **the dwelling is an arrangement of industrially produced units in a built environment,** I think the difinition states very accurately what the essence of the two relations is. But it is only fair to state that this arrangement is no doubt a form of building too. Taking the word in that sense, we could say that, all considered, this dwelling too is entirely built. Of course that is so. After all building is making a material environment. To prevent confusion it is therefore wise to give a name of its own to 'the built environment' as we called it earlier, but which strictly speaking is an environment built by the community. Because of the advent of the machine and the growing of two different relations between man and matter, we now have two different kinds of buildings. The term support is justified because it indicates the one way of building. In it the dwelling is built and the industrial production enables us to speak of arranging industrial products. This last form of building may, in strictly architectural sense, not be building at all but from the point of view of man who in this way creates his own environment, it is building in its purest form. What restricts the term support is that is sugggests living above groundlevel. The concept, however, of an industrial arrangement in a built environment can be applied to all kinds of dwellings. It refers to a method of making. Therefore, also with respect to a detached house, it is conceivable and sensible to differentiate between space built (the garage mentioned earlier) and what can be placed in it by choosing industrial products. One of the chief stumbling-blocks in developing new concepts which must become common property, is the finding of new terms and names. When here we use the terms 'room-cells' and 'supports', they denote the objects representing the two poles of the trend of thought evolved above. They correspond with the differences between the relation individual - individual environment and the relation community - material environment; with the difference between industrial product and building-activity. It is a matter of two poles and therefore these concepts derive their main importance from the fact that they cause a whole field of forces to lie between them, which allows of a great variety of possibilities. It is what happens **between** the poles which is of the greatest importance. For there the potentialities and variations are endless. The main purpose the two poles serve is to define the field within which we must work. The two poles must be named to find between them a common field of action for all who are concerned in the housing of man. I am convinced that if this is our approach to our housing problem, we shall sooner come to a balanced combination of built structures and industrially produced dwelling than is now held possible.

Seen in this light the space which is left in the built environment after the cells have been placed in it, and which proved to be the living space proper, represents so to say the field between the two poles. In it everything happens, also from the point of view of planning, everything is still possible in it; it is the nucleus of the whole system. What we cannot define but get to know by defining other things, is always what is most important. In this margin, which itself is not an industrial product, nor an independently built environment, nor a cell, nor a support, lies the true quality of the above described way of dwelling and building. By the same token as the space within the vase is the most important thing, as the dwelling is not composed of walls but of rooms, we are not concerned with the industrial product or the built structure, but with the playground which is formed between the two. The completely built dwelling is but too familiar to us, it has proved itself to be deficient in quality and quantity. The dwelling which is in all respects an industrial product reduces the environment to an article of utility such as a motorcar or refrigerator. Only by combining what is built with what is industrially produced, keeping the full identity of both in tact, we get that which is in between, which cannot be made as a thing and which can still become whatever is required and which is therefore fully habitable. Returning to our startingpoint it becomes clear that no name can be given to true quality but that it can be found between things which can be named. Quality is found in a relation of two or more definable things and is in itself only definable because of the relation.

Habraken.

# RESEARCH



**This article is concerned with the two spheres of human housing. Housing from the point of view of a community. Housing from the point of view of a family. What matters in one sphere of influence, and what in the other? How do you build for one sphere, how for the other? What is the part of industry in one sphere and how does it affect the other? What can the architect do in the sphere of the community? What can he do in the individual sphere? What does the community do? What does the individual do (the occupant)? What can the individual do? What must he do?**

## NETHERLANDS

## ○ the perfect barracks and the support revolution

**There was a time when the man who wanted a dwelling had to build it himself. This arrangement seemed to work quite well, but as society grew in size and complexity it was not always possible for the individual to find the time and resources—or for society to permit such freedom. So we devised the housing project, which we thought was very clever, but the problem persisted. Then we learned how to industrialise the housing project, and we are now putting all our resources into this idea. Now, just when it looks as if we have finally solved the housing problem, this Dutchman (N. J. Habraken) keeps spoiling it all. He says we've got it all wrong, that we've forgotten something . . .**

This inconvenient Dutchman is Professor N. J. Habraken, director of SAR (Foundation for Architect's Research) and professor of architectural design at the technical university of Eindhoven. He says we have forgotten the individual, the person being housed, that we have eliminated what he calls 'the natural relation'. We must, he says, reintroduce this missing force and put it back where it belongs—at the very centre of the housing process.

Habraken has been making this point gently and persistently since 1961 when he published his book *'The Supports and the People'* (Scheltema & Holkema Ltd, Amsterdam). He has been making it through SAR, which was set up by nine of the bigger architectural firms, together with the Federation of Dutch Architects, and as editor of the journal 'Forum'. He therefore has behind him a powerful body of opinion in a country whose housing is admired the world over. He is no crank, however disruptive his theories, but he is no idle theorist either; his scathing attack on 'the perfect barracks' built by the housing project method has always been balanced by the offer of an alternative. The development of this alternative and a prototype of Habraken's 'support structure' and 'support dwellings' should be built very soon.

It is tempting to rush into a description of the 'support' concept but this would undermine Habraken's insistence that the idea of the natural relation is paramount, the solution offered almost incidental. For, once the idea is firmly implanted and accepted, the forms needed to express it will automatically follow. He has suggested a form but he does not say this is *the* answer; he offers it diffidently, almost reluctantly, as though afraid lest people should seize the form without understanding the purpose, and thus turn out more perfect barracks of a different shape.

'The very fact that a town is primarily the outcome of a way of thinking would make it an empty gesture if I should offer a design for the town of the future (which I do not have) before we have agreed on the way the process will work. Only then, drawings suggesting the result of the process become worthwhile.

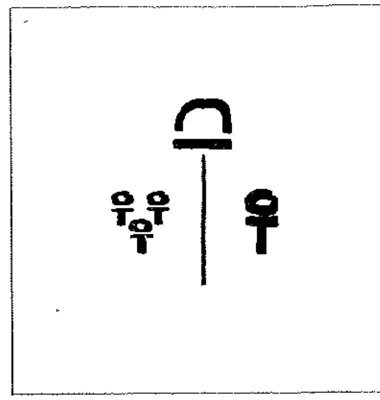
'Therefore it is no use asking me what ings, designs, concrete plans. It is not very important what I should want to do, for we can at least be sure of one thing—that what is going to happen in the future will be different from the picture I have in mind.'

This extract from a digest of his 1961 book makes it quite clear: we must start at the beginning.

In the introduction to this digest, Habraken harks back to the Housing Congress of 1918 in Amsterdam when an engineer (Berlage) backed by an architect (van der Waerden) proposed drastic standardisation of housing to cope with the poignant shortage of accommodation. A storm of protest followed, with the opposition coming from the architects and, more significantly, from the very people the proposals were designed to help—the labourers.

Berlage defined this opposition: 'The labourers—and now I come to the core of the resistance—see in the monotony which they fear (rows upon rows of identical, bigger and smaller houses), an onslaught upon their individuality, their liberty and their dignity as human beings. This kind

**Living is an act that takes place in both spheres. A home connects the two spheres; A home is the environment of a family and is part of a communal environment; A home has an interior and an exterior; Terminus of a series of communal services; Start of a personal enterprise. Living cannot take place exclusively in one sphere; Living exclusively in a communal sphere is tantamount to living in a barracks; Living exclusively in an individual sphere is tantamount to exile. A home must therefore be built in both spheres. It cannot be built in one sphere only. An individual who builds his own house completes his home in the sphere of the community. A community that builds houses must allow them to be completed in the individual sphere. The individual must be allowed to complete them**



drudge, a serf. And this is understandable. For, having emancipated themselves from a high-handed relief system and from the guardianship under which they had been for such a long time, they fear losing again the voice and initiative with respect to their homes. . . And now the proposed house . . suggests a cellular prison.'

This conflict between the method which, from the viewpoint of the expert is best, and the instinctive reaction of the occupant, is at the root of Habraken's thinking. He does not enter into the conflict: 'I aim at something else. I wonder why the conflict has been under discussion for such a long time. It appears to be as tenacious as the housing shortage itself.'

And having observed this, an important question suggests itself—might not the fact that the existing conflict between man on one side and the method of combatting the housing shortage on the other, which has already raged for almost half a century, indicate that there must be some connection between the two? Could it be that the housing shortage—or rather the apparent impossibility of remedying it—is caused by the discord between man and method.

The universal housing method is the housing project and if the housing shortage is indeed the result of a secret conflict between man and method, then, says Habraken, the housing project must be condemned. He concludes that the voice and initiative of the occupants in the widest sense of the word must be championed.

Once this idea is accepted, unknown possibilities loom up for the technical as well as the human aspects of housing: 'New riches we have done without for too long are made accessible.'

Although everyone agrees that there is a housing problem, it is not easy to define it. There are many difficulties, all interlocking and the solution of one is not possible without all the others being solved at the same time—'The engineer can no longer hope to increase production without causing a host of difficulties which are all non-technical and which he, being an engineer, can neither take in nor solve.

'The architect realises more and more that by designing he cannot give a new impetus to the housing of the people, for he realises that a house is the result of economic and technical forces and he cannot do much more than devise one more variation on the theme that they indicate.

'The townplanner discovers that he can design an ideal town, but that it cannot be built because the realisation of the plans is laid in the hands of countless other people, over whom he has, and may not have, any say. The occupant discovers that his personal desires have no influence on what happens, because he only gets into contact with the people who conduct an inquiry into living requirements, and occupy themselves with the planning of homes in which the persons interviewed will never live.

'In short, the man involved in housing feels frustrated in his endeavour to create better and more houses, because action in his own field proves to be insufficient or pre-supposes action in many other fields.'

It is no use, says Habraken, looking for faults in any one part, since each part may prove to be all right in itself. The whole machine has got stuck and the whole machine needs examination: 'We are less familiar with the joint action and interrelation of the forces which cause towns and houses in our society to be built, than with the forces which in an ant community cause the building of an ant heap. If the biological strategics which are at the root of our building activity are not recognised as a comprehensive reality, how then should we be able to influence it successfully?'

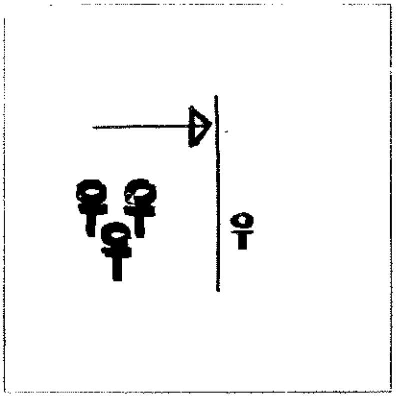
The housing process has evolved naturally, new elements being slotted in on the way, without much difficulty 'but our civilisation has reached a point at which, much that up to now worked as a matter of course, must be investigated consciously and rationally. As long as we do not do this, we need not be surprised if we prove to fulfil our housing task poorly and consequently fail in the accomplishment of one of the most fundamental tasks assigned to man.'

Habraken then goes on to show how the housing project has been fitted into the housing process and has now become universal. So general is it in fact that housing and the housing project have become one conception. When a solution to the housing problem is suggested, it is always expected that it will be found in the new way of handling the housing project. It should not, he insists, be regarded as the only means.

The fault with the housing project is that it does not satisfy all the forces at work in the housing process. One force has been eliminated: ' . . . a housing project is only possible if the individual, the occupant, does no longer concern himself with the way in which the building of his dwelling is effected. The influence which the individual, ie the layman, can exercise directly on the housing process must be eliminated to make a housing project possible. This method is therefore the result of a deliberate and evident interference in the balance of forces in our housing process. . . .

'It cannot be denied that here we face, indeed, a real force in the entire process, for if this were not the case, those who build the housing projects would have no ground to fear the interference of the occupant as an influence which they cannot control and which (they fear) causes confusion . . . the beginning of chaos, the end of housing itself.' Habraken admits that the introduction of the individual means the end of the housing project. But this, he says, is the beginning of housing.

In passing, he gives credit to the housing project for the efficient way it has got a lot of people under cover in the last 50 years, but says it has resulted in the phenomenon of an entire society housed



**At present the community is building homes for individuals who are unknown. The community wants to build completed homes. The homes are completed even to the extent of a mirror above the washbasin and paper on the walls. The community wants to do it all. Yet there is a point beyond which the community may not go. That is where the individual comes in . . . with his own choice of furniture, upholstery, floor coverings, and curtaining. Living is an act that takes place in both spheres. A home connects the two spheres. Terminus of a series of communal services; start of a personal enterprise. This even obtains in our communal housing projects; mass production housing. But the transition point has reached an extreme. The sphere of the individual is almost lost. The occupant is almost eliminated**

in housing projects; it is now possible to see the outlines of a process which reflects 'the elimination of man as an individual.'

And the defence of the housing project, that it enables the greatest number of people to be housed in the shortest time, does not stand up too well when there is still a shortage of houses—in spite of 'industrialisation' which in other fields of industry, has reached the stage where consumption is a greater problem than production. He concludes that there is no such thing as industrialisation in housing. He is not against industrialisation of the housing process, but feels that we are trying to industrialise the wrong process.

Paradoxically, he claims that the reintroduction of the individual as an active force holds the key to correct use of industrialisation. This paradox resolves itself when we learn what he has in mind, but he holds off the revelation until he has finished demolishing the housing project.

'The inhabitants of a development project cannot make their town their own. They remain guests in an environment which is not part of themselves. To become one with this environment, they must change, there is no other way out. It is therefore said that the people "are not yet ripe" for what is offered them and that they must grow into it . . . the object of all housing has been reversed. . . .

'So, today we get nothing but perfect barracks. The tenement houses have been taken from the slums and have, provided with proper sanitation, light and air, been placed in the open field. . . The only way in which the population can impress its stamp on the immense armadas of tenement buildings which have been washed ashore all around the centre of the town is by wearing them down. Destruction is the only way out left to man.'

After defining the dwelling ('any space in which people live becomes a dwelling. A dwelling is not recognised by its form but by the act of dwelling. Functionalism is trying in vain to determine *the* form of *the* modern dwelling') he goes on to define 'the natural relation.' It existed at its purest when man, unaided, built his own dwelling, and room must be made for it again in the housing process:

'The natural relation is the central force around which the entire system must be arranged. The natural relation is a source of energy and impetus. It is thousand fold, incidental, whimsical and perhaps elusive, but we must see to it that it nourishes the housing process continuously.'

But it is not only the individual who suffers at the hands of the housing project. There is the community (or lack of it), the society it belongs to (or doesn't belong to) and the town of which it forms a part (or non-part). 'So, dwellings should be built in such a way that the people, once admitted to them, are not forced to assume an unnatural guise. Society may not do violence to itself in order to be housed in housing projects. . . .'

At present, the planners attempt to achieve harmony between housing and society by dividing it into groups and then building for those groups. Habraken illustrates the futility of these 'brick and concrete statistics' with a useful analogy: 'When I have a handful of beads of various colours, I can get an insight into what I hold in my hand by dividing the beads into groups in such a way that all the beads of approximately the same colour are in one group. But if I do so, one thing is incontestable: the original arrangement was always different from what I see after the beads have been rearranged.

'So, it may be very useful to subdivide the population into imaginary groups. But what makes housing projects so tragic is that they are much more suitable for such imaginary groups than for the complex and varied reality. . . . Society left to itself would never arrange itself in that way.'

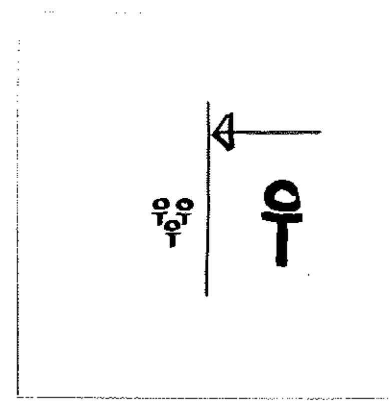
This attitude leads to the assumption that town and population are separate entities—but is it possible, asks Habraken, to conceive a population without a town or a town without a population? 'We must refuse to divorce the population from the town, for the shape of the one is determined by the other.' (If this theoretical divorce between town and population appears fanciful, it may be helpful to remember that we are now building towns in the middle of nowhere for populations who exist only as statistics.)

Once again, says Habraken, we must return to the natural relation if we are to achieve a town in harmony with its population—'Then it is possible for society, via the individual which is its smallest entity, via the dwelling which is the smallest entity of the town, to reflect itself in the shape of the town.' If the natural relation is active, a town is 'an organism which houses life in every cell, an organism which is never quite finished but which renews itself continually and which grows incessantly, ever different and ever the same . . . a cycle in which matter gets some of the mobility of life and life receives some of the permanency of matter.'

But this cannot be achieved by 'the dumb apparatus' of the development project, with its duty to plan on the known facts for a future in which the facts are unforeseeable. The development project prevents the town from renewing itself—the dwelling is not only tied up with the larger building block, but the blocks themselves have been arranged in the town planning scheme so that they form part of a bigger series. They are unable to renew themselves by changing to meet new needs and influences, by responding to the forces of the natural relation—they are renewed only when they are worn down, only when the structural soundness has deteriorated to the point where the people's health is endangered.

This means, says Habraken, that a town is always composed of some areas which are new, some which are old and the standard of your dwelling depends on where you happen to live. But the developers never catch up: 'It will always

**Sometimes the transition point of the two spheres lies at the opposite extreme. In a bidonville (shanty town) everything starts in the sphere of the individual and is not completed in the sphere of the community. There the sphere of the community is not productive, it is as in a jungle, inhuman. In camping sites the sphere of the individual predominates. There, an individual lives according to his own choice. Entirely due to the products of industrialization. But soon a communal road makes its appearance, communal sanitary services, a shop, a community centre. Something is built which completes this type of settlement in the sphere of the community. On the camping site only the barest necessities (from the communal point of view), are introduced. In housing everything considered most desirable from the communal point of view is introduced**



be possible to note a housing crisis in some part of the town which must be remedied by a big development project. So it becomes evident that the system, which as we saw was an emergency measure, is itself instrumental in always causing a state of emergency in some area.'

The result is a continuous game of musical chairs in which the population must move from area to area to be in the best housing, among the latest ideas, devices and amenities. The town dweller, says Habraken, is becoming a nomad 'like the primitive people who exhaust the soil and then migrate to other regions.'

The development project 'totters cumbrously from the one eruptive renewal to the next, in an everlasting feverish pursuit of reality, ever groping and seeking, theorising and rationalising in a stubborn endeavour to catch the incidental and the changeable in institutionalism and generalisations.' The population totters along behind it, seeking better housing but failing to achieve communities.

Habraken lists three prerequisites for development of sociological harmony in an urban area—the first, is the freedom to combine; the second, is the renewal of the dweller's environment; and the third, is *time*—time for a community to form and flourish. The first condition is prevented by the artificial arrangements imposed by a development project; the second is prevented by the indifference of the development project to the initiative of the individual; the third by the fact that the people need more time to grow into a community than the housing projects need to expand. 'An area which has today its own character is therefore always a slum area.'

We must make it possible, he writes, for urban areas to come into being, and get old without becoming outdated; areas which can contain the last devices and yet have an old history; areas in which the people can live for generations and which, all the same, allow matter to change; which is quite the opposite of what development projects offer us today.

'The modern dweller is a nomad who wanders about without taking part in the growth of his environment; he therefore need not blame himself for the shabbiness of it. He accepts his town as a natural phenomenon and finds the possibility for self expression (quite in keeping with his nomadic life) in his motorcar. We have strayed far from the image of man which we visualised in the beginning; man who creates his own environment to be in harmony with himself.'

But how is this new town to be achieved, old without being outdated, constantly renewing itself? The development project approach to housing may have failed, but what can replace it? Before answering this question, Habraken points out that the failure of the present system results from a balance of forces from which one force is missing. Reintroduce this missing force and the natural relation must catalyse the whole process and take it in a new direction.

Technology and organisation will be needed, but blind faith in them for their own sake will not bring a solution. They must be used as part of a new method but a method derived from factory production: the present application of factory methods to the housing project, says Habraken, is the equivalent of *an attempt to manufacture the seventeenth century coach by means of an industrial production system.*

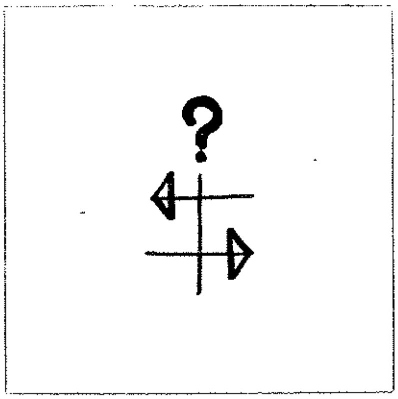
In other words, the wrong process has been industrialised. The uniform dwelling and the uniform way of life are not products of industrialisation, but of the housing project which produced standardised dwellings long before mechanization. 'In this context it is good to remember that never has an attempt been made to create a housing process that is the logical issue of an industrial production apparatus . . . we now know that the reintroduction of the natural relation is not incompatible with the principles of mechanical production; this reintroduction is only incompatible with the housing project.'

To reintroduce and preserve the natural relation, the dwelling must once again have the independence to be altered, improved, or replaced independently of its surroundings.

'If we visualise the town as an organism built up of independent living cells, it becomes clear that our modern cities are primitive organisms with a coarse structure which is not very flexible and has little vitality even if its scale is unprecedented and supernaturally large.'

'A truly modern town should rather lead us to expect that it would have an infinitely complicated and finished structure, built up of a much larger number of cells than the old town.' Habraken suggests that if the natural relation is really allowed to function, the forms will 'spring up on all sides, owing to the inventiveness and intelligence of the countless people involved.' . . . 'However sure I may be of the forms which I see rising up from the ruins of housing projects, the part they play in this connection is only of secondary importance.' Habraken does have form in mind, and we can see that it excites him enormously, but he seems able to hold off the revelation almost indefinitely. In his book, we can see him going back and forth across the theory of the natural relation, explaining it again and again in different contexts and in different ways, so that there can be no chance that we have missed the point. Time and time again, we can sense what he is holding behind his back, again and again he shies away back into the theory. But eventually he is ready to start building his town:

'The first and greatest problem we are confronted with, if we wish to visualise a town consisting of independent dwellings, is that the dwellings must be piled one on top of the other. The piling-up of dwellings has always implied that a number of dwellings are assembled in one building. It is the first step towards the dangerous



**In our housing the transition point between the two spheres is just as extreme as on the camping site, only in the reverse direction. Why is the borderline so extreme now? It has nothing to do with industrial production. It has to do with organization. That is: the way in which we believe things should be done. The way in which we believe we should work and think**

point at which the scale must be so much bigger that the vitality and flexibility of the organism of the town is endangered.'

'How are we to pile up dwellings without sacrificing their independence? This is the great problem in structural design which must be solved. The answer can be both simple and comprehensive. We must make structures which, in themselves neither dwelling nor building, lift the dwelling above the ground. Structures which contain independent dwellings in the same way as bookcases contain books, which each separately can be taken out and put back. Structures which have the task of supporting the dwelling, which supply us with building sites in the air and are permanent like streets. Even without wanting to know what these structures will look like, I would call them supports, after the task they must perform. So any structure which enables us to build dwellings which can lead an independent life and do not stand on the ground, is a support.'

At last! We are permitted to see the shape which might rise from the thoroughly pulverised rubble of the housing project. His definition is one of function, not form. To him, a support is a structure in which a number of dwellings can be assembled. Dwellings can be built, altered or demolished separately and independently from each other within this support.

This new element in the housing process offers unprecedented possibilities: 'On the one hand the supports restore the natural relation, on the other, they make modern industrial mass-production possible.'

Habraken tells a little story to illustrate how the human and industrial requirements are satisfied: a young couple want to move into a support town and they go around looking for a site. 'The support consists of a concrete structure of tiers of floors winding their way through the town. In between these floors are the dwellings side by side. A strip on one side of these tiers of floors is reserved for an arcade. This arcade connects the detached stairwells and lift shafts which are constructed at regular intervals. Between two such floors is an open space which, but a short time ago, had been filled by a dwelling, now demolished. This space is therefore enclosed at top and bottom by support floors and at the right and left by the blind walls of other buildings. . . .'

In short, the couple like the allotment and they decide to have a dwelling put into it. They begin shopping around among the people who make and distribute support-dwellings and after much thought they chose a particular make. But the riches of choice are not yet exhausted—they still have the enjoyment of deciding a ground plan and all the details which will suit their way of life. In this way, the natural relation as it affects both the individual and the community is satisfied: the couple have chosen their home, and in fact, to a large extent designed it. They have also chosen where it will be placed in the town.

Because the supports have become quite general and the technical construction of the support dwelling has been perfected, dwellings are made from prefabricated units. Technology has been used to create a mass production process compatible with the human relation. The supports and the dwellings will be completely different building processes. Because the support must provide for the unforeseeable future it must be extremely simple in form and construction.

'In contrast to the dwelling which will be built in it, it may not have the complicated details, nor the finish, nor the short life span of the factory-made product. It is a coarse structure. It is in a class with bridges, viaducts, canals and roads . . . works which withstand the centuries. The more substantial they are, the more the trouble of building them is rewarded.'

Construction of these supports can be mechanized as much as possible, but there will be no struggle to turn this into an industrialised process: supports are not transitory like dwellings. Once the crude construction work is eliminated from dwellings, these can be made entirely in the factory as a true industrial process. Site work will involve simple erection and connection to service ducts in the support structure.

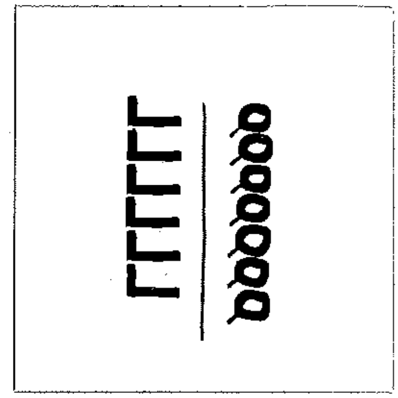
There is also a natural division between the public and private building sectors. The public authority will be responsible for planning and building the support structures; the private sector will be responsible for developing industries geared to the support dwellings.

Habraken is reluctant to tie himself down to form, design or construction method for the supports, but he suggests two requirements which must be met: as much as possible the support must have the same section at any given point and it must be as long as possible. The first requirement implies that all vertical connections—stairwells, liftshafts, and so on—should be constructed outside the support, to leave maximum space for arrangement on the platforms; the second implies that the supports will be 'long ribbons winding their way through the country. The town planning aspects of the support towns are exciting, though at first sight the town planner is robbed of many jobs which were formerly in his brief. The placing and movement of people is no longer planned. If they move, they move themselves for purely sociological reasons.

'This implies that the people will choose their dwelling with a view to their occupation and, especially, to the community they wish to be in . . . whatever may happen, wherever the social communities of the future wish to settle, in whatever form they will manifest themselves, it will always be possible without the necessity of abandoning the principles of the town planning scheme. The supports conform to the most important law of the town planner—that all contingencies shall be possible.'

Suddenly, the action of the individuals in a community will make that community identifiable by the choice of certain house types, the way they are assembled, their placing in relation to other dwellings and so on.

**A home comes into being in two spheres. It cannot be made in one sphere alone. What, then, should we produce in each sphere? In one sphere everything that is used collectively for housing. In the other, everything that is being used individually for housing. The product in the communal sphere we call the 'support' or 'framework for living'. The product in the individual sphere belongs to what we call the 'set of detached units'. The 'framework for living' contains by definition everything that is used collectively. The 'set of detached units' contains by definition everything which is used by the individual only**



Outside the dwelling, in the true sphere of the communal, the flexibility of the supports will bring rich rewards. Shops, schools, garages, churches and public buildings can be slotted into the structure as they are needed—a community does not inherit the amenities ready made (and perhaps quite unsuitable) as with the housing development. Nor is there any need for zoning of the residential and the commercial, since they can be intermingled as in the older communities.

Habraken speculates how a town might grow up: 'How will the town grow with a perfect harmony between supports, trees, streets and water, until forms result, which in harmony and timelessness, may rival our beautiful canals? How will man and matter merge into an individuality all their own? We shall no longer need to argue whether 'the occupant' wants a lot of glass in his house front or would rather have less sun, whether 'they' prefer a kitchen/dining room to a sitting/dining room. . . . The experience resulting from the interplay between dwellers and industry will give the answer in each separate case. Instead of theorising about 'the dwelling' we can now, by fixing rules as to the use and division into allotments of the supports, participate in a vigorous process which will lead to a new social relation, new ways of housing, new towns.'

The new towns could take countless different forms. The supports could form open or closed spaces and squares; they could run along wide streets or enclose traffic-free parks. Habraken visualises a town composed of closed gardens with the support structures shutting out the traffic. Inside the garden squares, scale would be determined by walking man. A 'support net' would be formed from rings of support structures linked by pedestrian bridges across the traffic.

'If we wish to shut out the noise and concentrate on the inside, the support rings should be made in such a way, the arcades for pedestrians and the detached staircases are on the outside, so that the dwellings get an inward orientation. How large must the inside space become? The dimension of a sizeable market square or larger? With a fixed density of population the size, of course, influences the height of the supports, so that there will be some optimum which is not so easy to establish. But let us please avoid right angles in the support ribbons, let us stick to flowing lines. This will give them a less aggressive, less monumental aspect—and besides, a support without sharp angles can be built more easily.'

Garages would be placed on the outside of the ring at ground level, thereby acting as a buffer zone between roadway and footway. Under the supports there would be a promenade and perhaps shops and entrances to the staircases. But on the inside he sees 'an open space with much green and paths. . . . Shall we plan a school in the middle of the stretch of green? A civic centre or a small conference hall? Or shall we put them all on the side, under the support, looking out on the park?

'On top of the support, a terrace running the full length can be designed, with some special buildings, a cinema, a gymnasium, a club. It would be possible to build one stairwell with a few lifts and one support section some six stories higher than the roof terrace, to house the smaller flats (or the very big ones), each covering an entire floor.'

But these are only suggestions, to set our minds working. The actual layout might be totally different, perhaps with all the special buildings under the support, leaving the roof clear for a garden, or allotment gardens on top ('What a sight such a town would offer from the air, with allotment gardens on all roofs'!). The real planning would be done by the community, indirectly as a reflection of their needs, or as part of a new relationship with the public authority. If they had cars, garages would be built; if they had an active social life, conference halls might be built. 'Or they may decide to embellish the covered promenade under the support, their support, by making the pavement more beautiful, or by facing the columns with marble. . . .'

Habraken goes on to show how the area could change to meet new needs of later generations, and continues: 'It is interesting to speculate how far the occupants can get a say with respect to the development of the areas in which they live. It may not be too much to surmise that a new relation between the citizens and the authorities may result from it. The responsibilities laid in the hands of the occupants with respect to the home will also be reflected outside it. For does not the entire building activity converge in the dweller?'

The result of all this, says Habraken, will be a town that reflects the lives of the people in it, but because the housing project has bred a passive consumer mentality in the dweller, the town will not necessarily be beautiful: 'It will not be possible to get people without style housed in a town with an aesthetic appearance . . . It is therefore necessary to educate the population to make it possible for a town to become beautiful. . . . The use of supports in itself might be a stimulating influence, strong enough to achieve this . . . the occupant . . . will soon develop a keen sense of judgment with respect to the quality of what is offered to him. . . . If the spark of interest and self interest once flares up, the main condition for an ever improving standard in housing has been fulfilled. It is in this light that we must see the examples selected at random, of the possibilities of the supports and the support rings. All this may result from it. Not by making a detailed plan of the town of the future—but by supplying new conditions.'

Habraken does not go into the cost and financing of the support revolution. He states simply that 'it is not a case of whether we can afford supports, but a case of whether we can do without them.' But clearly there would be economic advantages. The money spent by the local authority would be well invested since it would not have to come back for reconfacing

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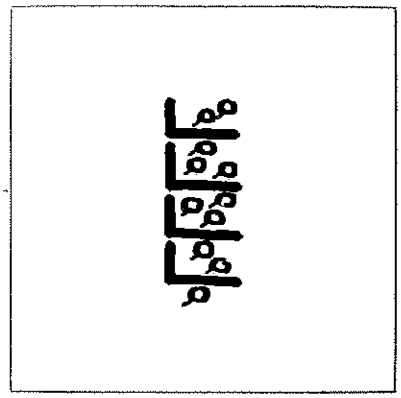
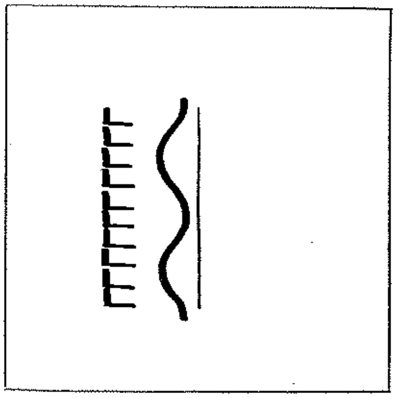


**A home is brought into being when support and detachable units meet. Therefore we do not make dwellings. We make supports and detachable units. We make completed and recognisable things, each belonging in its own sphere, created in accordance with its own pattern of relationship.**
**We can only make objects, products, things. We cannot make homes.**
**A home is not a thing. A home is an act. The dwelling is part of that act. The dwelling is an act. That is why you cannot make a home for someone else; (you can make 'a villa', or 'a bungalow', or 'a palace', or 'a block of flats', but not a home).**
**You can make supports or detachable units**



**In every sphere a product has its own time of use and its own wear life. The support bridges a generation and connects generations. A community wants something which has a longer life than that of an individual. Because a community lives longer than an individual and changes gradually.**
**A community takes over what is left behind from previous generations, uses it, changes it, passes it on to the following generations. It takes a generation before a community has settled into its new surroundings.**
**Then the details have been filled in, the trees are fully grown**

struction and redevelopment. The dwellings could largely be erected in the supports, regardless of weather conditions and technical experiments. Experiments in the field of housing as such could be made incidentally, without big projects being started for them. Architects and architecture will be favourably influenced too. Habraken does not enlarge this point; presumably he feels that if architects cannot see the possibilities, further explanation will not help.

Concluding his book, Habraken considers supports in relation to his own country. 'The Netherlands are in a unique position to develop the supports. The development projects have progressed so far that a critical point has almost been reached. What has been done here in the field of housing has been admired abroad. No country has such a wide experience as regards the needs and desires of modern man in connection with housing.

'Here, sooner than anywhere else, a point will be reached at which the spell of the development project must be broken; a point at which this system of housing must be discarded as an emergency measure which has served its purpose. We are too densely populated to build independent houses as is done in the US, by making use of prefabricated bungalows. And yet we must get back the independent dwelling. We are undoubtedly competent enough as regards technical skills and organisation to tackle the industrialisation of housing. If by building supports we should succeed in lifting the housing of modern man out of the past, the industry we should build up in doing so might become a source of wealth.' And here, for the benefit of those who control housing policy, is the jam which tops off Habraken's tough recipe—the support dwelling industry could develop a huge export business to the developing countries of the world, whose need for this type of dwelling is no less than the need in Europe. Subsidiary industries could even be established in foreign countries.

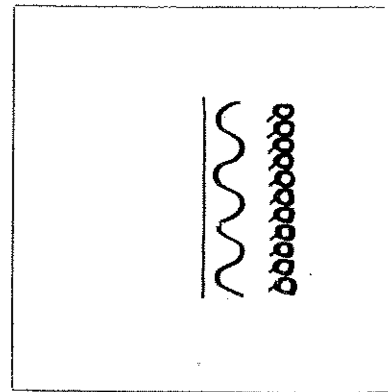
We have dealt with Habraken's work *The Supports and the People* at length because it is one of the strongest and most humane treatises ever produced on the subject of housing. In spite of the fact that it was first published in 1961, too little is known of it outside Holland.

Others have come up with ideas for structures which are in many ways similar to 'the supports' but perhaps not for the same reasons—the convenience of the planner, the architect and the builder have come first, while Habraken's work is geared to the convenience and fulfilment of the occupant. They have concentrated to an extent Habraken would regard as dangerous on form.

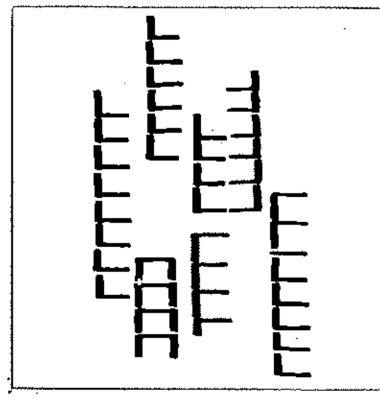
But the value of his work is not solely as an impassioned plea for new values. The theory is fast becoming reality through the research and development work being done by SAR and the faculty of architectural and urban design and building engineering at Eindhoven. SAR is now working on plans for a structure for living to try out its principles. This structure will be built for a large housing corporation, and will be completed next year if everything goes according to plan. This represents an achievement beyond the wildest dream of most housing theorists; the supports are on their way.

Meanwhile, SAR is working on a computer programming method to find all possible floor plans in a given structure, according to given standards. Rules of modular co-ordination have been devised

**A set of datachable units serves only one generation. Every generation is distinct from another. A detachable unit changes for many reasons because it is quickly worn out; because fashion changes; because technique is further developed; because we do not want to take over all our parents' things; because our opinions change; because we only live once**



**The support becomes a theme of architectural town planning. We get away from the block of flats. The supports form an urban tissue. As the detachable units become more clearly defined, the architect gets a greater measure of freedom in the design of supports. First of all the support makes possible the development of detachable units. After that the detachable units make possible freer development of supports**



so that it should be possible for one party to design a structure and for another to design some of the components to be placed in it. This is to ensure that the two could be brought together independently and when required. Much of SAR's work consists of giving advice and guidance to architects, producers and official bodies, who are willing to consider the possibilities of the design method evolved and who are trying to put it into practice. They have even found it possible to do some consumer testing: a model of a possible structure for living was displayed at the Utrecht Fair earlier this year and members of the public were told about it and asked for their opinions.

The idea of support structures is gaining momentum in the Netherlands. Much of the credit must go to Professor Habraken, the originator; but the Dutch architectural profession must have the credit for making it all possible by producing and backing a research organisation such as the SAR.

Many countries could benefit from having an SAR of their own and it is therefore worth outlining its structure. The initials stand for Stichting Architecten Research (Foundation for Architect's Research) and it was set up by nine of the bigger architectural firms who took the initiative with the BNA (Bond Nederlandse Architecten), the Federation of Dutch Architects. The managing board consists of 11 architects, one from each firm and two appointed by the BNA. The president of the Board is a lawyer and professor at Rotterdam University. The board has set up a research office, headed by Professor Habraken as director, with three other architects and a secretary. The Board meets about every month and the director of research presents a progress report and puts up proposals for new research. He takes the initiative, but is responsible to the Board. SAR is financed hy the nine firms and the BNA who guaranteed a certain budget for the first two years. Each office carries one share, the BNA two. This guarantee ended at the beginning of 1967 and a new guarantee has heen given for the current year. New guarantees must be found thereafter. Possibilities include a continued yearly contribution from the BNA, a limited government subsidy or an income from research commissions within the building industry or the government. A combination from all these sources may be the answer.

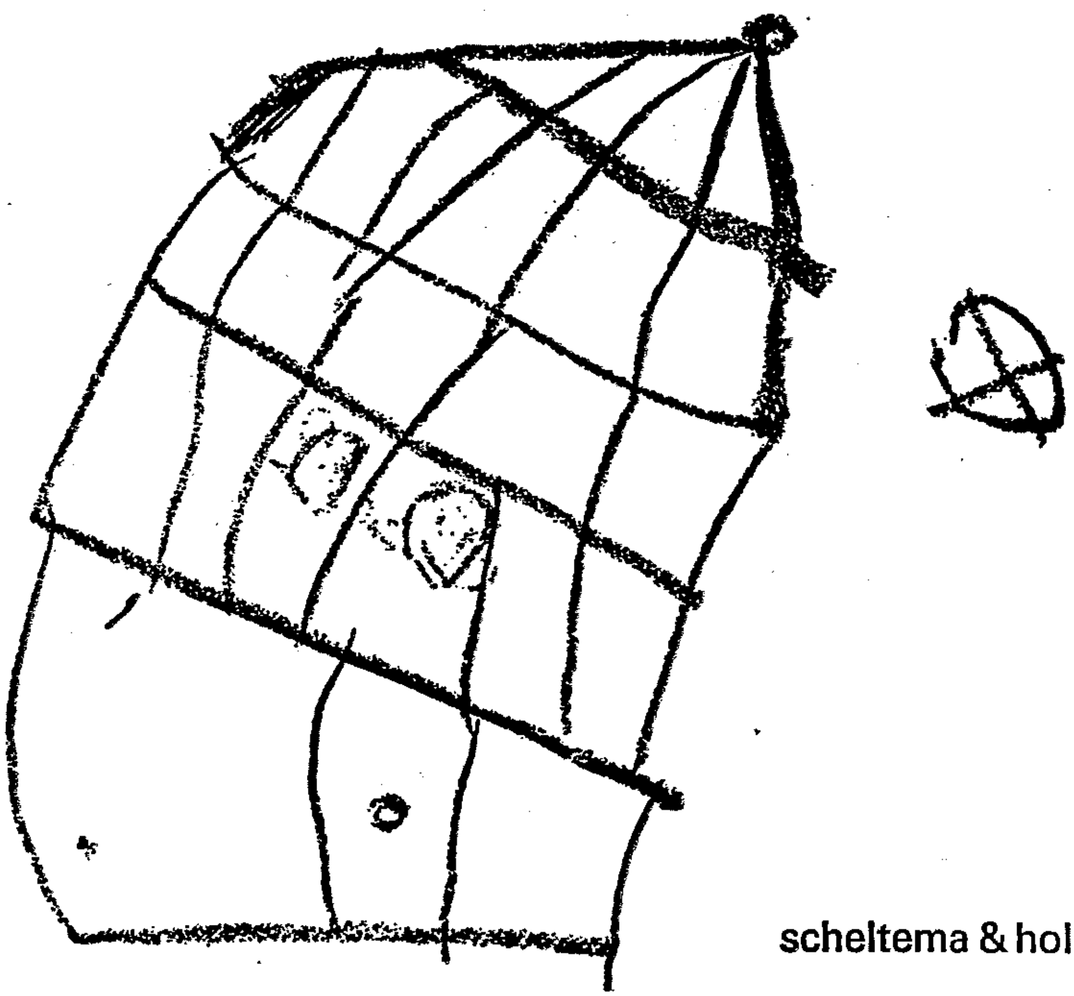
Research is currently limited to housing and specifically to the support concept, but the articles of the foundation include the possibility of other subjects. When Habraken was given the chair for architectural design at Eindhoven technical university, SAR was moved to Eindhoven so that he could remain its director. SAR and the faculty are now housed in the same building. One wonders if a thing like this could happen anywhere else in the world.

In Holland at least, the days of the housing project must surely be numbered. Elsewhere, it will, some day, come up against enormous vested interests who 'must get a return on capital investment to date.' It might take a generation, perhaps two, who knows?

What the Dutch are doing for housing today is in many ways similar to their achievements in shipbuilding in the sixteenth century. They are now showing us how to translate ideas and initiative into tangible results. They have also established that it is possible to get to Arcadia on a shoe-string ●

n.j.habraken

# aap noot mies huis
## three r's for housing



scheltema & holkema/amsterdam 1970

and, especially, what is the role of the industrial production system? What is the relationship between building and industrial production?
It proved necessary, time and again, to retrace the fundamentals of the work, to formulate more precisely the laws controlling the new standards. Anyone who wsnts to put communal housing on a new footing must do more than bear a 'message'; he cannot merely give an architect's point of view; he must refrain from the use of new terms merely because they are new. Somewhere there are a number of natural standards belonging to our era which must be traced; which must be made obvious.

This process of making real starting-points obvious is difficult. It requires that we continually reject old ideas and always remain on the alert not to slip again into automatic patterns of thought. It is therefore necessary to say the same thing over and over again from a different point of view, in a different way, until the simplest and clearest formula has been found.
In the notes about the two spheres the story of support and support-dwelling, of framework for living and detached unit is told again. The story of the two spheres is the story of new possibilities, without mention of 'creativeness' (of the occupant or the architect), 'flexibility', 'architecture' and other such words. Anyone who knows the two spheres can do something about the future. He can start work from new fundamentals.

Thinking in terms of the two spheres, several points become clear. Points which perhaps sound paradoxical, but which only seem paradoxical when considered according to standards of the recent past which are no longer valid.
The first apparent paradox is this:

In order to solve the housing problem we must stop wanting to build dwellings.

And architects must stop wanting to design dwellings.

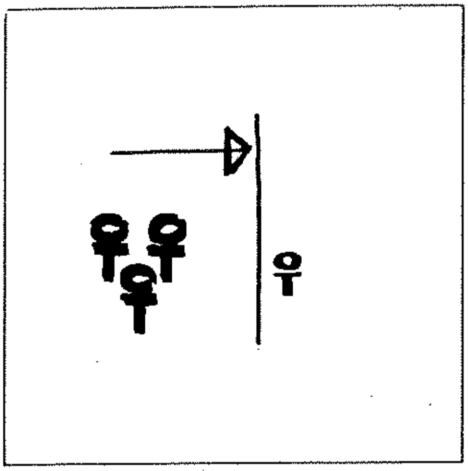
A dwelling is not a thing that can be designed or made. A dwelling is a result. The result of a housing process. The last act in this process is that of the occupant who goes to live there. The act of living there is the only one act which makes a dwelling of something (a space, a building, a hole in the ground). If I go to live in an attic or in a hen-house, then that becomes my dwelling. A dwelling is an act. If one wants to be concerned with housing, one should make this act possible. Thus one must study the housing process from one's own specialized field, promote it and direct it.
An architect will have to choose whether he wishes to continue designing dwellings, (those miserable objects which we now design and produce and which no longer make possible the act of real housing), or whether he wishes to occupy himself with housing. One does not go with the other. To be busy with housing also requires design, only not the designing of 'dwellings'. Knowledge of the two spheres makes it possible to start designing again in connection with the process of housing.
To design dwellings as this is happening at present, implies a negation of the process of housing.

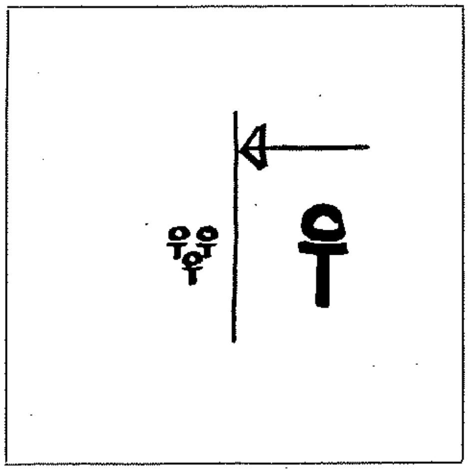
If the dwelling, does not exist a a product, the term 'housing' in the meaning of 'building dwellings' is really meaningless. Then it is twice as bad to speak of 'the industrialization of housing'. Building is by nature different from industrial production. 'Industrialization of housing' is a true paradox. A building structure is different from an industrial product and will always remain so, because a building structure is just that. Even though we build exclusively with the aid of industrially-made products, the act of building remains still something essentially different from producing industrially. So long as one does not take this simple truth as starting-point, every discussion about the industrialization of building will be a source of misunderstandings. The desire to create building structures as if they were industrial products is senseless. The idea of turning such a thing as a dwelling into an industrially produced thing has produced severe disturbance of mind. It has destroyed the clear purpose of building and has rendered the industrial production system powerless in the process of housing. Of course we have to produce industrially to provide housing.
But we can only really support our housing with industrial production if we realize that industrial production is something different from building. In order to provide housing we have to produce industrially and we also have to build.
Since there is a difference between industrial production and building, there is therefore also a relationship between them. That relationship must be clarified. Knowledge of the two spheres gives an insight into this and makes it possible to build efficiently and to produce industrially with efficiency within the framework of the housing process.

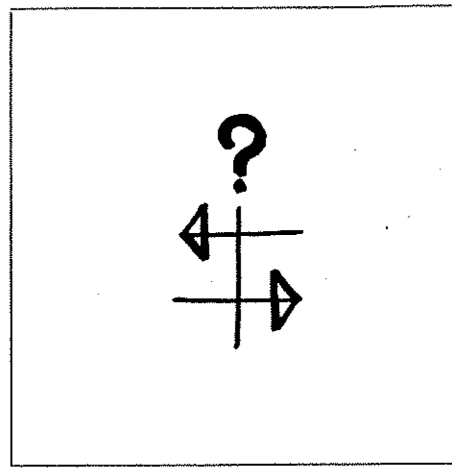
If a dwelling is not a thing but an act, the act becomes important. The act of living somewhere, of moving in, of settling in to a place in the direct sense of the word, implicates the occupant in the process of housing.
He is the only one who can bring this process to completion and thus also he is the only one who can start it again. The home comes into being, in the last resort, in the sphere of the occupant. But the process of housing consists of a series of acts. The measure in which these acts are attuned to one another determines the level of the process (i.e., the level of domestic civilisation or of civilisation pure and simple). The harmony in the process of housing determines the harmony in the material surroundings. We hardly know harmonious surroundings any longer because we have made a harmonious process very nearly impossible.
Nowadays we only know aesthetically-justifiable surroundings, so-called well-planned surroundings. Many examples of harmonious surroundings occurred in the past which were never designed.

Knowledge of the process of housing is in the first place: knowing who must do what. If the occupant has a role to play, so has society as a whole. Then we get on the one hand a role for the individual: the final act, the act of living somewhere, of settling into a place. This is an individual act. But it is an act which takes place in a community; in a given framework, in response to requirements laid down by the community. So, on the other hand, there is also a communal act. There is a sphere in which a community acts and a sphere in which an individual acts.
There are two spheres in which the process of housing is carried out.

Habraken







**De gemeenschap bouwt nu woningen voor individuen die onbekend zijn.**
**De gemeenschap wil voltooide woningen bouwen.**
**De woningen worden voltooid tot en met de spiegel boven de wasbak en tot en met het behang op de muren.**

**De gemeenschap wil het allemaal doen.**
**Toch komt er een punt waar de gemeenschap moet ophouden.**
**Dan komt het individu. Met zijn zelf gekozen meubels, met gordijnen, vloerbedekking, vitrage.**

**Wonen is een daad in beide sferen. Een woning verbindt de twee sferen.**
**Eindpunt van een reeks gemeenschappelijke voorzieningen; beginpunt van een persoonlijke onderneming.**
**Dat is ook nog zo in onze gemeenschaps-woningbouw; de massa-woningbouw.**
**Maar het punt van overgang ligt nu zeer extreem.**
**De sfeer van het individu is bijna verloren gegaan.**
**De bewoner is vrijwel uitgeschakeld.**

At present the community is building homes for individuals who are unknown.
The community wants to build completed homes.
The homes are completed even to the extent of a mirror above the washbasin and paper on the walls.

The community wants to do it all.
Yet there is a point beyond which the community may not go.
That is where the individual comes in... with his own choice of furniture, upholstery, floor coverings, and curtaining.

Living is an act that takes place in both spheres.
A home connects the two spheres.
Terminus of a series of communal services; start of a personal enterprise.
This even obtains in our communal housing projects; mass production housing.
But the transition point has reached an extreme.
The sphere of the individual is almost lost.
The occupant is almost eliminated.

**Soms ligt de overgang tussen de twee sferen geheel aan de andere kant.**
**In de bidonville begint alles in de sfeer van het individu en wordt de daad niet voltooid in de sfeer van de gemeenschap.**
**De sfeer van de gemeenschap is daar niet productief, is oerwoud, is onmenselijk.**

**In de camping overheerst de sfeer van het individu.**
**Daar leeft het individu naar eigen keus.**
**Geheel door middel van industrieel vervaardigde producten.**
**Maar spoedig ontstaat een gemeenschappelijke weg, een gemeenschappelijke sanitaire voorziening, een winkel, een gemeenschappelijke ruimte. Er wordt iets gebouwd om deze vorm van nederzetting te voltooien in de sfeer van de gemeenschap.**

**De camping is het spiegelbeeld van onze massa-huisvesting.**
**Op de camping ontstaat in de sfeer van de gemeenschap hetgeen vandaar uit minimaal noodzakelijk wordt geacht.**
**In de huisvesting ontstaat in de sfeer van de gemeenschap alles wat maximaal vanuit die sfeer bepaalbaar is.**

Sometimes the transition point of the two spheres lies at the opposite extreme.
In a bidonville (shanty town) everything starts in the sphere of the individual and is not completed in the sphere of the community.
There the sphere of the community is not productive, is as in a jungle, is inhuman.

In camping sites the sphere of the individual predominates.
There, an individual lives according to his own choice.
Entirely due to the products of industrialization.
But soon a communal road makes its appearance, communal sanitary services, a shop, a community centre. Something is built which completes this type of settlement in the sphere of the community.

The camping site is the reflection of our mass production housing.
On the camping site only the barest necessities, (from the communal point of view), are introduced.
In housing everything considered most desirable from the communal point of view is introduced.

**In onze huisvesting ligt de overgang tussen de twee sferen even extreem als in de camping. Alleen precies andersom.**
**Waarom ligt die grens nu zo extreem?**

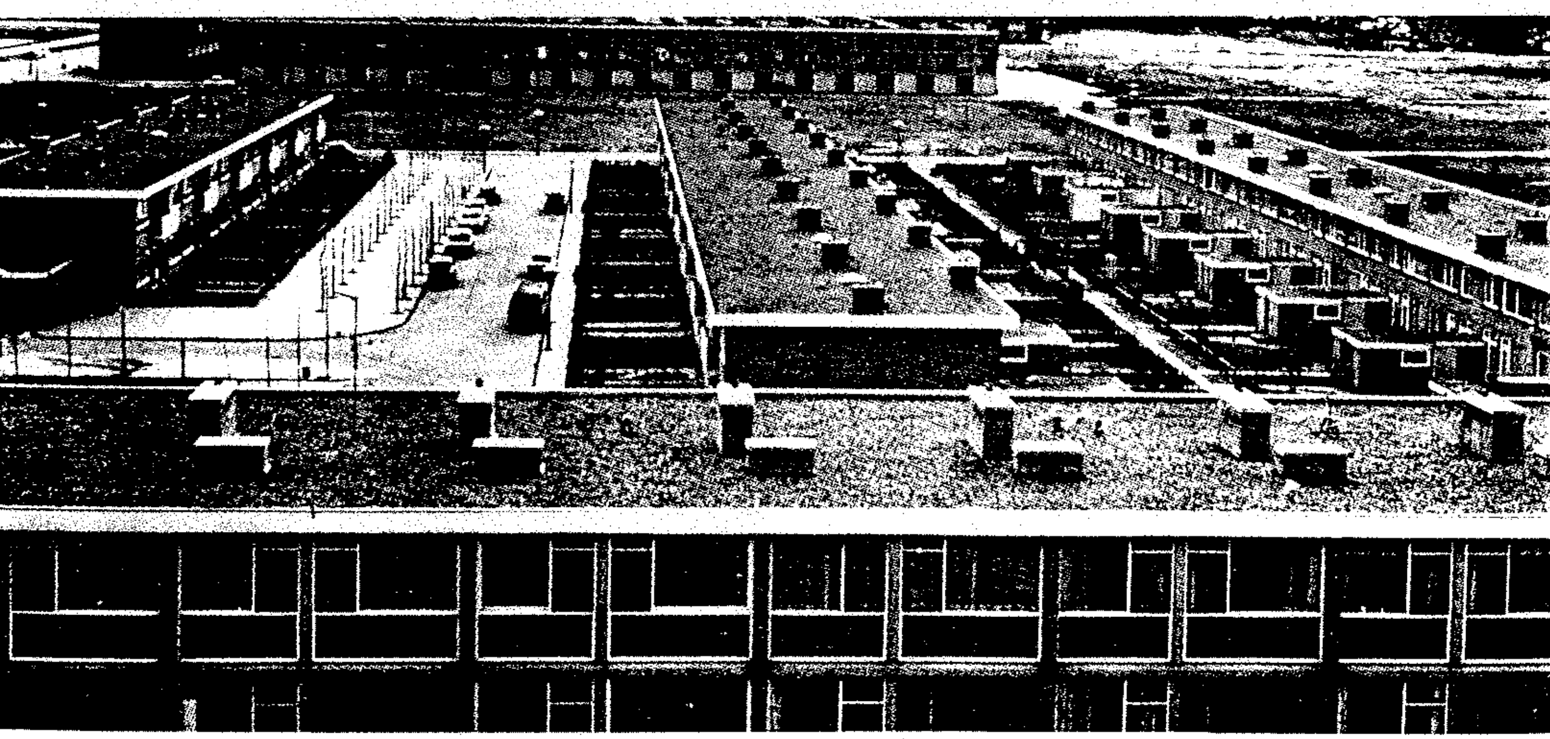
**Het heeft niets te maken met industriële productie.**

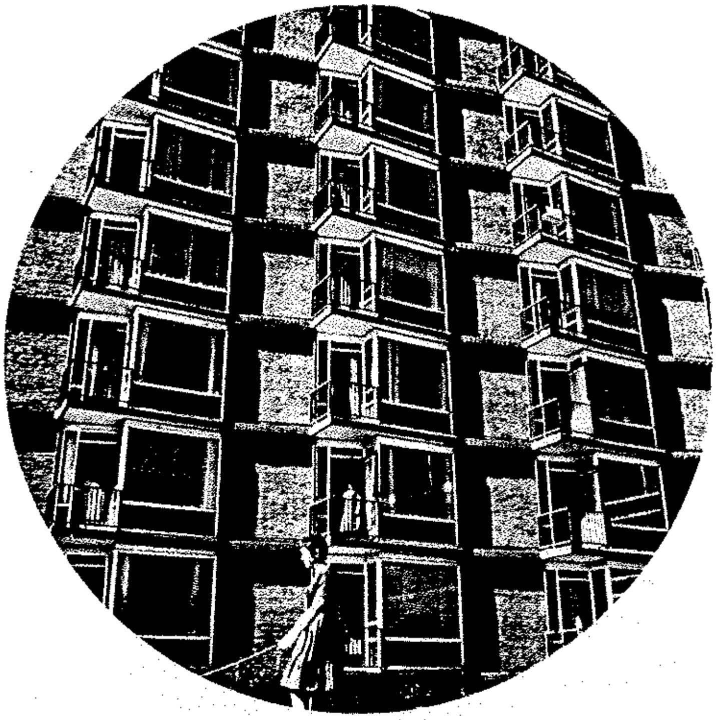
**Het heeft wel te maken met organisatie.**
**Dat is: de manier waarop we menen de dingen te moeten doen.**
**De manier waarop we menen te moeten werken en te moeten denken.**

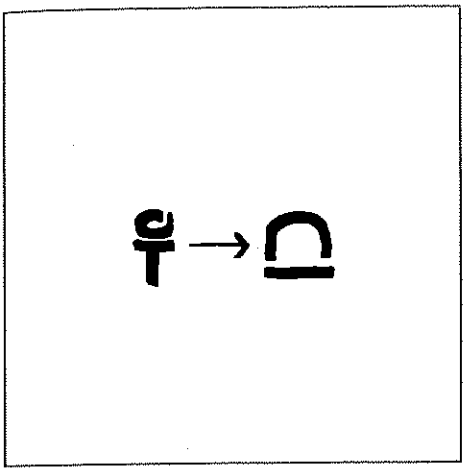
In our housing the transition point between the two spheres is just as extreme as on the camping site, only in the reverse direction.
Why is the borderline so extreme now?

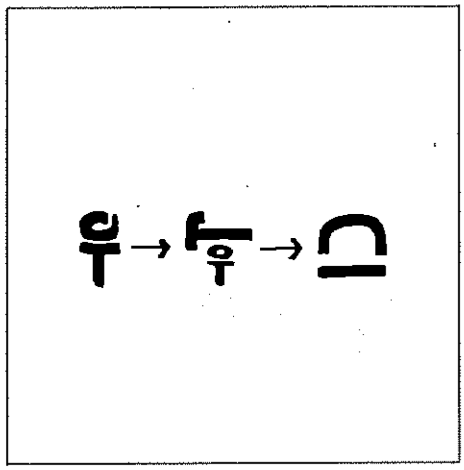
It has nothing to do with industrial production.

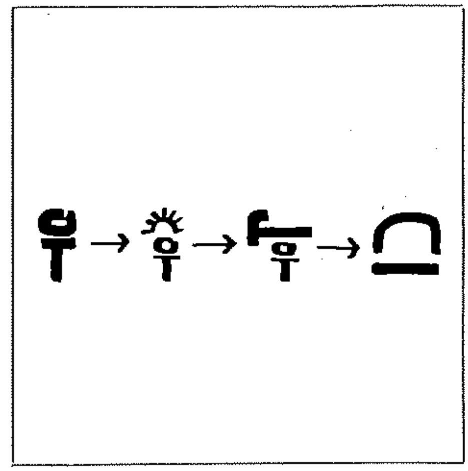
It has to do with organization.
That is: the way in which we believe things should be done.
The way in which we believe we should work and think.











**De eerste individuele relatie is de meest eenvoudige. De bewoner bouwt zijn eigen huis met eigen handen. Een vorm, die wij in de moderne culturen niet meer tegenkomen, tenzij als resultaat van een noodtoestand of op de camping. Er zijn natuurlijk nog beschavingen waar dit gebeurt zonder dat van een noodtoestand sprake is.**

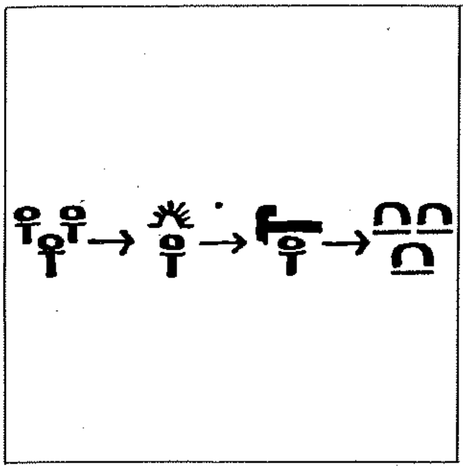
The first individual relationship is the simplest.
The occupant builds his own house with his own hands.
This is a type which we no longer meet in modern cultures, unless it be the result of an emergency or on a camping-site.
There are, of course, still civilizations where this happens without any question of an emergency arising.

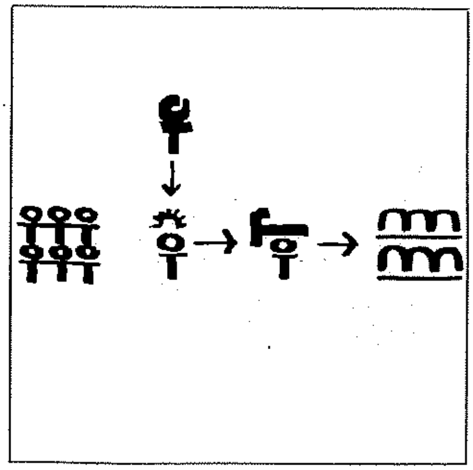
**De tweede soort van de individuele relatievorm is die waarin de vakman (bijv. de dorpstimmerman) zijn diensten aanbiedt.**
**De vakman kan in deze figuur ook een groep vaklieden zijn.**
**Deze vorm is ons uit de geschiedenis zeer vertrouwd.**
**Huisvesting ontstond zeer veel volgens deze relatie in de westerse geschiedenis.**
**Ook de veel geprezen traditionele Japanse woningbouw is er een mooi voorbeeld van hoe deze relatie tot een prachtige harmonische wooncultuur kan leiden.**

The second type of individual relationship is that in which the craftsman (e.g., the village carpenter) offers his services.
The craftsman mentioned here could also be a group of craftsmen.
This form is familiar to us from history.
This relationship was very often responsible for housing in western history.
Also the much-admired traditional Japanese house-building is a good example of how this relationship can lead to a splendid, harmonious living culture.

**De derde individuele relatievorm is die waarin tussen bewoner en vakman de architect als tussenpersoon optreedt. Dit is de vorm waarmee wij het meest vertrouwd zijn. Die in ons denken eigenlijk normatief is.**
**Toch zien we deze relatievorm nog slechts in uitzonderingsgevallen ontstaan in onze samenleving.**
**Er zijn maar heel weinig mensen die zich deze vorm kunnen veroorloven, want daarvoor is nodig dat men een architect opdracht geeft een huis te ontwerpen op een stuk grond dat men zelf bezit.**
**Architecten denken het liefst in deze relatievorm.**
**Nu nog steeds.**

The third type of individual relationship is that in which the architect acts as intermediary between occupant and craftsman. This is the type to which we are most accustomed. The type which we tend to consider as normal.
Yet we only see this type of relationship occur in exceptional circumstances in our communal life.
There are only very few people who can afford this type of relationship since for this it is necessary to commission an architect to design a house for a privately-owned piece of land.
Architects prefer to think in this type of relationship.
They still do nowadays.





**De derde collectieve relatievorm is die waarin de architect optreedt als gespecialiseerde tussenpersoon tussen de gemeenschap van bewoners en de vaklieden, die de bouwarbeid verrichten.
De woningbouwvereniging is oorspronkelijk vanuit deze relatievorm ontstaan, maar natuurlijk vindt men dit nu niet meer in de woningbouwverenigingen terug.**

The third collective type of relationship is that in which between the community of inhabitants and the craftsmen who are doing the actual building
the architect acts as the specialized intermediary.
The building society originated from this type of relationship, but naturally it is no longer to be found in presentday building societies.

**De 'zevende' relatievorm is een niet-relatie.
Geen van de voorgaande relatievormen vinden wij terug in de massawoningbouw.
Deze 'zevende' vorm van huisvesting kenmerkt zich door het feit dat daarin de bewoners eigenlijk niet voorkomen. Zij zijn onbekend tijdens het besluitvormingsproces dat tot het ontstaan van woningen leidt. Zij zijn een anonieme massa.**

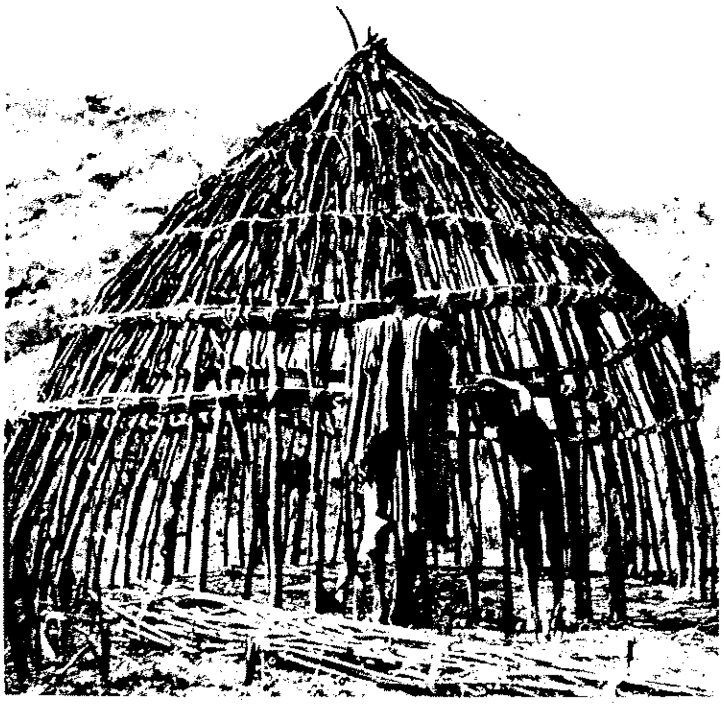
**Dit proces speelt zich uitsluitend af binnen de kringen van specialisten. De bewoner bestaat uit een abstract beeld dat deze specialisten zich vormen in onderlinge discussie om aan het werk te kunnen gaan. Zij observeren en onderzoeken daartoe 'de bewoner', die als zodanig natuurlijk niet bestaat.**

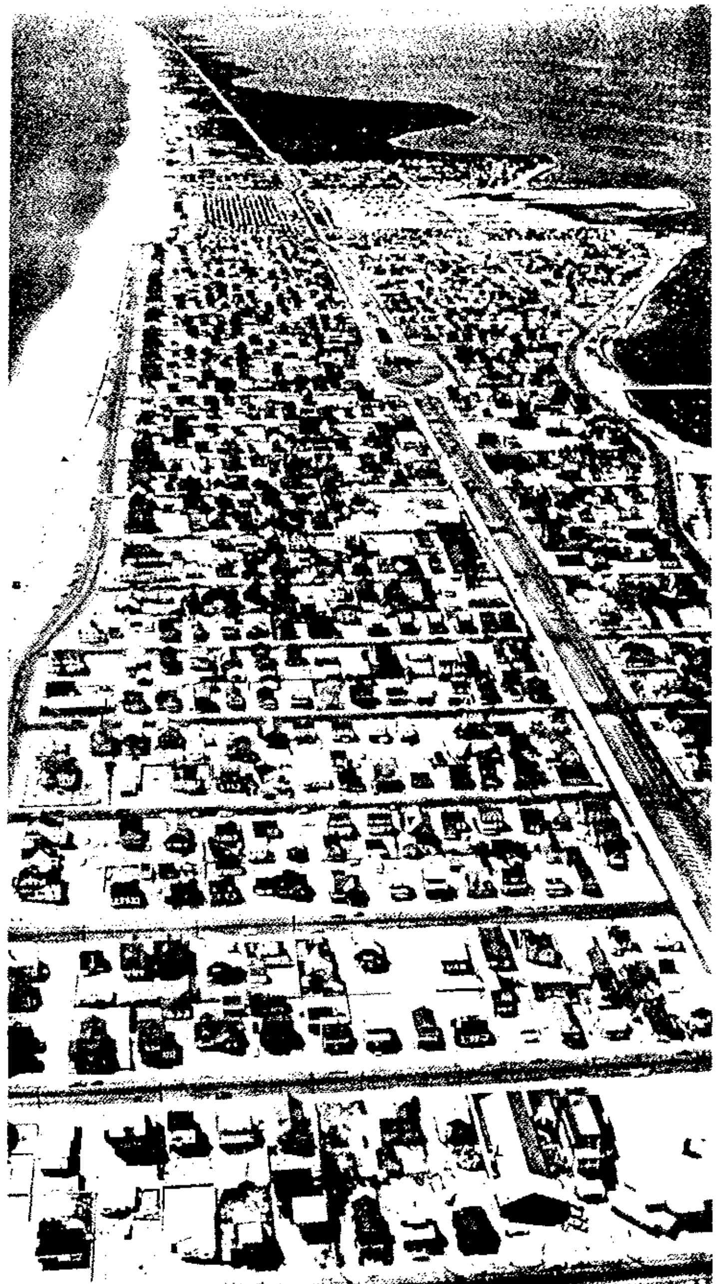
**Vandaar dat in het bovenstaand diagram van de groep 'anonieme massamensen' geen pijl is getrokken naar de architect. De architect krijgt zijn opdracht van een andere specialist, die evenmin als hij de bewoner is. Architect en opdrachtgevers doen hun best om dit dilemma op te lossen door 'de bewoner' te bestuderen. Oorzaak van veel semi wetenschap. Hier is dan ook eigenlijk geen sprake van een relatievorm waarin de bewoner aangegeven kan worden. Per jaar ontstaan nu volgens dit schema in ons land circa 100.000 woningen die eigenlijk niet-woningen zijn.**

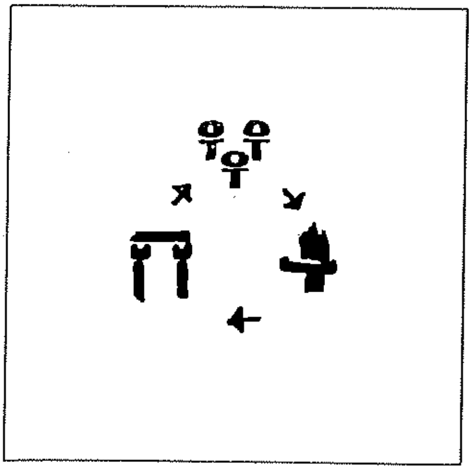
The 'seventh' type of relationship is a non-relationship. None of the previous types of relationship are found in mass production building.
This 'seventh' type of housing is charactarized by the fact that the occupants really take no part in it. They are unknown during the process of decisions which leads to the production of dwellings.
They are an anonymous multitude.

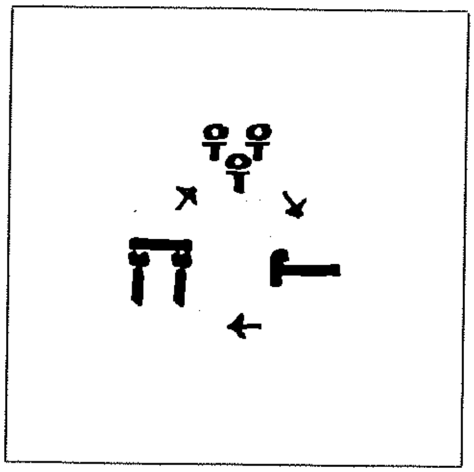
This process takes place exclusively within circles of specialists. The occupant is represented by an abstract image shaped during discussion among these specialists so that they can begin work. To this end they observe and examine 'the occupant' who, of course, does not exist as such.

It is for this reason that in the above diagram nothing reaches the architect from the group of the 'anonymous multitude' of people. The architect is commissioned by another specialist who is no more the occupant than he is. Both architect and the people who give the commission do their best to solve this dilemma by studying 'the occupant'... the cause of much half-knowledge. In this case there is really no question of a type of relationship in which the occupant can be recognized.
By planning in this way approximately 100,000 dwellings per annum are built in our country which are really non-dwellings.



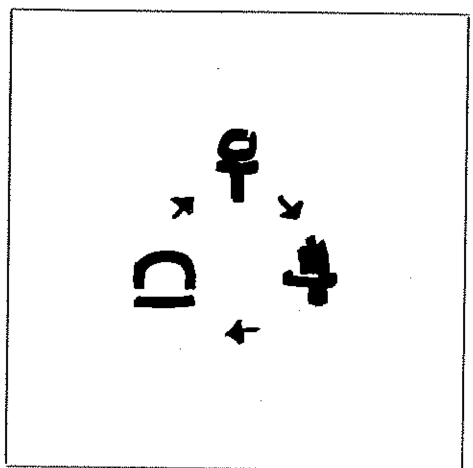






**Het gaat nu dus om de rol van het productie-apparaat. Het bouwkundig productie-apparaat bouwt natuurlijk niet alleen woningen. Het bouwt ook andere bouwwerken.**
**Zo kan een gemeenschap met eigen handen (zonder specialisten) een gemeenschappelijk bouwwerk maken. Bijvoorbeeld een plaats van samenkomst.**
**Volgens dit schema ontstonden de eerste gemeenschappelijke voorzieningen, (bijvoorbeeld ter verdediging).**
**Eveneens is dit schema het begin van het monumentale bouwwerk (grafteken, tempel).**

We are now concerned with the role of the production system.
Of course the architectural production system does not only build dwellings. It also constructs other building projects.
In this way the community can make a communal building unaided, (without specialists), e.g., a meeting centre.
In accordance with this scheme communal services were supplied for the first time, (e.g., for defence purposes).
Similarly came the beginning of monumental building (tombs, temples).

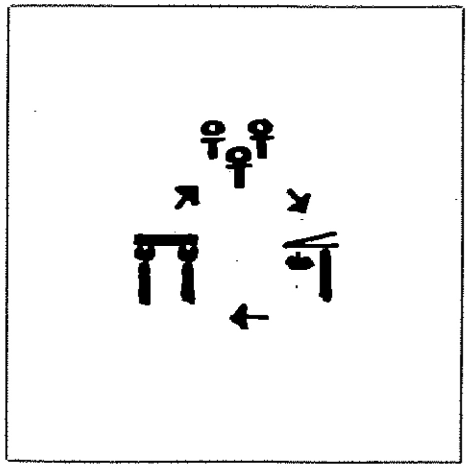


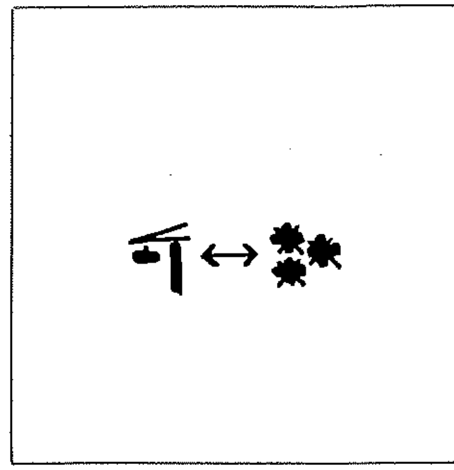
**De situatie ontstaat dat bij de bouw van het gemeenschappelijke bouwwerk de vakman optreedt. Het ambacht ontwikkelt zich. Daarnaast wordt de huisvesting nog geheel verzorgd door de bewoner zelf zonder hulp van een gespecialiseerd ambacht.**

**Hier zien we de twee sferen terug waarvan hier sprake is. Gemeenschap en individu staat ieder op hun eigen wijze in relatie met de materiële omgeving en gebruiken ieder een verschillend productie-apparaat. Dit beeld keert in vele variaties terug naarmate de ontwikkeling van de productietechniek voortgaat.**
**In onze tijd verdwijnt het. Het onderscheid tussen de twee sferen valt weg. Het blijkt dat een oplossing van het huisvestingsproces pas mogelijk wordt wanneer we in ons denken weer de beide sferen gaan onderscheiden in de situatie van vandaag. Dan wordt het namelijk mogelijk om de rol van het industriële productie-apparaat in de huisvesting veel duidelijker te onderscheiden.**

The situation arises that the craftsman takes part in the creation of communal building. The building creft is developing. Apart from that, housing is still completely done by the occupant himself, without the aid of specialized craftsmen.

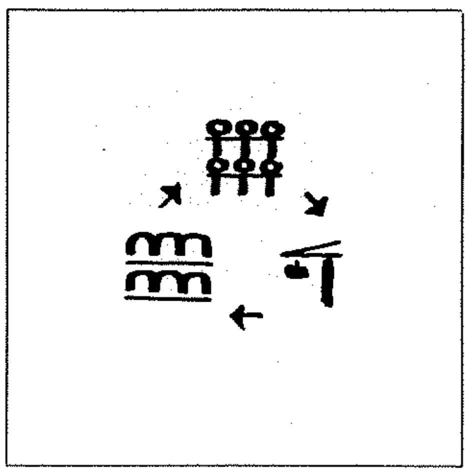
Now we recognize the two spheres under discussion here. Community and individual both have their own relationship to the material surroundings, and both use a different production system. This picture is repeated with many variations as the development of production techniques progresses. In our time it disappears. The distinction between the two spheres vanishes. It becomes apparent that a solution of the housing problem is only possible when we manage to differentiate again between the two spheres in our thinking in the present day situation. Then it becomes possible to distinguish much more clearly the role of the industrial production system in housing.





for the first time when rationalized production
by craftsmen was the only possibility.

It is therefore not the fault of industrial building that the natural relationship was severed. This relationship was severed before this system could penetrate into housing.



Wij bevinden ons nu in een situatie waarin het gemechaniseerde bouwbedrijf alle bouwen verzorgt. Er is geen verschil meer tussen het apparaat dat bouwt voor de gemeenschap en dat wat bouwt voor het individu. Er is ook geen verschil meer in het hele besluitvormingsproces. Het onderscheid volgens de twee sferen is geheel verloren gegaan. Het onderscheid tussen twee soorten gebruikers is verloren gegaan.

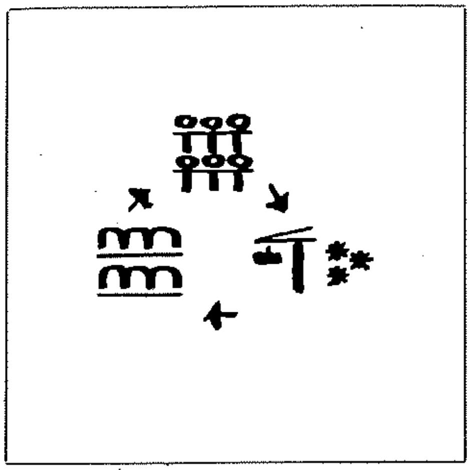
We now find ourselves in a situation in which all building is done by the mechanized building trade. There is no longer any difference between the system which builds for the community and that which builds for the individual. Neither is there any longer a difference in the whole business of making decisions. The division into two spheres is completely lost. The division into two kinds of users is lost.

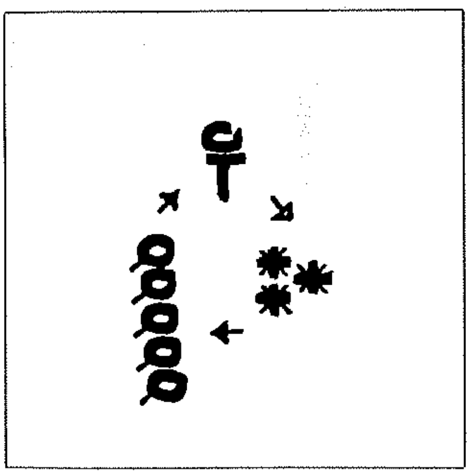
Dit universele bouwapparaat wordt meer en meer gesteund door industriële productie. Er is veel sprake van industrialisatie.
Het industriële apparaat, als onderscheiden van het bouwkundig apparaat, dringt in de bouw door. Voornamelijk als toeleverend bedrijf. Maar de pogingen zijn talrijk om het bouwkundig apparaat grotendeels door het industriële apparaat te doen vervangen.

Bouwen is in wezen iets anders dan industriële productie. Bij industriële productie beweegt het product en staat het apparaat stil.
Bij bouwen staat het product stil en beweegt het apparaat.
Onze materiële omgeving ontstaat door toepassing van beide apparaten. Veelal treedt het industriële apparaat op als toeleverend bedrijf voor het bouwkundig appraat. Soms staat het bouwkundig apparaat een deel van zijn taak af aan het industriële apparaat. Bijvoorbeeld de keukens ontwikkelen zich tot een soort industrieel vervaardigd product dat zich geheel aan het verzelfstandigen is. Reeds worden woningen gebouwd waarin keukens door de bewoners zelf worden gekocht. Ook kasten zijn op die manier afgestoten. Wij maken nu geen ingemetselde kasten meer in de woningen. De bewoner krijgt losse, industrieel vervaardigde kasten erbij. Hij kan er zelf meer van kopen en ze zetten waar hij wil.
Als we het industriële apparaat volledig willen benutten, moeten we het niet alleen als producent zien van bouwkundige onderdelen. Dit apparaat is vooral een producent van gebruiksproducten.

This universal building system is supported more and more by industrial production. A lot is said about industrialization. The industrial system, as distinct from the architectural system, is penetrating into building, mainly as supporting industry. But many attempts are being made to replace the architectural system for a good deal by the industrial system.

Building is by nature something different from industrial production.
In industrial production the product is mobile and the system is stationary.
In building the product is stationary and the system mobile. Our material surroundings are brought into being by the application of both systems.





Het industriële productie-apparaat werkt dus bij de huisvesting in twee verschillende relatievormen:
Bij de productie van gebruiksgoederen is de tweede individuële relatievorm (onder). En verder als toeleverend bedrijf in de niet-natuurlijke relatievorm, die wij als nummer zeven zagen (boven).
In het eerste schema ontstaan nu alleen meubels en huisraad. In het tweede de hele woning.

Als we nu industrialisatie in de huisvesting willen bevorderen, moeten we weten wat te doen.
Nu trachten we steeds meer de rol van het industriële apparaat in het bovenste schema te vergroten. We weten nu dat we dan noodwendig in de zevende relatievorm (massa-woningbouw) terecht komen.

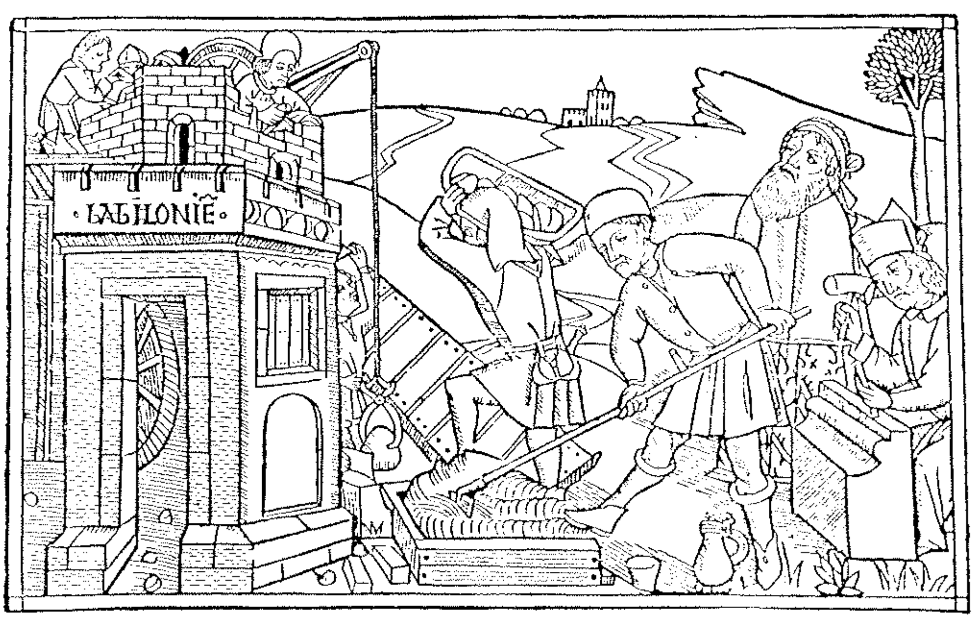
Zou bevordering van industriële productie in het onderste schema niet nuttig kunnen zijn? Dat is nog nooit geprobeerd. Toch kunnen we daar werken in een relatievorm die op het individu is ingesteld.
Wat betekent dat?

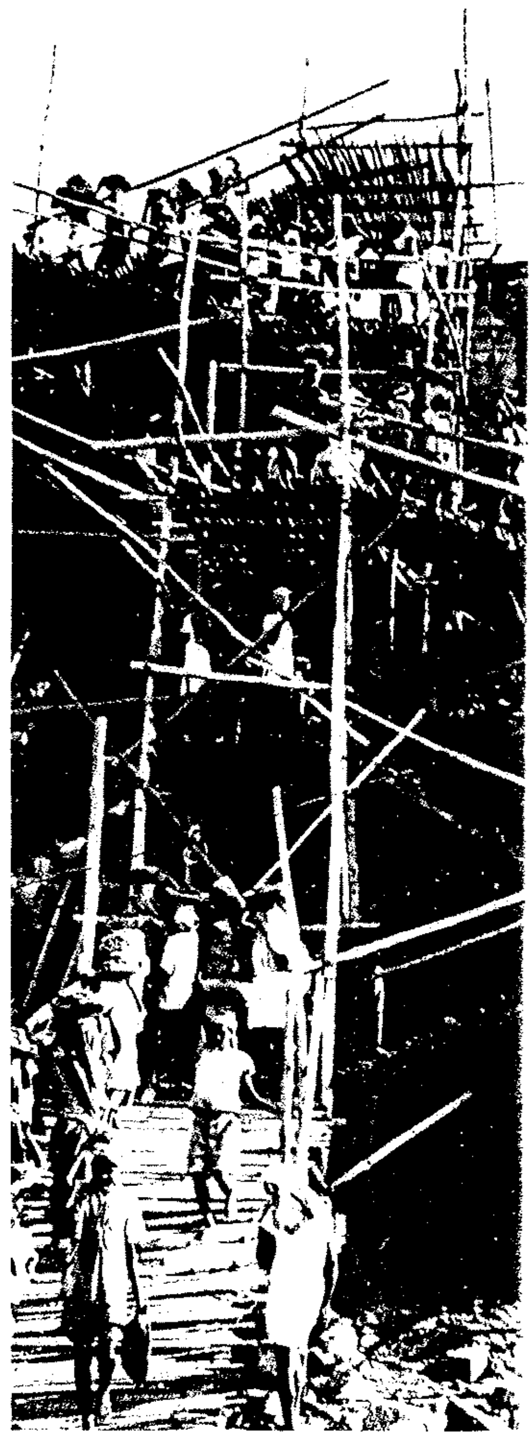
The industrial production system is thus applied to housing in two different types of relationship:

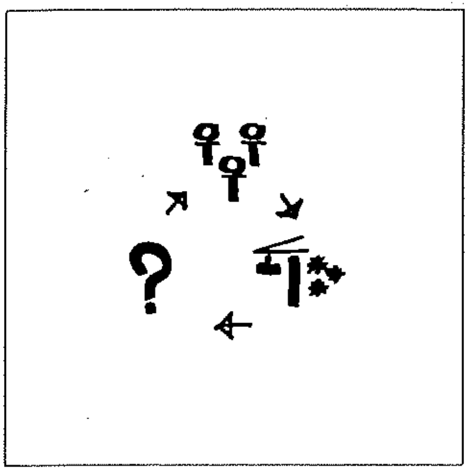
In the production of consumer goods we find the second individual type of relationship (upper scheme)
Further, as supporting industry, we find it in the artificial type of relationship which we saw as number seven (lower scheme).
In the lower scheme only furniture and household goods are now made.
In the upper scheme the entire dwelling.

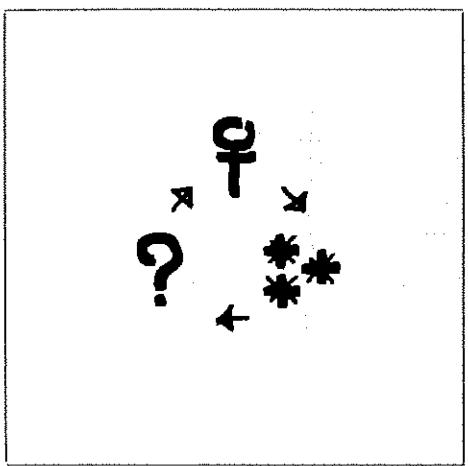
If we want to promote industrialization in housing, we have to know what needs to be done.
At present we are always trying to increase the role of the industrial system in the upper scheme.
We now realize that we must then end up in the seventh type of relationship (mass production housing).

Promotion of industrial production in the lower scheme for the benefit of housing has never yet been tried. Yet there we can work in a type of relationship which is attuned to the individual.
What does this mean?







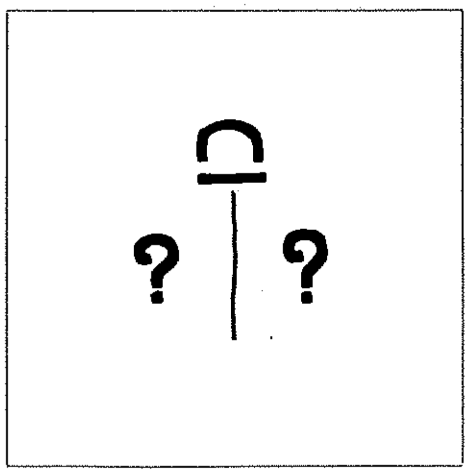




**Onze huisvesting zal er bij gebaat zijn als in ieder der twee sferen de juiste productie-apparaten werken en deze apparaten ieder iets te doen krijgen wat thuis hoort in de bijbehorende sfeer.**

**De meest gevorderde productie-apparaten in iedere sfeer zijn hierboven genoteerd.**
**De taak van de architect is te bepalen wat zij moeten doen.**
**Want de architect vertaalt behoeften in bouwkundige vormen en programma's.**

Our housing will benefit if the right production systems work in each of the two spheres, and these systems are each given the task which belongs to the appropriate sphere.

The most developed production systems in each sphere have been given above.
It is the task of the architect to determine what these systems have to do.
Because the architect translates needs into architectural types and progremmes.

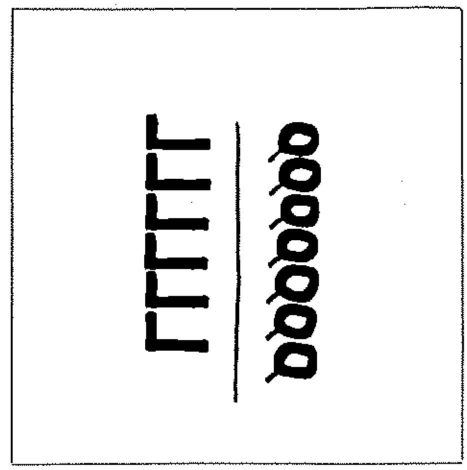



**Wat moet de architect nu invullen voor de twee vraagtekens?**
**Als hij links de woning invult, ontstaat de massawoningbouw (zevende relatievorm) onherroepelijk.**
**Als hij rechts de woning invult, ontstaat een soort caravanpark.**
**Hij kan geen woning invullen.**

**Hij moet ook geen woningen bouwen.**
**Hij moet huisvesting mogelijk maken.**

What sould the architect substitute for the two question marks?
If he fits a dwelling into the left hand group, mass housing production (the 'seventh type of relationship') is inevitsble.
If he fits a dwelling into the right hand group, a sort of caravan site develops.

He should not build homes.
He should make housing possible.



**De woning ontstaat in twee sferen.**
**Hij kan niet in één alleen gemaakt worden.**
**Wat moeten we nu in elke sfeer produceren?**
**In de ene alles wat voor de huisvesting collectief wordt gebruikt.**
**In de andere alles wat voor de huisvesting individueel wordt gebruikt.**

**Het product in de gemeenschappelijke sfeer noemen we 'drager' of 'woonstruktuur'.**

**Het product in de individuele sfeer behoort tot wat wij het 'inbouwpakket' noemen.**

**De woonstruktuur bevat per definitie alles wat collectief wordt gebruikt.**

**Het inbouwpakket bevat per definitie alles wat door het individu alleen wordt gebruikt.**

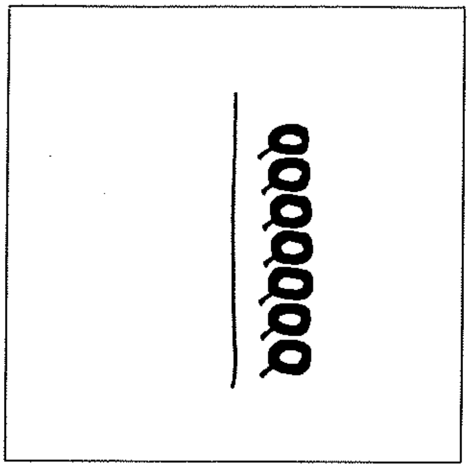
A home comes into being in two spheres.
It connot be made in one sphere alone.
What, then, should we produce in each sphere?
In one sphere everything that is used collectively for housing.
In the other, everything that is being used individually for housing.

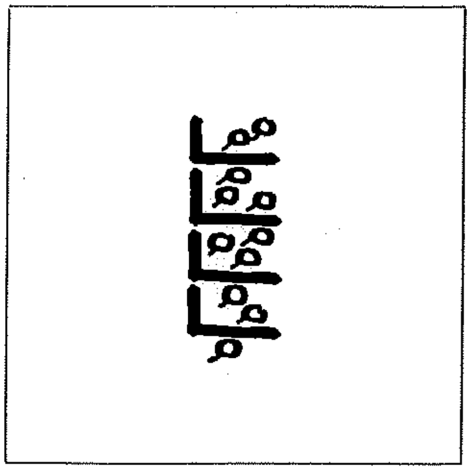
The product in the communal sphere we call the 'support' or 'framework for living'.

The product in the individual sphere belongs to what we call the 'set of detached units'.

The 'framework for living' contains by definition everything that is used collectively.

The 'set of detached units' contains by definition everything which is used by the individual only.



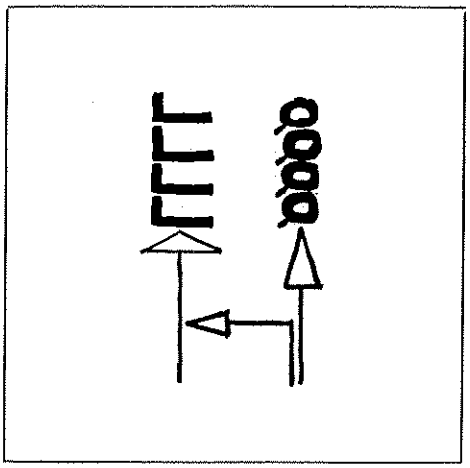


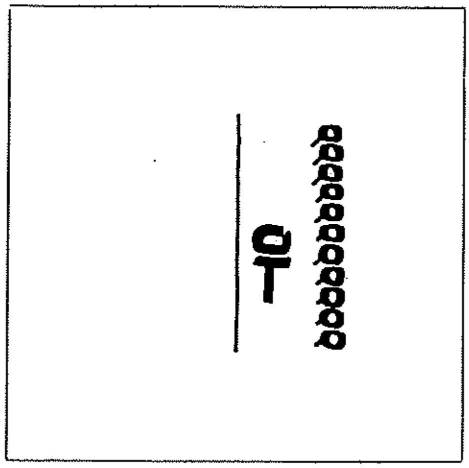
**Een inbouwelement is geen afbouwelement.
Een drager is voltooid voordat het inbouwelement erin komt.
Het inbouwelement komt erin nadat de drager is afgebouwd.
De inbouwelementen zijn er voor om de woning te maken.
Een drager is in zichzelf af, voltooid.
Een inbouwelement is in zichzelf af, voltooid.
Samen vormen zij een woning.
Een inbouwelement is een middel dat wonen in een drager mogelijk maakt.
Een inbouwelement is een woonmiddel.
Een woonmiddel is geen technisch onderdeel (zoals een deurkozijn).
Een woonmiddel is een gebruiksvoorwerp.
Een woonmiddel is in zichzelf herkenbaar en voltooid (zoals een keukenkastje).
Inbouwmiddelen bedienen alles wat staat ten dienste van de individuele sfeer.
Per definitie:
Dus ook sanitair, scheiding van ruimten, scheiding van de buitenlucht, verwarmingselementen, berging, enz., enz.**

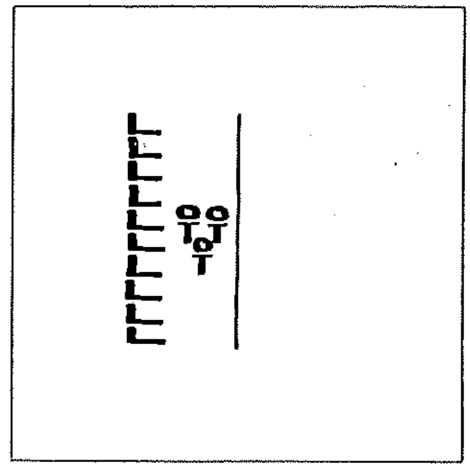
A detached unit is not a finishing element.
A support is completed before the detached unit is placed in it.
A detached unit is put in position after the support has been built.
The detached units serve to make a dwelling.
A support is complete in itself.
A detached unit is complete in itself.
Together they form a home.
A detached unit is the means of making a support habitable.
A detached unit is a means of living.
A means of living is not a technical component (such as a door-frame).
A means of living is a consumer article.
A means of living is in itself recognizable and complete, such as a kitchen cupboard.
Detached units serve to provide all requirements of the individual sphere.
By definition:
Also therefore sanitary equipment, division of space, separation from outdoors, heating elements, storage space, etc. etc.

**Een woning ontstaat door het samenkomen van drager en woonmiddel.
We maken dus geen woningen.
We maken dragers en woonmiddelen.
We maken voltooide en herkenbare zaken, die ieder thuis horen in hun eigen sfeer, ontstaan volgens hun eigen relatiepatroon.
We kunnen alleen objecten maken, producten, dingen.
We kunnen geen woningen maken.
Een woning is geen ding.
Een woning is een daad.
Daarom kan je geen woning voor iemand anders maken (wél een villa, of een bungalow, of een paleis, of een massa-woningblok, maar geen woning).
Je kunt voor iemand anders dragers maken, of woonmiddelen.
Je kunt de gelegenheid scheppen tot het ontstaan van woningen, omstandigheden maken.
Je kunt de zaken produceren, waarmee en waarin mensen kunnen wonen.
Je kunt de techniek besturen om de zaken te produceren waarmee mensen werkelijk kunnen wonen.
Want wonen is een daad.
Het plegen van die daad is een behoefte (de eerste, essentiële behoefte).
Je kunt technische dingen maken, die de daad mogelijk maken.
Je kunt die behoefte vertalen in de productie van duidelijk herkenbare dingen (als dragers en woonmiddelen).
Je kunt geen woning maken voor een ander.**

A home is brought into being when support and detachable units meet.
Therefore we do not make dwellings.
We make supports and detachable units.
We make completed and recognizable things, each belonging in its own sphere, created in accordance with its own pattern of relationship.
We can only make objects, products, things.
We cannot make homes.
A home is not a thing.
A home is an act.
The dwelling is part of that act.
The dwelling is an act.
That is why you cannot make a home for someone else; (you can make 'a villa', or 'a bungalow', or 'a palace', or 'a block of flats', but not a home).
You can make supports or detachable units.
You can provide opportunity for the creation of dwellings; provide the circumstances needed.
You can produce the things with which and in which people can live.
You can guide technique to produce the things with which people can really live.
Because living somewhere is an act.
Committing this act is a need (the elementary, essential need).
You can make technical things which make the act possible.
You can translate this need into production of clearly recognizable things (such as supports and detachable units).
You cannot make a home for someone else.
You cannot make dwellings for unknown people.







**Industriële productie heeft dus een tweevoudige rol. Toelevering van elementen voor de bouwproductie (half producten) (een bouwwerk kan in principe geheel samengesteld worden uit industriële producten; prefabricage); en productie van woonmiddelen voor de gebruiker (eindproducten).**

**Deze tweevoudige rol kan pas onderscheiden worden in de huisvesting als we de twee sferen kennen. De kennis van de twee sferen maakt goede toepassing van ons technisch vermogen mogelijk.**

Thus the role of industrial production is twofold. Supply of elements for building production: semi-finished products (parts of the support.) and production of means of living for the consumer; finished products (detachable units).

This twofold role can only be distinguished in housing if we know the two spheres. Knowledge of the two spheres makes possible good application of our technical ability.

**Bij productie van woonmiddelen ontstaat een rechtstreekse relatie met de individuele gebruiker. Net als bij de productie van een vervoersmiddel. Met alle voordelen van dien. (individuele keus, naar prijs, kwaliteit, smaak, verlangens).**

**En ~~met alle~~ gevaren van dien (beïnvloeding van de gebruiker met commerciële oogmerken).**

**Hier werkt de tweede individuele relatievorm. Het individu krijgt verantwoording te dragen. Hij kan zich identificeren met zijn woning. Men kan hem in zijn woning herkennen. Ten goede of ten kwade.**

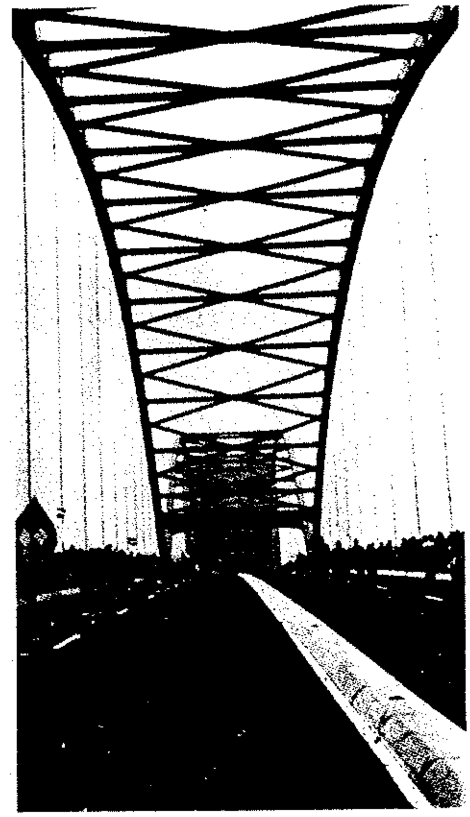
In the production of detachable units a direct relationship occurs with the individual consumer. In the same way as is the case with the production of other consumer goods. With all its inherent advantages. (Individual choice according to price, quality, taste, requirements).

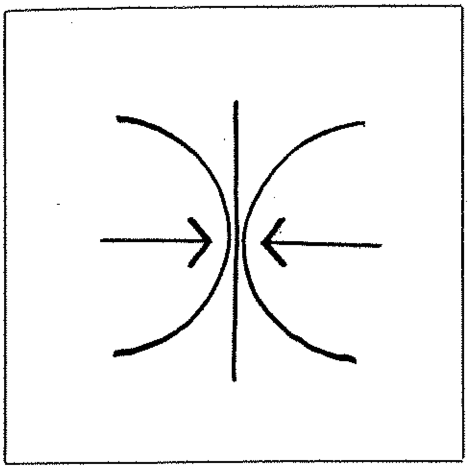
And with all inherent dangers (influencing the consumer for commercial purposes).

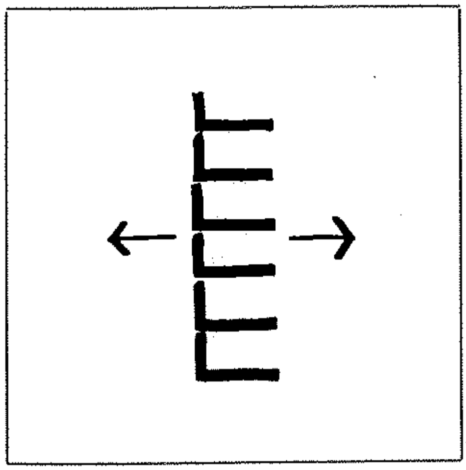
Here the second type of individual relationship is at work. The individual is given responsibility. He is able to identify himself with his dwelling. One can recognize him in his dwelling. For good or for bad.

**Bij productie van dragers is sprake van een relatie met de gemeenschap. Deze relatie kan overeenkomen met één der drie collectieve relatievormen, maar het behoeft niet. Hij kan ook gebouwd worden in de zevende relatievorm bij welke vorm dus op geen enkele wijze het individu persoonlijk is betrokken. Een drager is een gemeenschappelijke voorziening. Als een stratenplan, een kanaal, een tramlijn, een electrisch net. Dat zijn allemaal infrastrukturen. Een drager is een infrastruktuur.**

In the production of supports is raised the question of relationship with the community. This relationship may coincide with one of the three collective types of relationship, but this need not be so. The support can also be built in the seventh type of relationship, a form in which, as we know, the individual is in no way personally involved. A support is a communal provision. As is a street a canal, a tram line, an electric network. These are infrastructures. A support is an infrastructure.







**Eerst moeten we de twee sferen leren onderscheiden.**
**Dan moeten we leren erin te kunnen werken.**
**Als we er eenmaal in kunnen werken, wordt het onderscheid onzichtbaar.**
**Het verdwijnt in vanzelfsprekendheid.**
**Het onderscheid is een hulpmiddel (een weten).**
**Het leefgebied is een eenheid.**

First we have to learn to distinguish the two spheres.
Then we have to learn to work in them.
Once we are able to do this, the distinction becomes invisible.
It disappears unnoticed, as a matter of course.
The distinction is an expedient (a knowledge).
The living area is a whole.

**De drager is thema voor een stedelijk weefsel.**
**Ruimte om in te wonen (wonen is een daad);**
**Bepaling van een micro milieu;**
**Thema voor een macro milieu;**
**Is niet het gemeenschappelijk leefgebied maar het bouwkundig thema ervan;**
**Is niet het individuele leefgebied, maar de bevatter daarvan.**

The support will become the theme for an urban tissue.
Space to live in (living is an act);
Definition of a micro-milieu;
Theme for a macro-milieu;
It is not the communal living area but its town planning theme;
It is not the individual living area but its container.

**Het onderscheid van de twee sferen maakt hun verbinding mogelijk.**

The distinguishing of the two spheres makes possible to combine them.

# Supports Responsibilities and Possibilities

Professor N. J. Habraken

"It is characteristic of many who speak most of individual freedom in such matters that they do not think well enough of it to imagine that it might also be efficient"

**J. K. Galbraith,** The New Industrial State

Professor Habraken's views on housing are well known in Britain but they have been somewhat obscured by the language problem and by the way they have been presented (admittedly dolled up in the most brilliant typography) by other publications. The Editor invited Habraken to set out the central core of his thesis in a short article for the first issue of the Quarterly. What follows is the kernel of his argument for building *supports** and *detachable units.*

The idea of building supports is a very simple one.

Why should we go on building all these identical dwellings in endless rows or piled one upon the other?

Why not build some kind of superstructure in which people can have their own dwellings made in accordance with their own individual wishes? Let us call such a superstructure a *support.* After all it is a new kind of building with a newly defined function and it deserves a special name to identify it. Let us further imagine a set of elements (wall-elements, façade-elements, cupboards, sanitary cells) to be used in a support to make dwellings, and call these a *set of detachable units.* Why should we not build supports in great quantity and let people choose their own detachable units in the same way that they choose their furniture, their household equipment or their cars? Why not indeed? The very simplicity of the idea arouses suspicion. Things just are not that simple. Practical and experienced people will have no trouble in pointing out a host of difficulties that will arise if one tries to realize it. Of course the simplicity of an idea does not guarantee easy realization. On the other hand many people like the idea. In fact it sprang up in one variation or another, in many places, and in many minds all over the world. But an idea can be supported by the wrong reasons as much as it can be opposed for the wrong reasons.

Supports cannot be voted into existence. Even if everybody would be willing to have a try at them, the philosophy behind them should be quite clear to enable us to make the right decisions at the right time in the process of realization. If we know *why* we want something we shall be able to know *how* we shall get it. That is why I have spent my time trying to formulate why we should build supports, working from there on a method for realization.

I have tried elsewhere to formulate the philosophy behind the supports (*see note at end, Ed.*). We had the opportunity at Stichting Architecten Research (S.A.R.) to work out a method of design for the realization of supports that we are trying out step by step in practice. But this is neither spectacular nor exciting. Discussing supports almost daily with all kinds of people in all kinds of circumstances, a pattern of recurring questions and opinions emerges. I have often been tempted to assemble these questions and their answers to try to get hold of the pattern. Perhaps it would tell us a great deal about the society we live in and the fears and hopes that motivate it. But I am sure that is beyond my capacities. However, I will try to comment, more or less at random, on a few points that might be of interest to those willing to consider the desirability of building supports.

## 1. Supports and detachable units

First of all, misunderstanding about supports may arise when it is not understood from the beginning that the point of view taken is not a technical one, but one of human need. Man wants to be responsible for his material environment; people want to identify with it. To be able to identify with one's own environment one must be able to do something about it. An environment may be very beautiful and comfortable, but if it is not adaptable it cannot be a home. People living in it will not be dwellers but only guests. To dwell is to take action. Beauty and comfort cannot give identification. Only action can give that. Identification goes together with responsibility and responsibility presumes that there is a possibility to act. What can we do to build and produce in such a way that people again will be able to identify with their own material environment?

* Support (*Eng.*) – Drager (Dutch) = 'framework for living' (Habraken). *Support* ('Shorter O.E.D.'): To constitute the substratum of (a structure); to sustain in position above, have on it or at the top (1617).

The production of supports and detachable units can of course be argued from a technical point of view. If we are to build dwelling spaces in considerable quantity, supports have the advantage that they can be standardized in design and construction and be built in great quantity without the builder having to decide about standard plans and all the details and specifications that go with finishing the dwellings. Building supports gives great possibilities for the standardization of elements and also for prefabrication. It leads also to the rationalization of the building process. In a similar way, detachable units can be fabricated by industry in a continuous process. Detachable units should become new kinds of durable consumer goods, as it is in the creation of consumer goods that industrial production has been most successful. This is one reason why the idea of supports should appeal to those who have until now been so continuously frustrated in their efforts to apply industrial production methods to housing. This frustration itself may be a proof of the fact that the problem is not one of production in the first place. If that were the case, we should have solved it long ago. Nowhere have we been more successful in this century than in the field of production.

The moment we say, 'Let us industrialize housing and make standard components out of which dwellings can be made', we are faced with one crucial question: how shall we define the components to be made? In other words, what parts of the building should be broken down to enable us to produce these parts as factory-made elements? All industrial housing systems can be classified by the way this question has been answered. The most naïve approach is to slice up a given house or building in much the same way as a birthday cake is cut up into digestible pieces; the decision where to cut being made exclusively for reasons of production, transport or assembly.

More sophisticated systems recognize the fact that mass-production can only be realized if different kinds of dwellings and different plans can be made out of the same components. How does one find a series of components out of which a great variation of different dwellings can be made? Given a series of known and accepted types of floor plan this question also can be answered on grounds of production methods, transport and assembly. The result will always be the standard housing project as we have known it all along. The producer has to compete in a market where costs mean everything, with the disadvantage that he still may not be able to make what the client or local authorities may have in mind, and thus is not assured of the continuous production he needs to prove that industrial production is cheaper, better and more efficient.

Then again, some architects and builders recognize the fact that in a given superstructure a variation in floor plans can be made by means of the same finishing elements. Here once more the division is made exclusively on technical grounds. The result is again the kinds of buildings we already produce, the kind of housing and living we already know. Mass-production is not assured any more than by the traditional mass housing methods. No new market opens, no new needs are answered. Industrial mass-production outside housing production has been such a tremendous success because it did answer new needs, opened new markets and surrounded us with products that were not known before. New things, new companions in our daily lives with whom we want to live for many reasons even if the process of living together raises its own problems.

It is my conviction that we can only introduce industrial mass-production in the process of housing if we start thinking about human needs. As soon as we pose the question, 'How shall we make dwellings?' we are on the wrong track. People do not need dwellings in this sense. A dwelling is not a thing people need. A dwelling is the result of people fulfilling the need to dwell. The goal of production should be to make it possible for people to do so.

Indeed a dwelling is not a thing to be considered for production. We might as well say: 'People need freedom, so let us mass-produce freedom'. A dwelling is not a thing that can be specified and defined by a description of components, or, for that matter, functions or shapes. It can be a cave or an attic, a villa or a castle, a flat or a duplex. It just might be that we have in this era, in this generation, as little need for flats or houses as for castles and caves. Perhaps we cannot really apply our modern means of production efficiently and abundantly to the production of houses and flats any better than we could to the production of castles and caves. We should start trying to apply our production power to the production of things we really need for living and dwelling.

That is why I think we should build supports and detachable units. A support is a thing that can be specified and produced. A detachable unit is a thing that also can be produced and specified. Specification of these two items starts with a statement of human need. By definition a support is a building that contains everything for which not one single occupant is responsible – everything in the sphere of communal responsibility. Detachable units are the things the individual dweller will be responsible for. Thus the decision about where the support ends and the detachable unit begins is not made on technical grounds and it is only then that we can expect our technical solution eventually to be the best technical solution possible.

## 2. Supports and 'flexibility'

Discussing supports easily leads to the topic of 'flexibility'. This term has by now been worn down to the point of having no meaning whatsoever. Many architects think of supports as structures which offer large areas of floor with as few obstructions in the way (e.g. columns and ducts) as possible. Such a structure they argue, gives maximum flexibility. Others even leave out the floors and think about skeletons to be filled in. Such conceptions are also the outcome of a 'technical' point of view – in this case the technical point of view of the designer. Not however the designer of supports but the designer of dwellings (those things that are not things). It is quite clear that if I, as a designer of dwellings, want maximum freedom, an unobstructed floor area is what I like to see. And if I prefer to think in three dimensions instead of two, I shall choose the skeleton. It will enable me to design any kind of dwelling I like. The designer of supports, on the other hand, is occupied with another problem. He does not want to design dwellings. He tries to conceive of a building in which other people, who are not designers, will be able to recognize possibilities to live by, through the means of detachable units. A support therefore should not be neutral. Neutral things are hard to identify with. And to dwell is a process of identification even if it is not consciously recognized as such. The support should incite and intensify this process. It should give real form, real spaces; spaces that are not rooms (yet) but nevertheless tempt the imagination, suggesting more possibilities for living than the occupant could have thought of before seeing them. A support should, by its architecture, provoke use. It should offer places, dark or sunny, small or roomy, that could just be places to sit, to eat, to sleep. Places that suggest possibilities for kitchen, bedroom and living areas in unending variations and combinations. I think the designing of supports calls for real architecture and real architects who compose shapes and spaces that eventually may have much more character than can be found in any other design for housing that we can think of today.

The same principle applies to the design of detachable units. Automatically most designers think of detachable (or 'flexible') wall-elements in the first place. We have at S.A.R. come to the point of trying to do away with wall-units as much as possible. Dwellers (who are not designers or technical people) do not easily identify a wall-unit. Much less will they identify *themselves* with such a unit. We try to think of things the occupant recognizes as useful. Things to put other things in, to do something with or to do something in. We think in terms of cells and cupboards that, arranged in patterns, define 'rooms' and serve them at the same time. We add screens, not walls, where only visual partition is necessary. It is in this field of designing detachable units, 'units for living' as we like to call them, that unknown possibilities await discovery.

The term 'flexibility' also comes up in discussions about the function of supports as urban infrastructures. Why should supports be seen as static and be allowed to stand there for much longer than the lifetime of a single dwelling? After all the urban shape changes too. How can we safely build those permanent infrastructures without them becoming a nuisance to later generations? Pushed to the extreme the argument runs like this: would it not be better to conceive of a technical solution which enables us to take apart the whole construction in say 20 years and then start all over again? Or re-assemble the elements into something new, better suited to the newest demands of urban design? Would it not be better to make supports themselves also 'flexible'?

The fact that urban design solutions are subject to change is undeniable. It can also be taken for granted that the rhythm of change is accelerating. When we consider the subject of change of the supports themselves we must again take human need as a guide-line and not simply technical possibilities. Suppose building techniques and productivity would enable us to reconstruct our urban areas every 20 years, however unlikely this may seem at the moment, would such a possibility be desirable? It is no use doing things just because they are possible. Such a possibility would, I think, only appeal to designers and production people, not to those people we build for. Change in our material environment is the outcome of a social process, the process of man in continuous contact with his environment. This process takes place in two spheres, in the sphere of the individual family and the sphere of the larger group, the community. In both spheres the rhythm of change is dictated by two forces: the technical possibilities and the decisiveness of those who are responsible. These two forces of course influence each other. We are bound to take decisions only about what is known to be technically possible. On the other hand, new technical possibilities increase the field we can decide about. The greater the technical possibilities the more submissive our material environment will become. Increasing change will be dictated by our desire for change and our ability to decide about it. Technical freedom being equal in the communal sphere, the process of making decisions will always be slower than in the individual sphere. The greater the number of people involved, the more time and energy it takes to decide about change. The greater the area of the material environment we are thinking of, the greater the number of people involved will be and the slower the change will be. In the future our ability to change our material environment in the communal spheres in harmony with those involved will depend in an ever-increasing degree on the social, administrative and political forces at work.

Supports are part of the urban environment. The urban environment, being the outcome of communal needs, spans the generations. We want our material environment to be adaptable to our individual needs. We also want it to be a link with other generations. Indeed we want to change what has been given us by former generations and we should do so with greater freedom; we do not want, however, to start all over again. Besides, it takes generations to complete a new urban area. It takes at least a generation to grow the trees. For a community to identify with an urban area takes longer than one generation. The process of communal identification is much more a process of 'adding to' or 'filling in' than a process of replacement. If replacement is asked for it will be piece-meal, bit by bit, a slow and continuous sequence of corrections towards greater harmony.

The division into a communal sphere and an individual sphere on which the concept of supports and detachable units is founded springs from the point of view that the individual dweller needs a greater sphere of responsibility than is left him in the housing project of today. It leaves the communal sphere only vaguely defined as 'not-individual'. Certainly the involvement of the community – in the shape of any group of people bigger than a family, be it neighbourhood, or inhabitants of a country or any discernible group in between – deserves further study. Here we touch the subject of relationship between man and material environment as a continuous and dynamic interaction. A subject which will be left unexplored as long as technical people stay just technical people and those skilled in the humanities see our material environment only as a scene in which the subjects of their study just happen to move about. It will, I am afraid, take generations before we reach the situation in which housing and urbanization will be seen and studied for what they are: the outcome of a process in which man and matter are no longer separate units but names for different sides of one phenomenon as inseparable as night and day.

It certainly will take generations before we have developed the tools and methods to study and influence this phenomenon a little less haphazardly and ignorantly than we do today.

### 3. Freedom and creativity

This view must also be kept in mind where the ability of the dweller – who is neither technician nor a designer – to 'create' his own dwelling is questioned. Here two camps can be recognized. There are those who seriously doubt this ability. I have noticed that this doubtful mood can be found especially among the people who have spent much of their time and energy in furthering the cause of better housing for the masses. Public and semi-public officials who have for many years fought the battle for better housing conditions are likely to adopt a paternalistic view about the needs and abilities of the people whose well-being they have so close to their hearts. More than anyone else perhaps they know the hazards and pitfalls that beset the partisan for a better environment. Will people indeed be able to house themselves? Who will answer that question? But then, are people indeed able to raise their own children? We do not require an answer to that question before we decide that people have the responsibility and the right to raise their own children. Until now, no substitute has been found that does not make things even worse. We can organize education and information for parents. We cannot organize the raising of people's children. In much the same way we can organize education and information about housing and about dwelling, and this certainly has to be done. That will not be taking away responsibility. We can also, as specialists, try to produce and design in such a way that people will be as much sustained as possible in their act of dwelling without their responsibility being taken away from them either. We could try to do this by the design and production of supports and detachable units, for example.

On the other side there are those who greet the idea of supports as an opportunity at last for everybody to be 'free' and 'creative'; those who believe in the artist hidden in every man's soul waiting to be freed and given the opportunity to make beautiful things. It has to be seen how far creativity is the result of freedom. I am inclined to think that perhaps creation is a process of liberation, which makes freedom the result of creativity, vaporizing instantly when the creative action stops. We must, I think, refuse to see the housing process as anything other than a story of human bondage. It sounds a trifle too easy when one uses the words 'freedom', 'creativity' and 'beauty'. I much prefer expressions like 'possibility to act', 'involvement and identification' and 'integrity and honesty'.

Both the doubters as well as the defenders of the ability of people to 'create' their own dwellings think too much of the dweller as a would-be architect. They find it hard to imagine a situation in which dwellings come into being without actually having been designed by a specialist. The dweller, in the designer's eyes, becomes somebody who is going to do what until now specialists were doing. That leaves the specialist with something less to do and he asks for an answer to the question about the ability of the dwellers to 'create'.

It might be argued, however, that the specialists have not less to do than they are doing now. They simply have to do something different which, I am sure, asks as much of their professional skill, or, for that matter, of their 'creativity' as they can offer. I have already stressed the point that a support should be far from a neutral kind of structure, but it can only be a good support, provoking use as a good support should, when it is an artistic creation in the fullest sense of the phrase. But even more to the point is perhaps the fact that to design a support is to design possibilities, a set of suggestions and invitations, which can be translated into architectural form. The monologue that is, until now, given by the architect, becomes a dialogue. That does not mean that the architect has given part of his monologue to somebody else to recite. It is just another play he is in where to do his part well he has to say every word his role requires and he has to say it clearly in a well articulated and inspiring way to be understood and to make it possible for the other fellow to act his part.

Hence, I do not think we have to speak of the dweller as somebody who overnight is becoming 'creative'. He is the person who gets the opportunity to choose from different possibilities and from different products. That is something he has been doing all along in selecting and buying furniture, clothes, cars, washing machines, camping equipment and everything that keeps the household going. On the way he is developing a definite feeling for quality. A sense of what is going well for him and what is not; keeping an eye on what the neighbours are doing and trying hard to please himself but not being too different from the crowd he feels he belongs to. It comes quite naturally. That is why I like to call the relation between man and his material environment the ***natural relation*** as opposed to the unnatural relation – which in fact is no relation at all – we have become so addicted to. As for Beauty and Architecture, that is something for the designers of supports and detachable units to worry about. That is our responsibility in the first place.

**Note**: In *Forum* (Holland), Vol. XX, No. 1, December, 1966; *Forum*, Vol. XX, No. 4, November, 1967; S.A.R. publications, Eindhoven; the author's book *The Supports and the People*, Amsterdam, 1961. See also article in *Interbuild/Arena*, October, 1967, pp. 12–19. *Editor.*

Photo: Jacques Meijer

# MASS HOUSING: THE DESPERATE EFFORT OF PRE-INDUSTRIAL THOUGHT TO ACHIEVE THE EQUIVALENT OF MACHINE PRODUCTION

One of the most frequently referred to but least understood figures in European housing is **Nikolaas Habraken,** Chairman of the Faculty of Architecture at Eindhoven Technical University and Research Director of the SAR (Stichting Architecten Research), the Netherlands architect-financed housing research organization. To those who find their way to this man's thinking via the only partially translated text of his book *De Dragers en de Mensen* (The supports and the people), it seems frankly incredible that he should be able to combine such controversial opinions on the subject of mass housing with an established academic position. **Martin Pawley** recently visited Habraken at Eindhoven and presents this primer on the man, his organization, his theories, the achievements of his pupils and the future of his ideas.

**The man**

Nikolaas John Habraken was born in 1929 in Indonesia, then a Dutch colony. Both his parents were Dutch although his mother was a fourth generation Indonesian by birth. In 1942 he and his family were interned in a concentration camp by Japanese occupying forces and there they remained until the end of the war. In 1946 he and his mother came to Holland for good, and in 1948 he enrolled at Delft Technical University for a degree course in building engineering. Housing was not a subject much discussed in schools of architecture at that time and although he speaks well of one or two of his teachers—notably the aged Granpré Molière and the ex-*de Stijl* town planner Van Eesteren—Habraken attributes most of his interest in the subject of housing to the overriding crisis of accommodation which afflicted all of Europe during the early post-war years, and to the *lack* of academic direction in the subject. The key concept in his later housing theories—that of a separation between the dwelling unit itself and the structure necessary to support it—dates from his student days and may have been influenced he thinks by Indonesian self-build practice.

He graduated in 1955 and was immediately drafted into the armed forces, choosing the building department of the air force because he was given to understand (inaccurately as it turned out) that he would be able to gain design and construction experience there. Having, like most national servicemen, a great deal of time on his hands, he began instead to write a book about what was wrong with conventional housing practice. This project did not progress very well and by the time of his discharge in 1957 he had only numerous false starts to work with. Nonetheless, using his accumulated air force savings he rented a room in Delft and turned to writing full time. Six months later his money was exhausted and still no book. However he enlisted the aid of a patron, a fellow student who had dropped out and got rich as a contractor, and with the aid of handouts continued writing. A further six months elapsed but the book remained uncompleted and in 1958 Habraken was offered a teaching job at Delft which he accepted. Here, teaching interior design, he continued his nebulous progress until marriage in 1959 brought responsibilities and, through his wife's family, contacts with publishers. 'Nobody liked my way of not doing anything at that time,' he recalls, and in fact the new environment galvanised him into activity. Not only was the book completed in 1960 and a publisher found, but Habraken left the university and went to work for J. F. Berghoef, an architect who had won a competition to design a new Amsterdam Town Hall as long ago as 1939. Berghoef, a dedicated traditionalist, had worked sedulously on this project for twenty years and aided by the megalomaniac dreams of civic functionaries produced at length a masterpiece of monumentality which aroused enormous public opposition when the designs were published in 1961. Eventually Berghoef surrendered his commission, but by that time Habraken had left to join Lucas and Niemeyer at The Hague. The publication of his book, *De Dragers en de Mensen: het einde van de massawoningbouw* (The supports and the people) (Scheltema & Holkema NV. Amsterdam, 1961); led to a certain amount of press interest and a five-minute television interview, but to date only about forty copies per year have been sold—the first impression is not expected to sell out until 1970. Nonetheless it was the publishing of the book—un-illustrated and specialized as it was—that established the course of Habraken's life after 1961.

Between 1962 and 1965 he concentrated on learning the practice of architecture, running jobs for Lucas and Niemeyer and lecturing at odd times on the subject of his book. During this time dissatisfaction over housing progress in the Netherlands was steadily rising. Only about 60,000 dwellings per year were being completed in the early sixties—a figure which in relation to the country's 12,000,000 population is approximately equal to British performance at the same time. Concern in the architectural profession was largely based on the feeling that low-cost housing did not and could not represent a design challenge, despite the fact that it accounted for a large proportion of the bread and butter work of most of the 1800 registered architects in the country; and it was this level of dissatisfaction which brought about the first positive remedial moves. Unfit housing, in the sense currently discussed in Britain, hardly existed after 1960 in Holland and the general standard of building and maintenance there is still very much higher than our own.

Despite this comparatively favourable situation the housing committee of the *Bond Nederlandse Architecten* (BNA) held informal discussions during 1964 to which representatives of ten leading firms of housing architects were invited. One of these firms was Lucas and Niemeyer and one of their representatives—largely on the strength of his book—was Nikolaas Habraken. The upshot of these talks was the establishment of the *Stichting Architecten Research* (SAR), a foundation intended to finance independent research into housing by contributions from the ten interested offices. This organization was launched in the spring of 1965 under the chairmanship of a lawyer and professor of Rotterdam University. Habraken himself almost by default—since he alone did not have his own office—became Director of Research to the foundation; leaving his employment to work full time in the newly rented SAR offices in The Hague with the aid of one draughtsman and a secretary. He was joined there shortly after by Hans von Olphen, Thys Bax and Fokke de Jong, Dutch architectural graduates who are shortly to establish a practice in order to design and supervise the construction of the new town of *Maakssen Broeck* according to Habraken's principles.

To the surprise of all concerned with SAR, consultancy work for manufacturers and contractors soon began to arrive in reasonable quantities and, when in the autumn of 1966 Habraken was invited to become Chairman of the Faculty of Architecture at Eindhoven Technical University, he took the opportunity to remove his whole establishment to new, peaceful and more spacious quarters there.

The SAR itself now occupies a suite of rooms in a prefabricated single storey building adjacent to the school of architecture. Incoming research commissions now acconnt for 90 per cent of the running costs of the establishment and the original grant has now diminished to the status of a guarantee fund. The success of the *Maakssen Broeck* competition entry will shortly denude SAR of most of its current staff but Habraken expects more to arrive. Like Frank Lloyd Wright at Taliesin he does not need to advertise.

At present he is considering writing a longer exposition of the design rules applicable to his system in the form of a general theory of support structures. He leads a regular life in apparently untroubled surroundings, lunching at midday on bread, *prosciutto* and cheese washed down with glasses of 'Jacky' chocolate milk. He drives a Morris 1800 and is slightly disappointed by the inertia displayed by the 400 students at the lavishly equipped Eindhoven school. They do not, as it appears, even write on the walls.

**The organization at Eindhoven**

The term 'architect' is not protected in the Netherlands; thus for the 1800 architects registered with the BNA there are perhaps 3000 more practising in the country. Only four full-time schools train architects, whilst six academies, including Rotterdam and Amsterdam, operate evening class courses. The four full-time schools are lavishly equipped by British standards (each stndent for example is issued with a drawing board and Kuhlmann drawing machine), but very few students arrive from overseas—the total proportion being well below 10 per cent. The chief reason for this is the language, a complex, isolated tongue which even natives find difficulty in spelling correctly. This language barrier (breached to some extent by the fact that practically all Netherlanders speak English), combined with the curious history and topography of the country, fosters a remarkable cultural isolation even from neighbouring countries. More books are published per year in the Netherlands than in the USA—but very few are translated into other languages.

The administration of the Netherlands, governed as it is by the overriding concerns of drainage, water level and land reclamation (the last major flooding, resulting in the deaths of several hundred people, occurred in 1953), is similarly unique. Motorway construction, which has proceeded at a fabulous rate since the early fifties, is under the control of the National Water Board, which with its traditionally unquestioned powers represents the foundation of all environmental planning in the country. Add to these factors the monotonously flat landscape and dense population, well-maintained housing and comparative prosperity, and a general acceptance of the importance of design, in the modern movement sense, becomes easier to understand. The Netherlands is a modern architect's country; there is little evidence of pop-art, supergraphics, ad-hocism, Archigram, or any of the late sensate design styles that dominate the London scene. Even poster advertising is strictly controlled. Few women work and those who do have a look about them reminiscent of the '*travaille, famille, patrie*' values of another world.

At the school in Eindhoven, few people are impressed by Robert Venturi; a picture of the Archigram 'Walking City' is pinned to a bookcase (together with some cuttings about the British Museum extension row); and the favourite architect is Pieter Blom, a non conformist who has recently completed a Student Union building at the University of Enschede in the manner of posthumous Frank Lloyd Wright. Buildings in the Netherlands are not about information or communication, but about space and structure, and this can clearly be seen from the massive, overglazed forms of the Technical University at Eindhoven **1** which was begun twelve years ago by the large practice of Van Embden, Choisy, Roorda van Eysinga, Smilf and Wittermans.

The SAR offices themselves are more reminiscent of a medical research centre than any part of an academy of architecture. There is very little noise; an experimental 'sanitary cell' is being constructed from Dexion and chipboard in one corner, freestanding bookshelves divide up a large office, and rubber plants stand tastefully here and there. Two secretaries and four architects make up Habraken's team but they are seldom all in the building at the same time. Project reports and the SAR's own publications are spiral bound with brown card covers; most of them represent design studies carried out for con-

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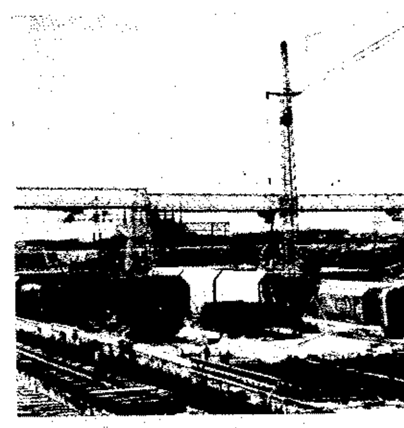

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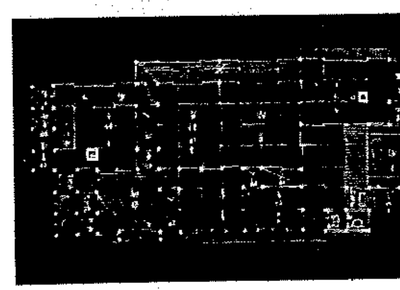

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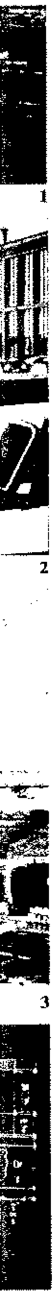
**1** *Part of the Technical University at Eindhoven designed by Van Embden, Choisy, Roorda van Eysinga, Smilf and Wittermans, and begun in 1957. The SAR is located out of the picture to the right.*

**2** *The DAF factory at Eindhoven. Part of Habraken's theory is that the dwelling should be composed of 'detachable units' built like cars or washing machines—whilst the 'support structure' only should be the concern of the traditional building industry.*

**3** *Civil engineering work in Holland. A prototype for the multi-storey support structure.*

**4** *Japanese Tatami mat planning. The family itself sketches the floor plan using the constant dimensions of the Tatami as the planning module. Habraken sees his own principle of dimensional coordination through the use of zones and margins at work here.*



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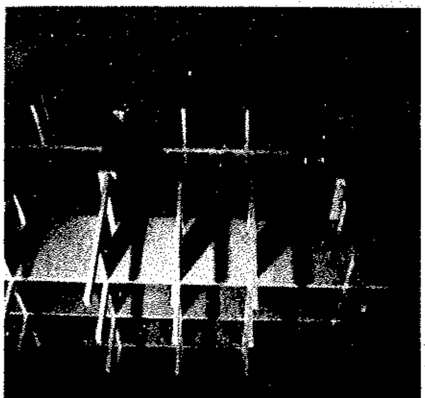

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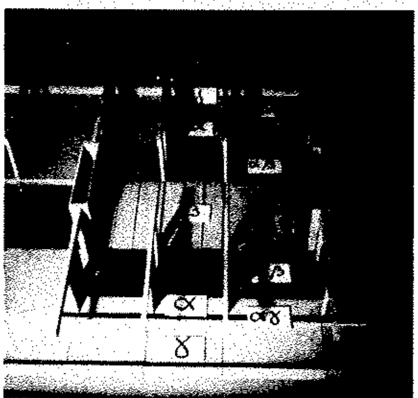

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tracting organizations, timber **5** and concrete development associations, trade fair exhibits, and unsponsored projects for high rise support structures.

Work this year has become increasingly concerned with the detailed design of the detachable units which are to fit into the modular space formed by the support structure. A dimensional co-ordination pamphlet was published in February 1969, followed by a manual of planning permutations for houses, flats and maisonettes in September. As a consequence of this work a prototype structure, financed by the Dutch Concrete Society (*Hollandse Beton Groep*), and the Philips Pension Fund, will be constructed in the near future. The prototype sanitary cell, comprising bath/shower, wash basin and wc together with provision for a washing machine, already exists and features raised floor with ring drainage, forced ventilation through the ceiling, a prefabricated hot and cold water supply and a high level electric ring main. A design manual for the unit was published in October 1969.

The Netherlands Housing Ministry (*Ministerie van Volkshuisvesting*) has operated a new system of building regulations since 1965 under which housing subsidies are allocated on a points system related to the space and equipment standards of the dwelling. This arrangement which neatly combines a kind of Parker Morris with a kind of yardstick, enables financing to be settled at an early stage in the design process whilst in no way penalising design ingenuity in the extraction of extra points from a given floor area. Habraken's own planning system using an arrangement of fixed zones and adjustable margins **6, 7, 8** works well in this context and Thys Bax's computer programmes (intended to provide a direct link between the dwelling users requirements and the manufacturers production programme) promise to submerge the greater part of the computation necessary.

Interestingly enough Wates in this country, although totally ignorant of Hahraken's work have projected something like a support structure/detachable unit complex for a new estate at Forestdale, Aldington.[1] Here a stepped brick and concrete framework capable of supporting a varied mix of dwelling units is to be built first, with the correct type of dwelling and finish for the particular market situation inserted later. The dwelling units will not of course be 'consumer durables' in the sense that Habraken intends, hut it is significant that developers in this country ar[e] already seeing the advantages of a primar[y] structural separation.

**Habraken's theory**

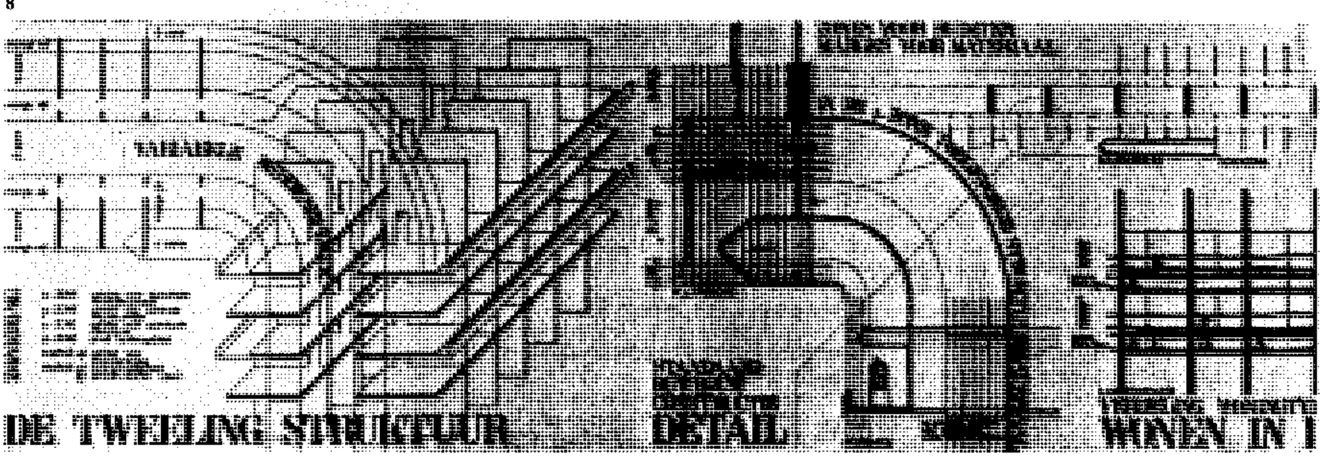
Habraken differs from most automobile house analogists in that he sees the failure o[f] mass housing to equal the performance of th[e] automobile industry as an indictment of th[e] principle of mass housing as it is understoo[d] today. In this extract from the English diges[t] of his 1961 book he explains his basi[c] argument:

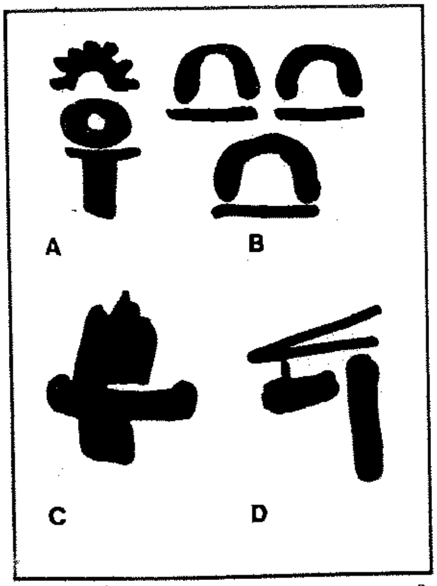
'Industrialization cannot really come abou[t] as a result of the introduction of as man[y] industrial products as possible into tradi[-]tional building methodology; for to appl[y] mass production successfully, it is necessar[y] to find a method which is founded on th[e] logic of production itself. As long as w[e] refuse to do so, our attempts at 'rationalizing[']house construction will remain as confuse[d] as those of the automobile industry woul[d] have been if they had persisted in their earl[y] efforts to mass-produce what were effectivel[y] powered seventeenth-century coaches.

'The dream of a dwelling made more o[r] less in the same way as the modern motor ca[r] is already fairly old; but parallels drawn alon[g] these lines are too obvious and far too mis[-]leading. They tend to make us set out agai[n] in search of 'the dwelling': a 'thing' to b[e] discovered by the effort of 'redeeming design'[.] Mechanical production is not by any mean[s] synonymous with the principles of mas[s] housing as they are understood today. It i[s] still possible to make full use of mechaniza[-]tion *without* total uniformity of product. Th[e] use of the machine does not automaticall[y] bring about uniform dwellings and uniforn[m] ways of living.

'The industrialization of housing which i[s] so often discussed is nothing but mechaniza[-]tion of the mass housing project. If we wis[h] to investigate conditions necessary for a[n] industrialized *housing process* we must bea[r] in mind that this does not automatically impl[y] industrialization of the mass *housing projec[t]*

'The 'natural relationship' presupposes tha[t] the dwelling is independent and that it i[s] possible to alter, improve or replace i[t] *independent of its surroundings.* Up to no[w] this has been possible only with the detache[d] one-storey house, a fact which goes far t[o] explain its popularity. To revise the housin[g] process this flexibility must be made possibl[e] in the case of high rise dwellings as well. Thi[s] stated briefly, is a concrete problem whic[h]



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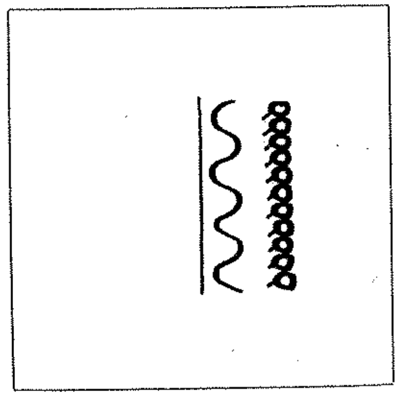
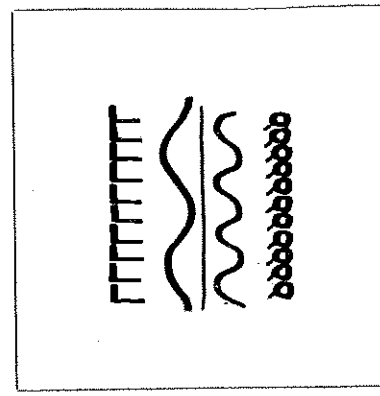


**Een woonmiddel bedient één generatie.**
**Iedere generatie onderscheidt zich van de andere.**
**Het woonmiddel verandert om vele reden:**
**omdat het snel versleten is;**
**omdat de mode anders is;**
**omdat de techniek verder is ontwikkeld;**
**omdat we niet alles van onze ouders willen overnemen;**
**omdat onze opvattingen veranderen;**
**omdat we maar één keer leven.**

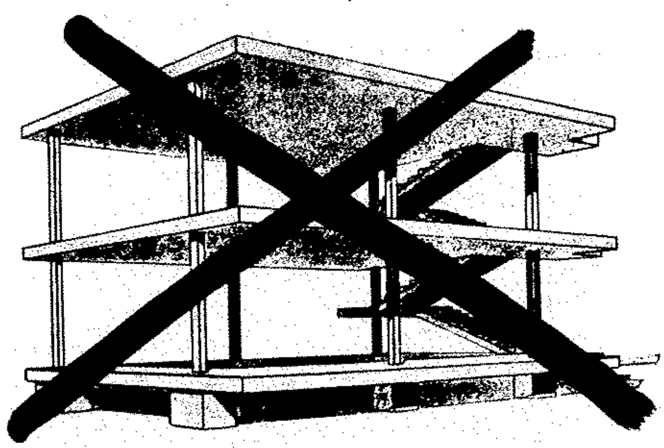
A set of detachable units serves only one generation.
Every generation is distinct from another.
A detachable unit changes for many reasons:
because it is quickly worn out;
because fashion changes;
because technique is further developed;
because we do not want to take over all our parents' things;
because our opinions change;
because we only live once.



**De relatie in de ene sfeer heeft ook een tragere machinerie dan de andere.**
**Het gemeenschappelijke besluitvormingsproces is van nature traag.**
**Het individuele besluitvormingsproces is van nature sneller, impulsiever. Vooral in een situatie waar veel keus geboden wordt, waar persoonlijke identificatie van belang is.**

The relationship in one sphere also works with slower machinery than in another.
The communal process of taking a decision is by nature slow.
The individual process of taking a decision is by nature quicker, more impulsive. Especially in a situation where there is a lot of choice, where personal identification is important.

**5, 6, 7** *The arrangement of zones and margins can be seen more clearly in this series of photographs showing the 'twin structure' model in various stages of completion.* **5** *shows the basic support structure with rectangular servicing ducts rising between the 'twin' structural frames.* **6** *shows the central gap bridged by prefabricated flooring units and the zones and margins indicated by symbols on plan, (zones light, margins dark). In every case zones, α, β, γ and so on, are allocated to specific functions—such as bedroom areas, living rooms and access ways. Margins (αβ, αδ, βγ) express the location of structure or servicing components. As for instance margin αε which indicates the dimensional limits of the wall unit which must separate the interior of the dwelling from the access balcony.* **7** *shows a dwelling type superimposed on the zone and margin model—this time with balcony access.*
**8** *Part of a study carried out for the Netherlands Timber Development Association in 1967 showing (left to right), the arrangement of zones and margins in plan and perspective in relation to the support structure. The structural principles governing the design of the support structures themselves. Alternative flat and maisonette plans within the modular support structure; and finally a legend and part-section.*
**9** *Part of Habraken's symbol vocabulary for analysing the relationship between public and private realms in housing.* (**A** *architect,* **B** *dwellings,* **C** *do-it-yourself,* **D** *mechanized building trade*).
**10** *Part of Habraken's argument incorporating a rejection of Le Corbusier's theory of structure as skeleton. The different life-spans envisaged for detachable units and support structures makes it necessary to regard the latter as enclosure rather than framework.*



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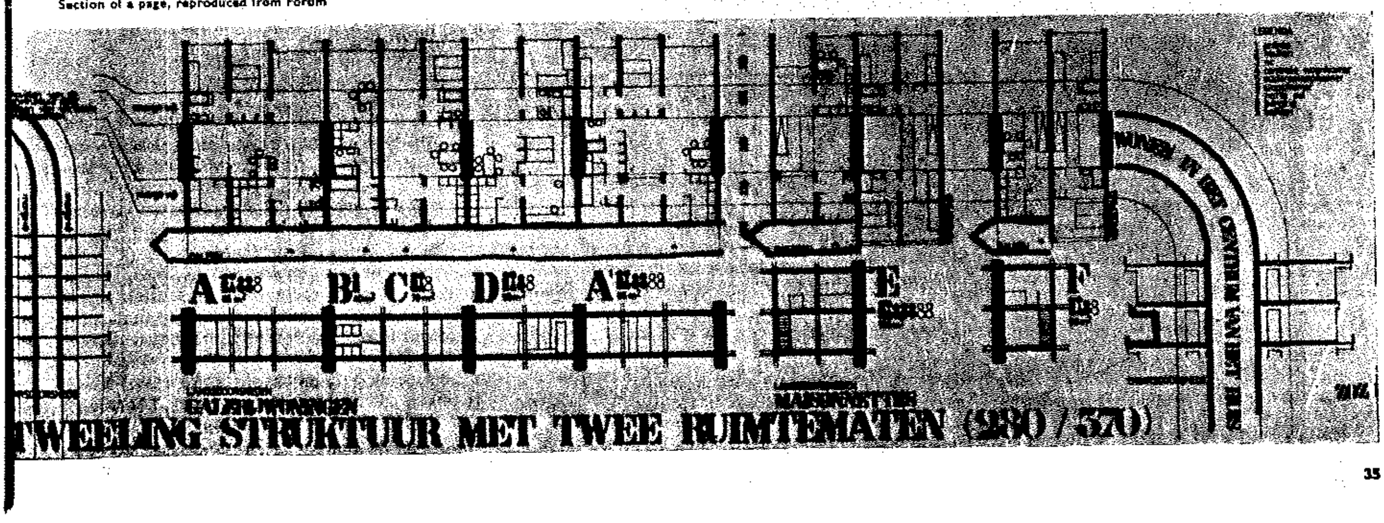

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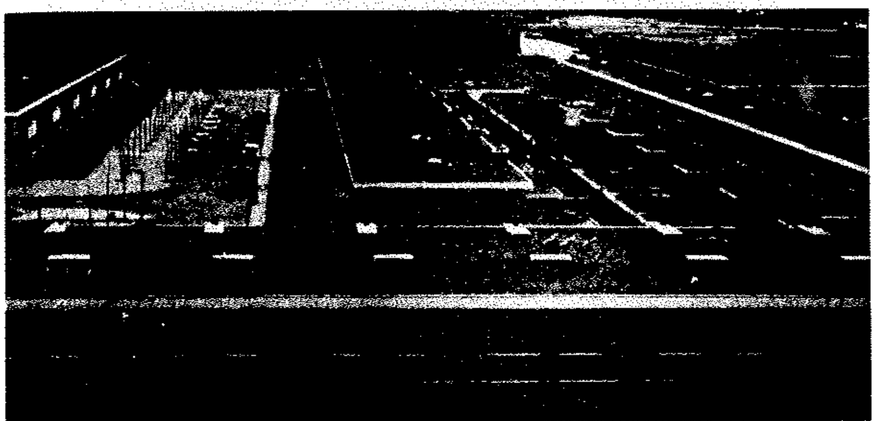

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*11 Detachable units without support structures—camping.*
*12 Support structure dwellings without detachable units—the conventional mass housing project.*
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must be solved in order to derive a contemporary housing-process.

'If we look at an urban structure as a conglomerate of buildings each building must be independent in the sense that it can be built and demolished irrespective of other buildings. Rising land values and the consequent necessity to build high has caused buildings to become bigger—and this in its turn has caused an even greater departure from the concept of the dwelling as an independent unit. In the organism which is the town, we want to see something quite different, the independent dwelling as a cell leading its own life, rejuvenating and renewing itself in response to the stimuli emanating from social rather than economic or technical pressures. For a 'natural relationship' these cells must be small enough to correspond to the components of society itself.

'The fact that urhan expansion at present means a growth in the size of huilding units has caused a coarsening of town structure. The size increases enormously, but the number of component parts decreases. New areas of Amsterdam for instance have higher densities than the old central part, but they are arranged in a smaller number of structural units. If we visualise the town as an organism built up of independent living cells, it becomes clear that our modern cities have become, in evolutionary terms, increasingly primitive organisms with a coarse structure, little flexibility and little vitality despite their unprecedented and excessively large scale. A *truly* modern town should in fact have an infinitely complicated structure, built up of a much larger number of cells than an old town. It would then become 'natural' in the sense that, in nature, more complicated organisms develop a multiplicity of basic organs.

'It would be interesting to investigate the social and cultural influence of this current inability to build big towns with complex structures. How is it that we always resort to enlargement of scale and structure? Such an investigation into the 'biology of towns' could give us a considerably better insight into the elusive phenomena with which our lives are inextricably interwoven. Unfortunately we cannot wait for creation of such a science, and in anticipation we must try to create towns of the future which despite their size do not sacrifice the complexity of small cellular construction.

'The bottleneck in the development of town planning is to be found in the field of housing. The coarsening of urban structure and the discrepancy between it and society are assuming increasingly insufferable proportions. The technical problem is therefore not that of prefabrication of the mass housing project, not its industrialization, but development of the independent dwelling, and the reintroduction of the 'natural relationship' which goes with it. The town must assume a structure in which that which must be small is small and that which must be big is big. It must be possible to find a method of building which gives full scope both to man and machine, to the 'natural relationship' and mass production side by side, for the discrepancy between them is founded in the housing project, not in housing itself.'

The 'natural relationship' which Habraken mentions in this extract is in fact the relationship between private and public realms which he expresses through the division between support structure and dwelling unit. The support structure in this case represents the limit of social or public concern, whilst the dwelling, composed of detachable units purchased or hired as consumer durables and possessing the same approximate life-span; represents the private realm—wholly under the control of the individual.

As a means of expressing this formulation Habraken has developed a system of symbols which he employs in visual and mathematical relationships to develop his argument. The 1966 SAR publication *Forum* contained the whole of Habraken's mass production theory expressed by this means **1**, **2**, and in it he clearly demonstrates that the employment of the same mechanized building trades in hoth puhlic *and* private sectors lies at the root of the unsatisfactory mature and performance of contemporary housing.

**Maakssen Broeck**

The Netherlands is a very heavily urbanized country and as long ago as 1960 it was seen that the geographical positions of Rotterdam, The Hague, Amsterdam, Hilversum and Utrecht was leading to the construction of a *de facto* linear city of circular form approximately 60Km in diameter. Discussion of this possibility led to an increase in land values around the circumference of this ring and to the planning of possible developments by both public and private organizations. A part of this latter process led to the purchase, by a large development consortium called CSO (*Combinatie Stede Ontwikkelung*) of most of the land in and around the small village of Maakssen, situated 20Km from Amsterdam and 15Km from Utrecht. The purpose underlying these manoeuvres, which was to gain control of the site of a new town intended eventually to house 40,000 people, was partially thwarted by the Mayor and farmers of the village who proceeded to form an organization of their own, borrowing public money in order to retain control of key plots in the area. The upshot of the whole affair was the establishment of a sort of Development Corporation on which both CSO and the Maakssen community were represented. This organization then held a closed competition for the design of the town, specifying 70 per cent low rise and 30 per cent high rise on a 500Ha site.

Three large firms of architects were chosen, two of them members of the committee on housing whose levy supported SAR. The remaining entry was invited from Fokke de

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Jong, a member of Habraken's SAR team. De Jong, with the aid of Bax and Von Olphen (also of SAR) submitted their entry early in 1969 and to their surprise won. As a result they are in the process of establishing a practice so that they can begin detailed design work in the first phase, which is scheduled to start in June 1971.

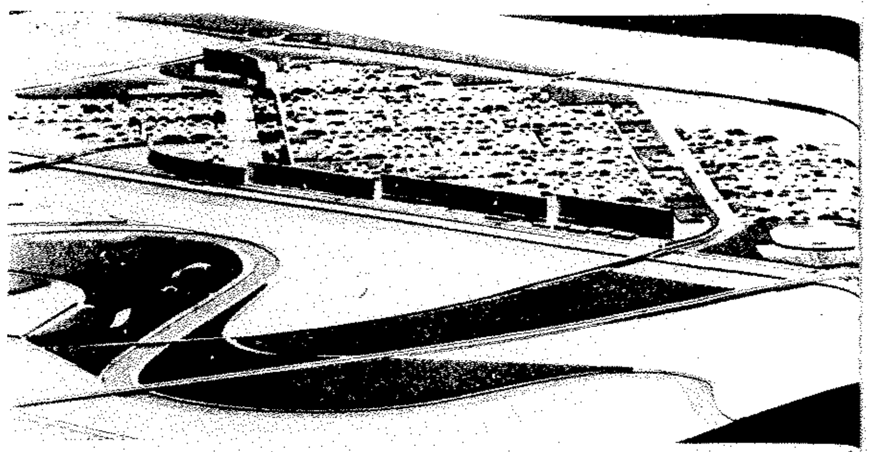
De Jong and his collaborators employed Habraken's principle throughout their design and despite the high density demanded by the site, were able to provide the necessary weighting in favour of low rise accommodation which their competitors had found difficult. The town itself has a trading estate for light industry but will in the main serve the neighbouring city of Utrecht. Car parking is scheduled for 2·5 places per dwelling.

Using Habraken's zone and margin principle, with the actual dwelling mix remaining a variable until the construction stage, the planning of accommodation was not decided at the time of the competition entry—only parameters, showing the theoretical limits of provision for different dwelling types, were calculated. CSO were impressed by this display of operational versatility which in fact offers great advantages for developers in areas of uncertain demand, or, as now, during periods of financial hardship.

The new town of Maakssen will be completed in 1986, and a companion settlement south of Utrecht, called Nieuwe Gein and planned to house 100,000 people, is now projected.

**Prognosis**

Habraken, who looks younger than his forty years, does not see the success of his plans in the future as a matter of optimism; 'fatalism' is the word he prefers to use. When asked to



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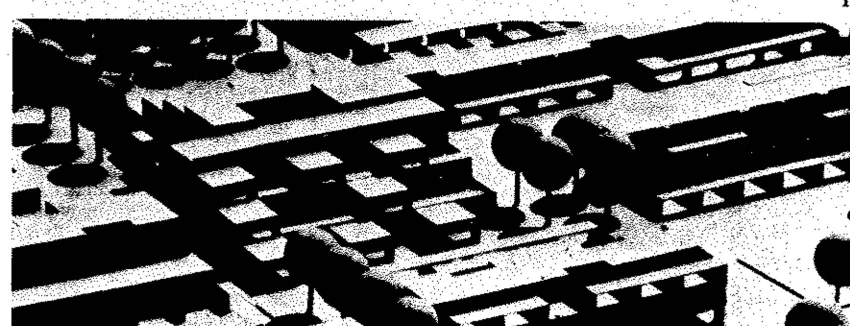

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**13** *Habraken's assistants, the architects of the competition-winning application of his ideas. Left to right: Fokke de Jong, who was asked to submit an entry, Hans von Olphen and Thys Bax—who is working on the computerization of Habraken's design method.*
**14** *The model of Maakssen Broeck showing high rise accommodation (30 per cent) and, beyond, the low rise units. The meandering waterway in the foreground is a small river called the Veght; between it and the new town runs a canal, whilst numerous small lakes and channels penetrate into the town itself. To the left of the picture is the area allocated to light industry.*
**15** *A second view of the Maakssen model showing river Veght, canal, motorway and feeder routes, high rise and commercial area (fronting onto canal).*
**16** *Low rise housing at Maakssen. Because the dwellings are to be built in two distinct stages—support structure and dwelling unit—planning has not yet gone beyond the establishment of maxima and minima for the number and type of dwellings which can be included. The marketing situation at the time of sale will be allowed to influence the precise mix of dwelling types.*

17 Ad hoc *development on the coast. A gridiron plan separates user developments uncontrolled by architectural inspiration. Much of Habraken's prognosis is derived from such patterns of settlement.*

explain this he merely points out that five years ago no one seriously expected the SAR to be able to survive on research income, let alone that his pupils would win a major competition for a new town. Neither did he apparently expect to rise to the rank of Faculty Chairman in the newest of the Netherlands' four full-time schools of architecture.

Holland's population is expected to double its real earning power in the next thirty years and with a *per capita* housing output already nearly double that of Britain, Habraken can see no reason why the building industry should not absorb a considerable proportion of that increase. To do so, he insists, is merely a question of offering increasing choice and flexibility in the dwelling, and to do this a fundamental separation between support structures and detachable housing units is essential. The advantage of his system in such a context derives from its flexibility of scale. The same methodology can be applied to ensure that proposed housing developments conform to the requirements of the *Voorschriften en Wenken* (Dutch Building Regulations), that they can provide what market research indicates that people want by way of equipment and space standards; that costs can be controlled via computer control of quantities, that the detailed design of dwellings need not be attempted until major questions of siting, servicing and structure are settled; and above all that the components of the dwelling unit itself can be continuously modified and renewed (like an airliner) independent of their support structure.

The vague sense of disappointment that one feels on discovering that Habraken's brilliant critique of the housing process has led only to a system whose employment must reduce still further the control the architect can exert over the *farm* of mass housing, may perhaps be merely a facet of the withdrawal symptoms being experienced by much of the architectural profession over the loss of a formerly assumed omnipotence. It is curious that the very people who in Britain deplore NBA standard house shells, yardstick control of housing costs and impending 'rules for environment' from the Ministry of Housing, are often most impressed by Habraken's perceptive attacks on current housing practice—imagining as they do that these are the precursors of astonishing new perspectives for the architect. They are not. Instead Habraken's 'natural relationship' offers new perspectives for the building user. Practically all the advantages under the SAR system accrue to the occupier, who within reasonable limits can not only design his own dwelling but adapt and modify it with ease so that the estimated ten year life of components facilitates rather than diminishes opportunities for change.

For Habraken the establishment of stable environmental areas by means of support structures, coupled with the facilitation of internal change by means of detachable units, answers the question of the architect's involvement in 'personalization', 'territoriality' 'image building' or any other *recherché* remnant of architectural omnipotence. The very simplicity and duplicatability of his system explains his 'fatalism' about its eventual adoption. The traditional methodology of mass housing, whose product has proved even less capable of coming to terms with increases in the size, range and capability of consumer durables than the spacious urban housing of the eighteenth century, possesses no advantage at all over what Habraken proposes. As he wrote, attempts to industrialize the mass housing process resemble attempts to 'manufacture the seventeenth century coach by means of an industrial production system'. The fundamental separation between dwelling unit and support structure represents for the first time a correct analogy with the methods of production used in the automobile industry. For the first time the house has been separated from the land as the car was separated from the road. The precise details of the system employed are of little importance; the support structure can range from low rise party walls with concrete floor slabs, to a high rise triangulated megastructure. The important thing is the *organizational separation*, and that, as far as can be discerned was Nikolaas Habraken's idea.

Implementation of this principle has of course implications for ownership and tenure as well as for design and construction; and it may be no accident that the system is most likely to get under way in Holland, a country with as much privately rented housing as owner occupied. Leasehold has undeniable advantages over freehold when it comes to apportioning responsibility for diverse parts of the same structure. At the same time, to take the automobile analogy further, the rental or hire-purchase of detachable units. together with the usual consumer durables, may undermine the principle of ownership altogether—just as proposed thirty-year mortgages here in Britain are merely continuing the process whereby hiring and credit sale are replacing the traditional idea of possession by the concept of temporary rights over things.

Whether such developments are likely to run into trouble eventually in the face of allegedly inbuilt needs and desires such as are posited by the exponents of 'territoriality' and 'personalization' on housing, must remain to be seen. Looking coldly at the precedents one can only consider the undeniable advantage to the consumer which accrued from the mass-production of automobiles. Few people complain about the similarity of Minis or *Volkswagen*, and the kind of gadget industry which serves to 'personalize' cars is *built into* the detachable unit method advocated by Habraken.

'The architect cannot initiate anything,' he observes shrewdly. Only the client, the manufacturer or the financier can do that. In providing a system for designer and manufacturer alike Habraken feels he is cooperating intelligently with the inevitable.

[1] *Architect's Journal* May 15th, 1968, pp. 1122.

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ir. N. J. Habraken

# de ontwikkeling van een taal
# the pursuit of an idea

De ontwikkeling van een taal.
Het verhaal van de S.A.R. is het verhaal van een achtervolging. De achtervolging van een idee. Het idee dat het individu een onmisbare rol te spelen heeft in het huisvestingsproces en dat alleen wanneer die rol wordt vervuld de industrialisatie pas werkelijk kan plaatsvinden. De termen 'drager en inbouwpakket' waren de kristallisatiepunten van dat idee. Zij gaven weer, dat er een tastbaar terrein geschapen moest worden waarover het individu zeggenschap zou krijgen. Dat daarnaast en daardoor het terrein bekend zou worden waar de gemeenschap beslissingen moest nemen. Daarom zijn drager en inbouwpakket gedefinieerd in termen van zeggenschap. De drager bevat al datgene waarover de gemeenschap zeggenschap heeft en het inbouwpakket bevat datgene waarover het individu zeggenschap heeft. De woning is een resultaat en geen doel. Het doel is, een gemeenschap in staat te stellen zich te huisvesten. Het resultaat, de woning ontstaat wanneer gemeenschap én individu beiden hun rol vervuld hebben.

De achtervolging van dit idee leidde in de eerste plaats tot het inzicht dat het ging om niet minder dan de reorganisatie van het huisvestingsproces. Als er een sfeer is waarin de gemeenschap beslist en als er een sfeer is waarin het individu beslist dan moet er ook een produktieproces zijn voor een gemeenschap en een produktieproces ter wille van het individu. Dan is er een proces dat tot dragers leidt en er is een proces dat tot inbouwelementen leidt. Dan zijn er beslissingen die over dragers gaan en beslissingen die inbouwelementen betreffen.
Hoe is het mogelijk straks dragers te bouwen waar allerlei verschillende individuen verschillende inbouwelementen, die op allerlei verschillende plaatsen geproduceerd kunnen worden, kunnen doen aanbrengen? Hoe is het mogelijk om op allerlei verschillende plaatsen inbouwelementen te doen produceren die straks door allerlei verschillende individuen in allerlei verschillende dragers geplaatst kunnen worden?
Dit leidde tot de noodzaak van een stelsel van afspraken. Afspraken die het mogelijk moeten maken dat één partij dragers ontwerpt en produceert in de zekerheid dat daarin straks allerlei woningen gevormd kunnen worden d.m.v. allerlei verschillende inbouwelementen. Afspraken die tegelijkertijd het mogelijk maken dat een andere partij inbouwelementen fabriceert in de zekerheid dat ze in iedere drager geplaatst kunnen worden. En deze afspraken moeten niet alleen garanderen dat het een past in het ander, maar moeten bovenal garanderen dat het resultaat optimaal zal zijn vanuit een gebruiksstandpunt.
Hoe worden zinvolle en doelmatige beslissingen genomen bij de voorbereiding en de bouw van dragers en hoe worden zinvolle en doelmatige beslissingen genomen bij de voorbereiding en produktie van inbouwelementen. Hoe wordt het mogelijk om de gebruikswaarde van een drager te kunnen bepalen en de gebruikswaarde van een inbouwelement te kunnen vastleggen? Dit betekende dat een methode ontwikkeld moest worden om het normatieve denken in het huisvestingsproces, wat zich tot nu toe uitsluitend gericht had op de geheel voltooide woning, nu te richten op het voltooien van dragers en het voltooien van inbouwelementen. Niet alleen het technische proces moest worden gereorganiseerd maar vooral ook het normatieve denken.

Iedere verdeling van arbeid berust op afspraken. Ieder stelsel van afspraken houdt een methode in. Iedere methode heeft zijn eigen stelsel van afspraken, zijn begrippen, zijn tekens, zijn conventies, kortom zijn eigen taal die samenwerken mogelijk maakt. Zo leidde de achtervolging van een idee tot een verdeling van taken en leidde de verdeling van taken tot een stelsel van afspraken, en maakte het afspraakstelsel de ontwikkeling mogelijk van een methode en uit die methode groeit nu langzaam een taal.

Het tastbare resultaat van vijf jaar werken in de S.A.R. is een stapel papier; schetsen, rapporten, plannen, en tekeningen. Ook ontwerpen van structuren, ontwerpen van inbouwpakketten en eindeloze plattegrondvarianten. Ontwerpen die zijn ontstaan uit eigen onderzoek en ontwerpen die zijn gemaakt in opdracht van diegenen die als eersten poogden de ontwikkelde principes in praktijk te brengen. Als het nu tijd is om een overzicht te geven van al het werk dat gedaan is, zou het toch onjuist zijn om dit te doen door het produceren van een min of meer chronologisch overzicht van de belangrijkste ontwerpen en studies die zijn gemaakt, want de tekeningen zijn in zichzelf resultaten van toeval. Ontstaan omdat een vraag werd gesteld, omdat een gedachte naar boven kwam of een mogelijkheid zich voordeed. Het zijn hiërogliefen die de moeite van het bestuderen waard zijn, niet om erachter te komen welk verhaaltje nu toevallig is verteld, maar om te ontdekken dat er een taal bestaat die we nog maar zeer gebrekkig kunnen spreken, maar die ons nieuwe mogelijkheden moet bieden.

## zônes en marges

Het principe van de zône, zij het in primitieve vorm, is van het begin af aan aanwezig geweest bij het werk in de S.A.R. Van een ontwerpmethode mag worden verlangd, dat op methodische wijze een verband gelegd kan worden tussen de kwalitatieve eisen die men stelt aan de ruimten, die gebouwd moeten worden, en de kwantificeerbare factoren die uiteindelijk bepaald moeten worden om te kunnen bouwen: de plaats en de afmeting van de ruimten en de dingen.
Bij het ontwerpen van een structuur weten we nog niet welke ruimten precies uiteindelijk zullen worden gemaakt. Toch willen we weten dat het mogelijk moet zijn om ruimten te maken die voldoen aan de kwalitatieve eisen die wij stellen. Ook moeten die ruimten van de juiste kwaliteit op de juiste plaats terecht kunnen komen. Hoe regelen we nu dat ruimten van de juiste afmeting op de juiste plaats komen zonder dat we al kunnen zeggen welke ruimten nu precies zullen ontstaan? Hiervoor zijn zônes en marges een hulpmiddel. Een zône is een gebied waarvan we de afmeting en de plaats kunnen vastleggen. Vervolgens kunnen we aan dat gebied een gebruikswaarde toekennen die overeenkomt met de gebruikswaarde van een groep van ruimten. Een zône maakt het dus mogelijk dat de

The story of the S.A.R. is the story of a pursuit. The pursuit of an idea. The idea of the individual playing an indispensable part in the process of housing. And the idea that industrialisation can only really take place, when the individual has taken upon himself to play that part. The focal points in the idea were termed 'support structure' and 'detachable units'. They express the need for the creation of a tangible field over which the individual would have right of say. And in circumscribing that, the part over which the community would have to make decisions, would also be known. That is the reason why the support structure and the detachable units are defined in terms of 'right of say'. The support structure contains everything over which the community and the detachable units everything over which the individual has right to say. For a dwelling is not a purpose in itself, but the result of a purpose. The purpose being to enable a community to house itself. And the result a dwelling, in which both the community and the individual have played their part.

In the first place the pursuit of this idea led to the opinion that it concerns nothing less than the reorganisation of the process of housing. If there is a sphere in which the community decides and one in which the individual decides then there must be a productionprocess for the sake of the individual as well as for the sake of the community.
Then there will be one process which leads to support structures and one which leads to detachable units. And consequently one set of decisions will be taken concerning the support structures and one set of decisions will be made about the detachable units. How will it be possible in future to build support structures which allow all sorts of different individuals to install different detachable units produced at a number of different places? And how will it be possible to have detachable units produced at a number of different places, which all sorts of different individuals will be able to place in all types of support structures?

This led to the necessity of having a system of agreements. Agreements which must make it possible for one party to design and produce support structures certain that those structures can later on contain all kinds of dwellings made by means of different detachable units. Agreements which must at the same time make it possible for the other party to produce detachable units certain that they can be placed in every support structure. And these agreements must not only guarantee that one fits the other, but above all that the result will be the most favourable one from the user's point of view. How are meaningful, practical decisions made during the preparation for and the building of support structures and how are they made during the preparation for and the production of detachable units? How will it be posisble to decide upon the extent of usefulness of a support structure or of a detachable unit?
This meant that a method had to be developed to direct evaluative thinking in the housing process towards the competition of the support structures and the detachable units in stead of being solely concerned with the completed dwelling. Not only was it necessary to revise the technical process, but more especially the evaluative process of thinking.

Every division of labour is based upon agreements. Every system of agreements contains a method. Every method has its own system of agreements, its own ideas, its own signs, its own convention; in short its own language making co-operation possible. In that way the pursuit of an idea led to the division of tasks; the division of tasks led to a system of agreements; the system of agreements made it possible for a method to develop and out of this method a language is now slowly emerging.
The tangible result of 5 years of work in the S.A.R. (Foundation for Architectural Research) is a pile of papers; sketches, reports, plans and drawings. Also designs of structures, of detachable units and endless variations on floorplans. Designs arising from its own research and designs commissioned by those who were among the first to attempt putting the evolved principles into practice. If now is the time to give a survey of the work done it would still be incorrect to do this by producing a more or less chronological survey of the most important designs and studies made. Because the drawings themselves happened by chance. Coming into existence because a question had been posed, a thought had come to the surface or a possibility revealed itself. They are hieroglyphies worth studying not in order to discover which story has by chance been told, but in order to discover the existence of a language, which up to now we can only speak very imperfectly, but one which should open up new vistas.

## zones and margins

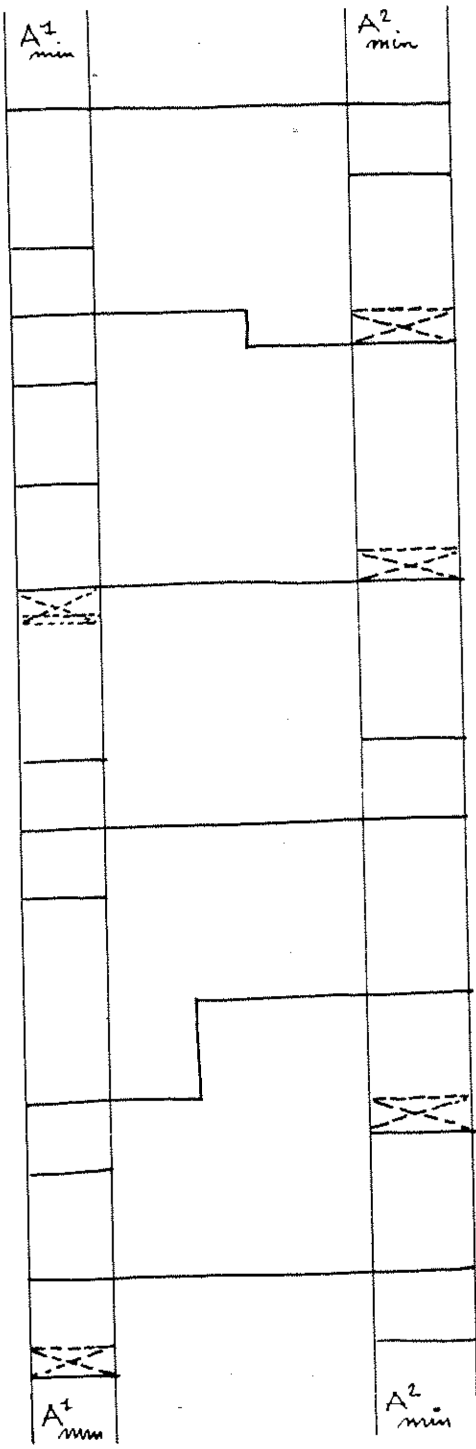
The principle of the zone alheit in primitive form has been present from the beginning in the work of the S.A.R. One may expect from a design-method that it can in a methodical way make the connection between the qualitative requirements demanded of the spaces which are to be built and the quantifiable factors which ultimately have to be defined in order to build: namely the position and the size of the spaces and objects.
In designing a structure we do not — as yet — know exactly what spaces will ultimately be created. Nevertheless we want to know that it will be possible to create spaces satisfying the qualitative requirements we demand. Also these spaces of the right quality must end up in the right place. How do we arrange that spaces of the right dimensions end up in the right place without being able to say as yet exactly what kind of spaces will come into existence?
In this zones and margins are an aid. A zone is an area of which we can fix the place and the dimensions. Next we can attribute an utility value to that area, which corresponds with the utility value of a group of spaces. A zone therefore enables an architect to make decisions concerning the place and the dimensions of a group of spaces in a plan. Consequently a zone gives the architect the opportunity of making

ontwerper beslissingen neemt over de plaats en de afmeting van een groep ruimten in een plan. Een zône biedt de ontwerper dus de gelegenheid om in algemene zin beslissingen te nemen. Hiermee wordt de mogelijkheid geschapen om van algemeen naar specifiek toe te ontwerpen. We kunnen eerst algemeen geldende beslissingen nemen en vervolgens daarbinnen weer meer specifieke over kleinere onderdelen. Overal waar in algemene zin ordening van ruimten nodig is, en bij welk ontwerp van enige complexe aard is dat niet het geval, kunnen de zônes een hulpmiddel zijn.
Een marge is een overgangsgebied tussen twee zônes. Het is niet al te overdreven om te zeggen dat architektonisch ontwerpen de kunst is van het bespelen van marges. Ruimten worden gegroepeerd en gaan in elkaar over. Overgangen tussen ruimten bieden gelegenheid tot marges. Iedere overgang heeft dikte, heeft maat. Een lijn bestaat in werkelijkheid niet. Als zônes een hulpmiddel zijn om in algemene zin ruimten te ordenen dan horen daar marges bij om in algemene zin overgangsgebieden te bepalen.
De ontwerper is geheel vrij om, wanneer hij zônes en marges heeft bepaald, daaraan de kwalitatieve spelregels toe te kennen die hij nodig vindt. Hij kan bepalen wat in bepaalde zônes wel of niet mag. Hij kan vastleggen welke gebruikswaarde hij aan bepaalde zônes wil toekennen. Hetzelfde kan hij bepalen voor marges. Zo hebben we bij het werk in de S.A.R. vaak bepaald dat marges het gebied zijn waar de elementen komen die de ruimten bedienen. Hierdoor is het gebied van de zône het vrije gebied wat altijd beschikbaar is voor het eigenlijke verblijf. Dit geeft niet alleen de mogelijkheid tot een duidelijke ordening van de elementen, maar het geeft ook een goede afleesbaarheid van de kwaliteit van een zônering. Hoe ruimer de marge is, hoe meer voorzieningen aan een ruimte toegevoegd kunnen worden, hoe meer speelruimte er letterlijk ontstaat.
Hoe ruimer de zône is hoe meer ruimte er is gereserveerd voor de specifieke functie zonder de daarbij behorende voorzieningen. De marge krijgt bij een dergelijke afspraak een utilitair karakter; de zône daarentegen een veel meer vrij kwalitatief karakter.
Wanneer de zônes en marges bepaald zijn en de spelregels zijn afgesproken is daarmee een communicatiemiddel geboden, want de ene ontwerper kan een structuur maken op basis van de zônes en marges en hun afspraken en de andere ontwerper kan die structuur verder afmaken en invullen op grond van dezelfde afspraken. Er is een dialoog mogelijk tussen twee partijen die de gelegenheid biedt om zonder misverstanden gezamenlijk complexen-problemen aan te pakken. En dat is de functie van een taal: de gelegenheid bieden tot communicatie.

decisions in a general sense. This enables him to design from the general down to the specific. We can first make generally received decisions followed within that framework by more specific decisions concerning smaller matters. Wherever in a general sense arrangement of spaces is necessary, and in whatever design of any complex nature will this not be the case, zones can be an aid.

A margin is an intermediate area between two zones. It is not too exaggerated to state that architectural design is the art of manipulating margins. Spaces are grouped together and pass from one into the other. Intermediates between the spaces create scope for margins. For every intermediate has its thickness, its dimensions. A line does not really exist. If zones are a help by regulating spaces in a general sense, than margins belong to them by regulating the intermediate areas.
When the architect has decided upon zones and margins, he is completely free to ascribe to them the qualitative rules he considers necessary. He can decide what is or is not permitted in a given zone. He can fix whatever utility value he wants to certain zones. And he can do the same for the margins. In that way we have often in the course of our work for the S.A.R decided that margins are the area in which elements are to be placed to service the spaces Consequently the area of the zone is a free area, always available for actual living Not only does this afford an opportunity for the clear-cut planning of the elements, but it also gives a good indication of the quality of the zoning. The more spacious a margin the more provisions can be added onto a space hence literally more ellow-room is created. The more spacious a zone the more space is reserved for the specific function without the services belonging to it. By such an agreement the margin has an utilitarian character, in contrast to the zone which will have a much freer qualitative character.

When the zones and margins have been determined and the rule decide upon a means of communication has come into existence. For the one architect can make a structure based on the zones and margins and their conventions and the other architect can complete it and fill it in by virtue of the same conventions. There is a dialogue possible between two parties enabling them to tackle complex problems together without misunderstanding. And that is after all the function of a language: To act as a vehicle for communication.

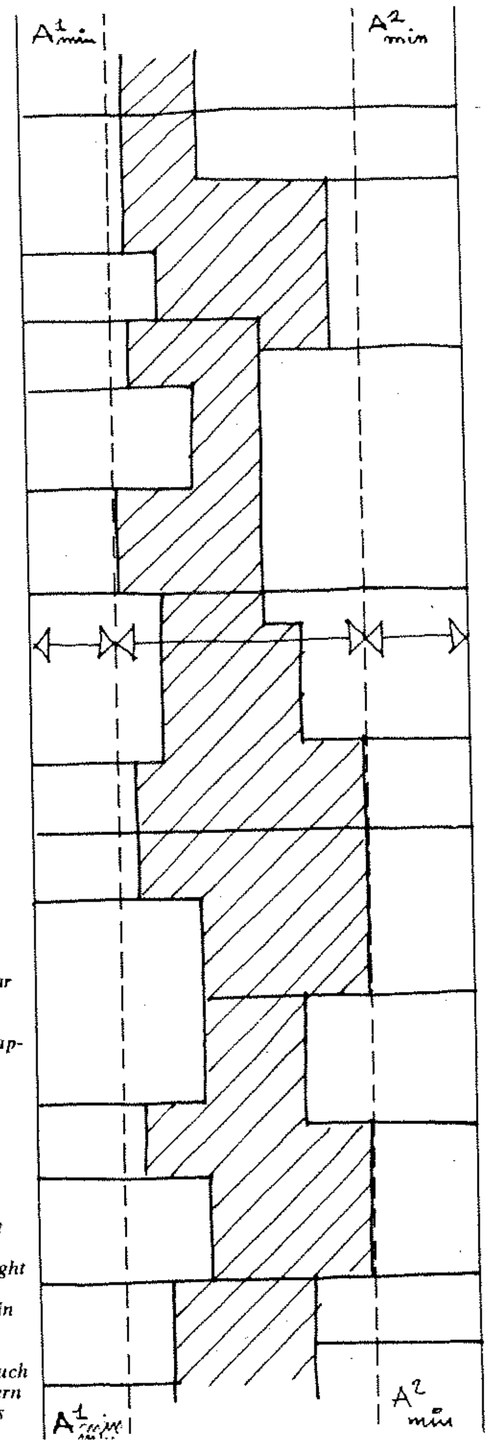


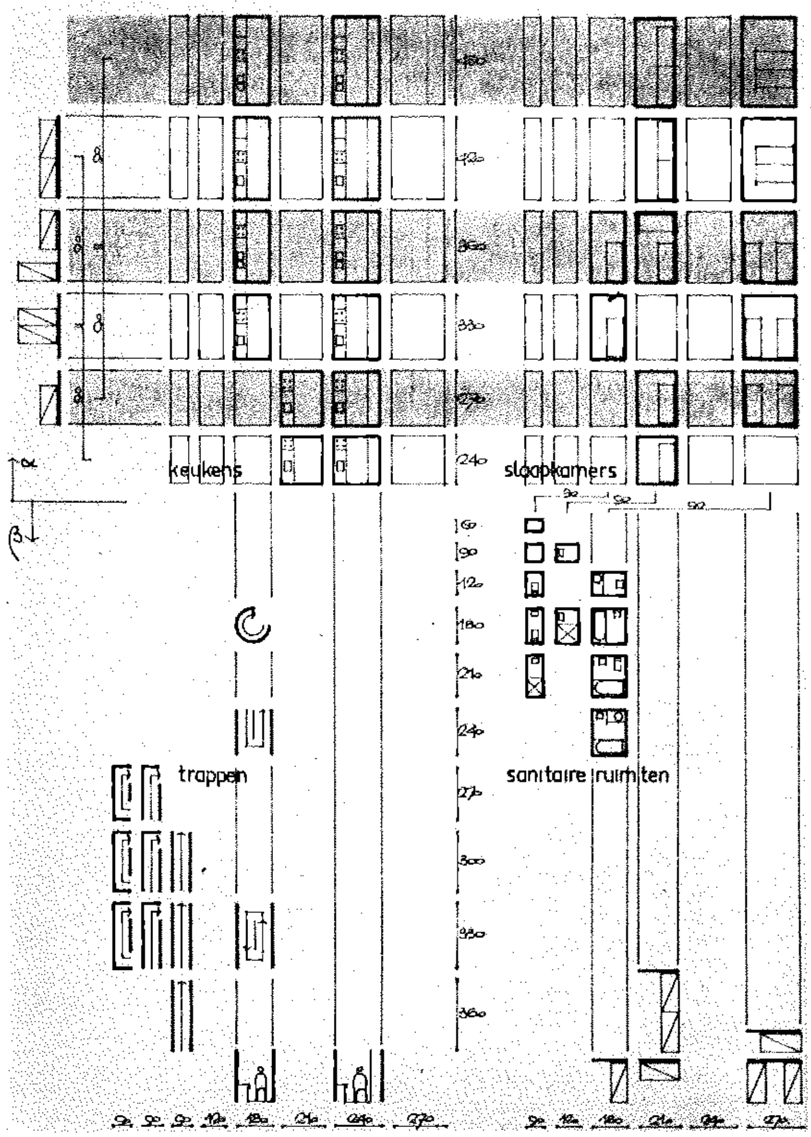
*Illustratie 1.1.*
*Studie uit 1963 waarin het principe van de zône voor het eerst wordt gesteld. Wanneer een willekeurig aantal woningplattegronden aan elkaar geschakeld wordt is er achter de gevel altijd een gebied aan te wijzen waar geen wanden aanwezig zijn evenwijdig aan de gevel.*

*Illustration 1.1*
*Illustration 1.1 belongs to illustration 1.2*

*Illustratie 1.2.*
*Deze illustratie behoort bij 1.1.*
*In een willekeur van plattegronden in een drager is dus toch een zeker patroon aan te wijzen: aan de buitenzijde zullen stroken te onderscheiden zijn waarin alleen wanden zijn die loodrecht op de buitengevel staan. Vanuit deze eerste observatie, dat in een schijnbare willekeur die in een drager zou kunnen optreden toch een patroon aanwijsbaar is werd een systematiek ontwikkeld. Pas later is geformuleerd dat een dergelijk patroon mede ontstaat op grond van gedragseigenschappen van de gebruikers. Hiermee werden de kwalitatieve aspecten die in zônes vertegenwoordigd zijn gevonden.*

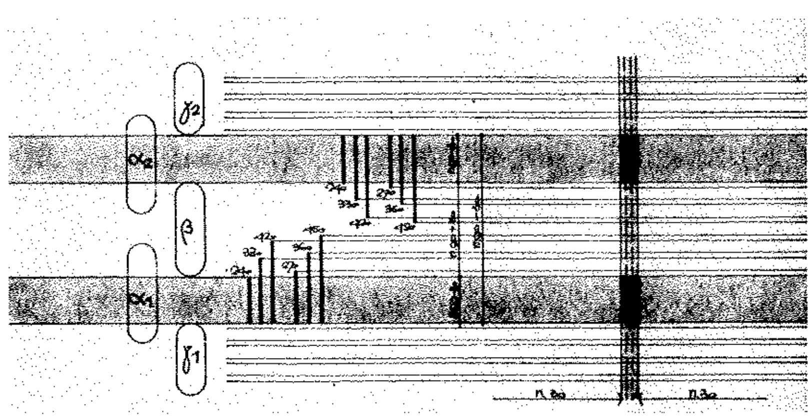
*Illustration 1.2*
*This illustration belongs to 1.1*
*In any given set of floorplans in a support structure it is nevertheless possible to point out a certain pattern. On the outside areas will be visible which contain only walls standing at right angles to the façade.*
*In the seeming arbitrariness which could exist in a support structure a pattern can be indicated. And from this first observation a system was developed. Only later it was formulated that such a pattern is also caused by the behaviour pattern of the users. In this way the qualitative aspects represented in the zones were found.*






*Illustratie 1.3.*
*Studie van april 1965.*
*Een zône kan worden geanalyseerd op zijn gebruikswaarde. Wat is de waarde van een dieptemaat van 2.70, 3.60 of 4.50 voor de plaatsing van bedden of keukenapparatuur?*

*Illustration 1.3*
*Study dating from april 1965*
*A zone can be analysed according to its utility value. What is the value of a depth of 2.70, 3.60 or 4.50 metres in connection with the placing of beds or kitchenapparatus?*

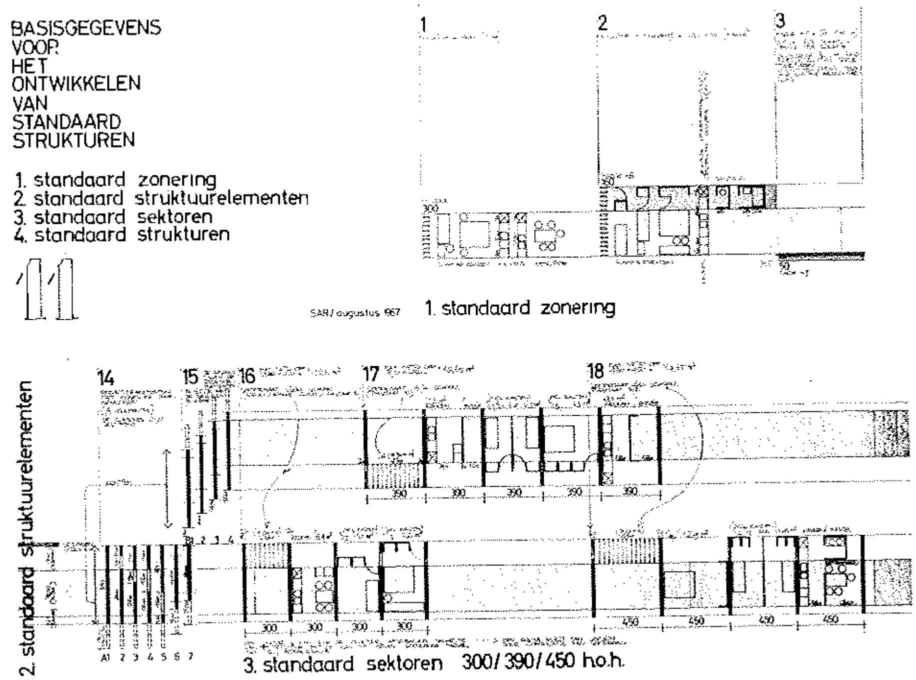


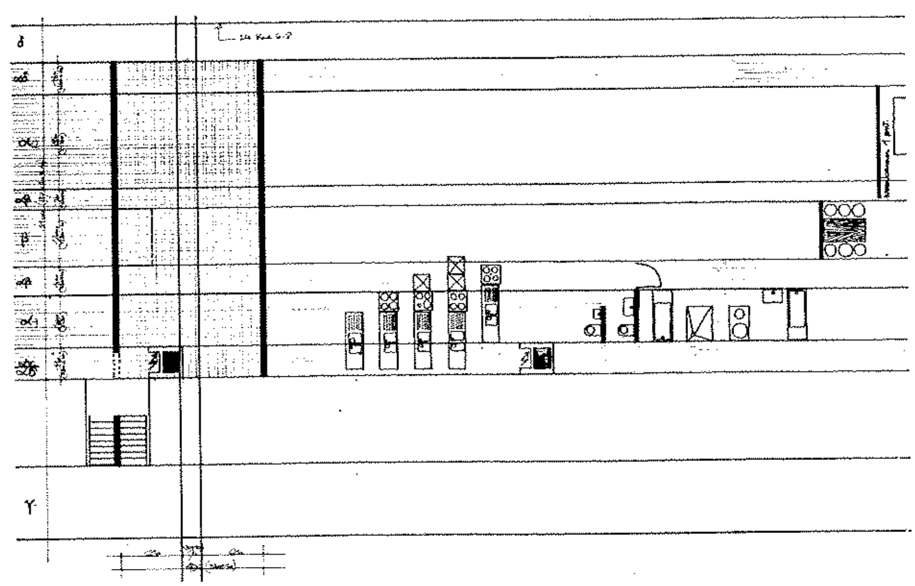
*Illustratie 1.4*
*Studie uit april 1965.*
*Notities van zônes met verschillende bestemming. Hoewel de benamingen alpha, bêta en gamma al aanwezig zijn, is er nog geen sprake van een marge.*

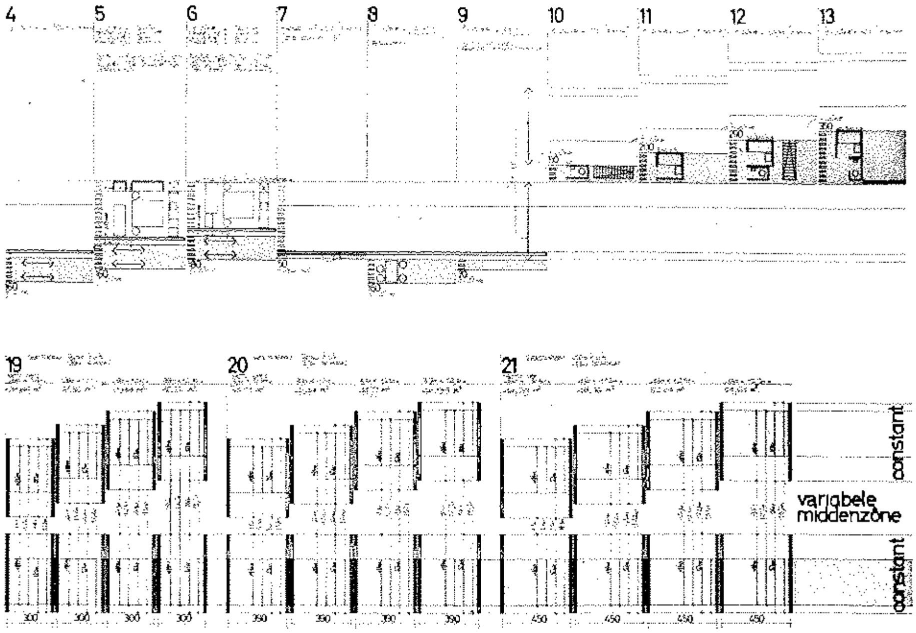
*Illustration 1.4*
*Study dating from april 1965*
*The notation of zones with different functions. Though alpha, beta and gamma have already been designated, there is as yet no question of a margin.*

*Illustratie 1.5.*
*zônering voor woningwetbouw. De*
*Een studie om te komen tot een standaard-zônering voor een woningwetbouw. De analyse van een zône betekent het onderzoeken van de gebruikswaarde van een gegeven zône vanuit tevoren gestelde normen. Dit onderzoek gebeurt door in de gegeven zône allerlei plaatsingsmogelijkheden van elementen en functies te noteren.*
*Het zoeken naar een standaard-zônering houdt verband met het feit dat een zône in zichzelf een bepaalde normstelling voor ruimten vastlegt. Wanneer de woningwet gezien kan worden als een pakket van normen, kan worden onderzocht of deze normen voldoen aan een of meer standaard-zônes. Daarom zou dan de veelheid van normen zijn vastgelegd in een simpele notitie voor een zônering en daarbij behorende marges. Wanneer men nu maar ontwerpt binnen deze zônering is tegelijkertijd verzekerd dat een groep van normen, zoals die van tevoren zijn gesteld, zullen worden gehonoreerd.*
*Studie uit augustus 1967.*
*Het principe, dat het vaststellen van zônes en marges met bijbehorende afspraken tegelijkertijd het vaststellen van een norm is, geeft een nieuwe dimensie aan de communicatie-mogelijkheden die met behulp van zônes en marges kunnen worden geschapen.*

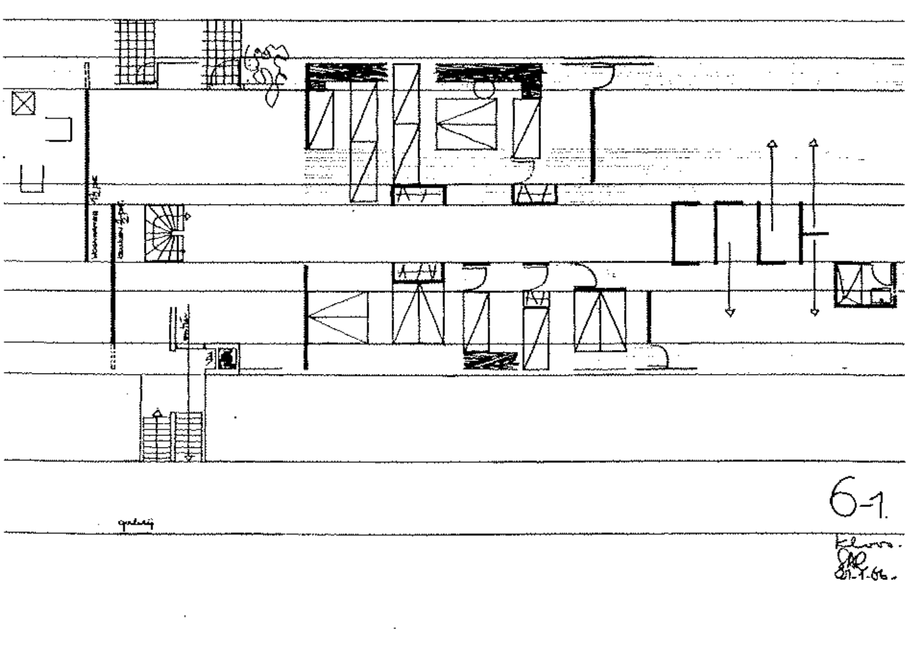
*Illustration 1.5*
*Zone- and margin-analysis*
*A study in order to arrive at a standard zoning for subsidized housing. (A Dutch law sets a number of minimum and maximum standards for subsidized housing). The analysis of a zone means research into the utility value of a given zone based on previously established standards. This type of research is done by noting down all sorts of significant allocation possibilities for the elements and functions in the given zone.*
*The search for a standard-zoning is connected to the fact, that the zone itself sets certain standards concerning the spaces. When the subsidized housing law can be seen in the light of a collection of standards than researches can be made into these standards to see whether they meet the requirements of one or more standard-zones. In this way the multitude of standards could be reduced to a simple notation for a zoning and its margins. If only a design is made within this zoning-system one would be ensured at the same time of honouring a group of previously established standards.*
*Study dating from august 1967*
*The principle being that in the establishment of zones and margins and their conventions at the same time a standard is established. And this adds a new dimension to the communication possibilities created by the aid of zones and margins.*



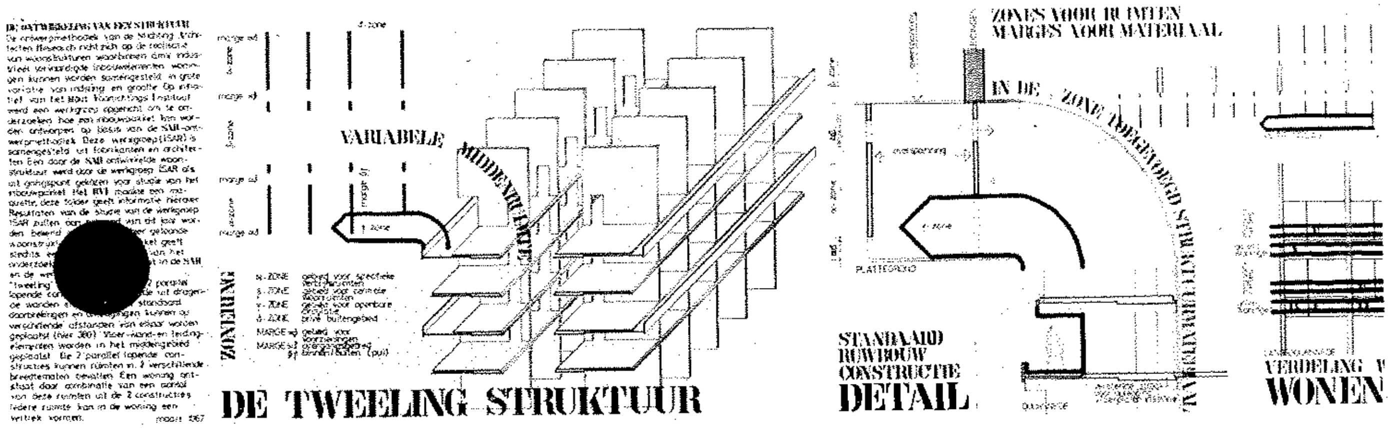


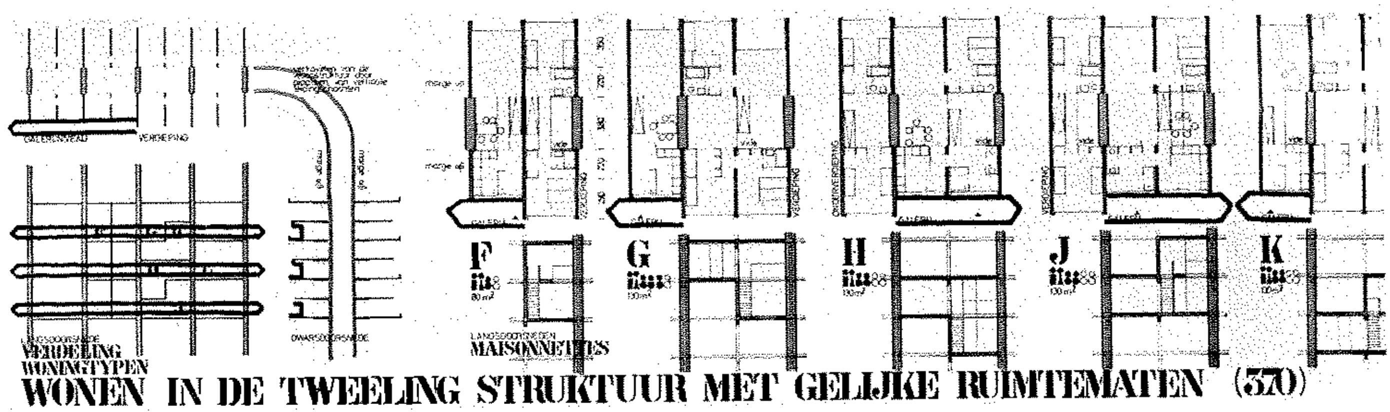

4. standaard strukturen




*Illustratie 1.6.*
*Zône- en marge-analyse van een gegeven structuur.*
*In deze studie was uitgegaan van een gegeven plattegrond. Vanuit die plattegrond zijn zônes en marges afgeleid en is de gebruikswaarde van die zônes en marges geanalyseerd. Daarna werd het mogelijk om op overzichtelijke en volledige wijze alle andere mogelijke varianten te bepalen die in dezelfde gegeven oppervlakte mogelijk waren.*
*Studie voor het architectenbureau Kloos, uit januari 1966.*

*Illustration 1.6.*
*Zone — and margin — analysis of a given structure*
*This study was based on a given floorplan. From this floorplan zones and margins were deducted and their utility value analysed. Next it became possible to decide clearly and completely upon all the other variations possible in the same given plan.*
*Study undertaken for the architect's office of Kloos, january 1966.*



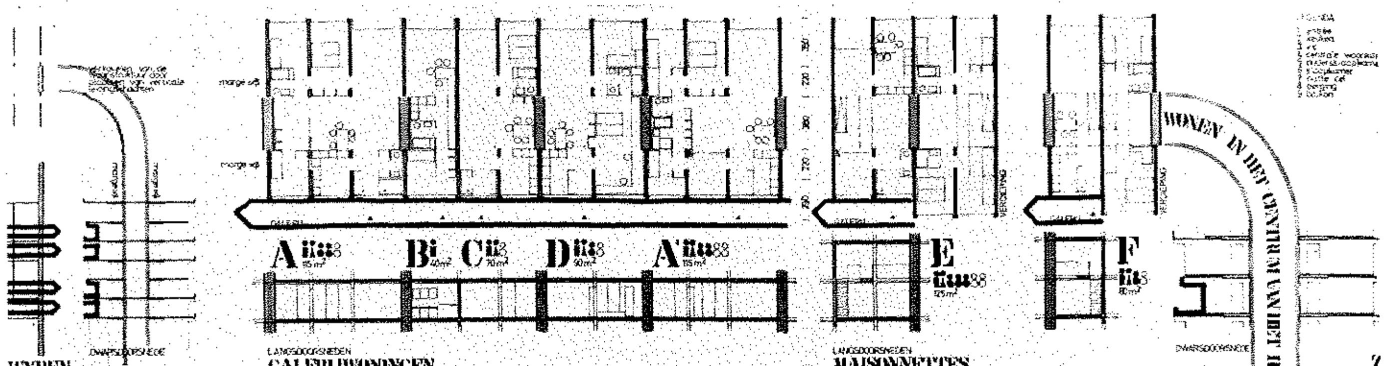




*Illustratie 1.7.*
*De verzelfstandiging van zônes en marges in de structuurvorm.*
*Wanneer zônes en marges bekend zijn en een richtlijn moeten geven voor de verdere indeling van een structuur ligt het voor de hand, dat de structuur op zijn beurt de zônes en marges herkenbaar maakt, zodat de oriëntatie van de ruimtelijke mogelijkheden die de structuur biedt geboden wordt. Dit heeft geleid tot een studie waarin de α-zône met de aangrezende marges in een structuurvorm verzelfstandigd werden. Deze studie was een poging om vanuit de techniek van vandaag, binnen de mogelijkheden van de woningwet, te komen tot een nieuw bewoningstype, ontwikkeld vanuit het begrip van de zônering. Hierdoor werden niet alleen de α-zônes duidelijk herkenbaar gemaakt, maar tegelijkertijd werd een belangrijke waarde toegekend aan de β-zône als algemene verblijfsruimte in het midden van de woning. Deze studie wilde tegelijkertijd illustreren, dat een bewust ontwikkelde structuur geen neutraal ding is, maar een duidelijk ruimtelijk thema biedt waar in allerlei plattegronden op gevarieerd kan worden.*
*Studie op initiatief van het Houtvoorlichtingsinstituut van maart 1967.*

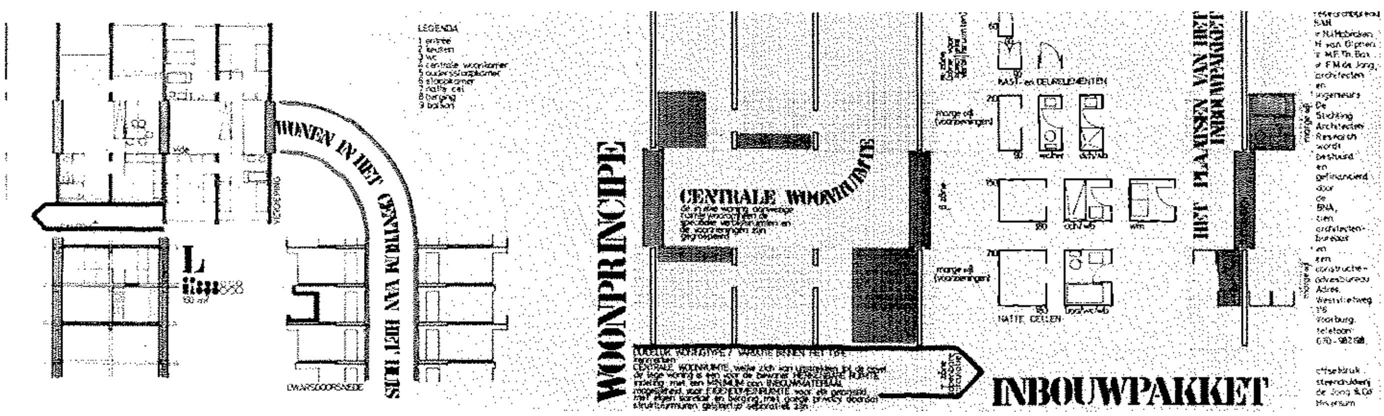
☐
*Illustration 1.7*
*Zones and margins become independent in the structure*
*When the zones and margins are known and expected to point towards a further lay-out of a structure, it is obvious that the structure in turn renders the zones and margins recognizable. In that way the spatial possibilities inherent to the structure are revealed. This hashed to a study in which the α-zone and the adjacent margins became independent and visible in the structure. This study was an attempt to arrive at a new type of dwelling based on the present-day technology, within the possibilities of the subsidized housinglaw and evolved out of the concept of the zoning. In this way not only the α-zones were made manifest, but at the same time a high value was set upon the β-zone as a general living-space in the middle of the house. This study desired simultaneously to illustrate that a consciously developed structure is not a neutral thing, but offers a clear, spatial theme on which variations can be carried out in all sorts of floorplans.*
*Study at the initiative of the Netherlands Timber Development Association in march 1967.*

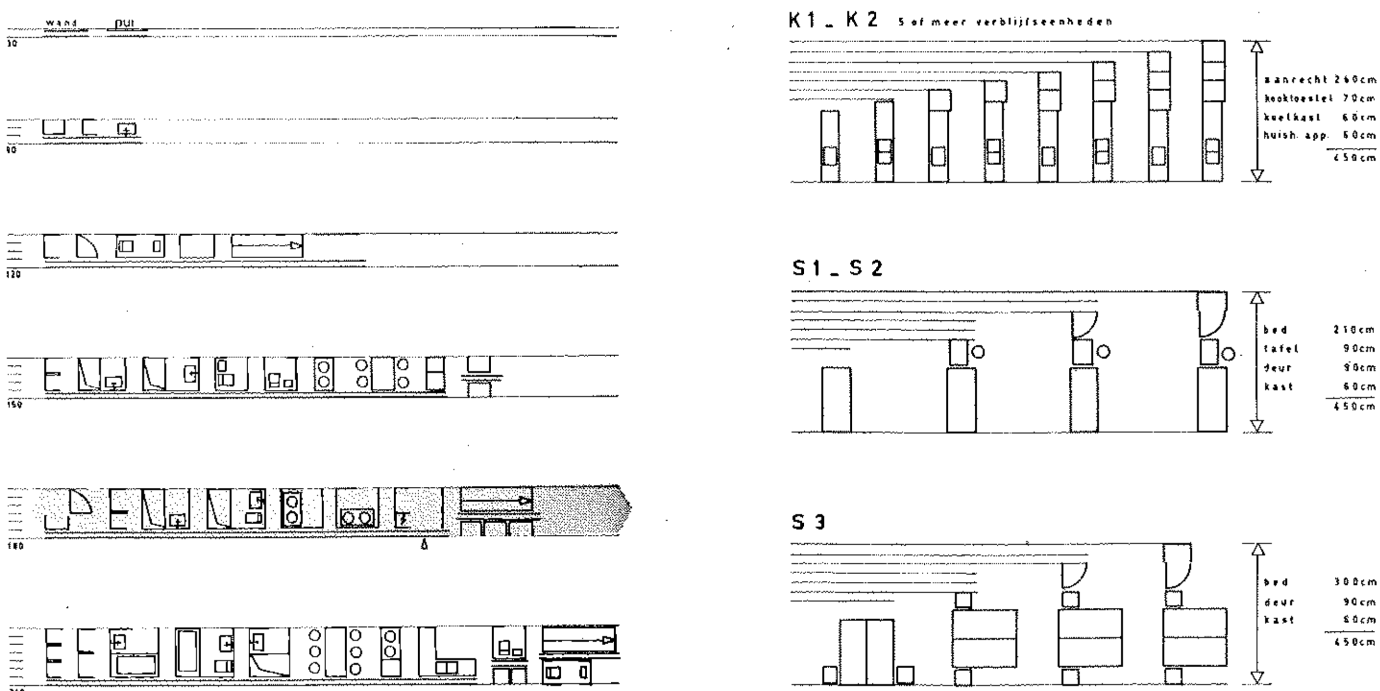
*Illustratie 1.8. en 1.9.*
*Een systematisch onderzoek naar de gebruikswaarde van diverse zône- en margematen.*
*In het kader van een werkgroep van het Ministerie van Volkshuisvesting, het Bouwcentrum en de S.A.R. werd voor het eerst getracht een systematisch overzicht te geven van de gebruikswaarde van de verschillende zône- en margematen.*
*De illustraties geven twee bladen weer uit de betreffende studie.*
*Werkgroep tweede woningcyclus. Daarachter de namen van de leden van de werkgroep.*

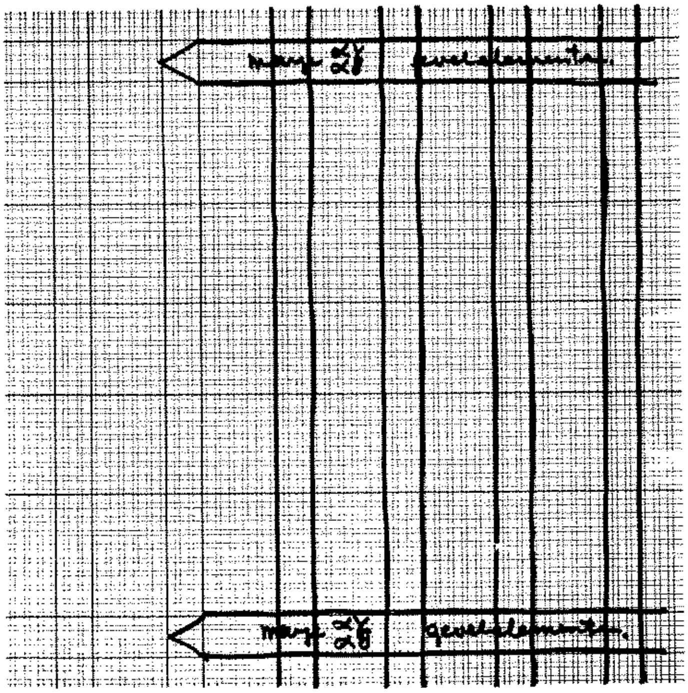
☐
*Illustrations 1.8 and 1.9*
*A systematic analysis of the utility value of the various measurements of zones and margins.*
*Within the framework of a researchteam of the Ministry of Housing, the Dutch Building Centre and the S.A.R. an attempt was made for the first time to produce a survey of the utility value of the various measurements of zones and margins.*
*The illustrations show two pages from the study concerned. The researchteam of 'the second buildingcycle'.*

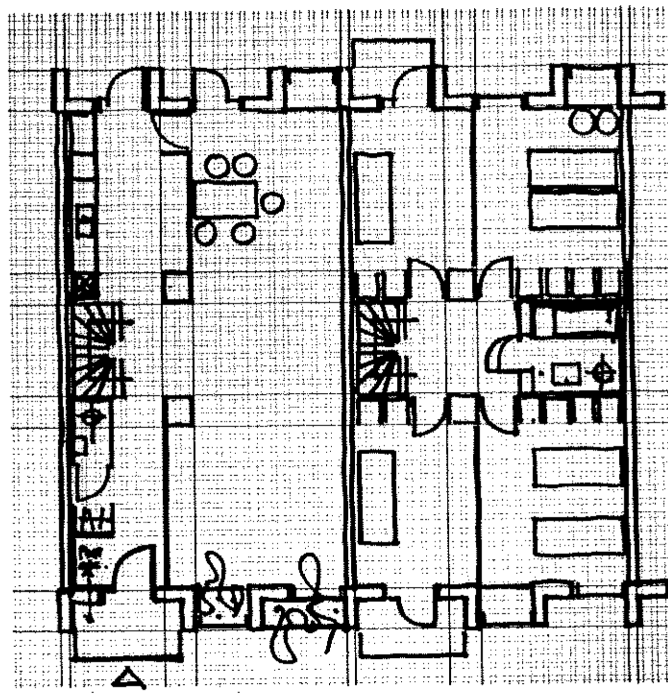


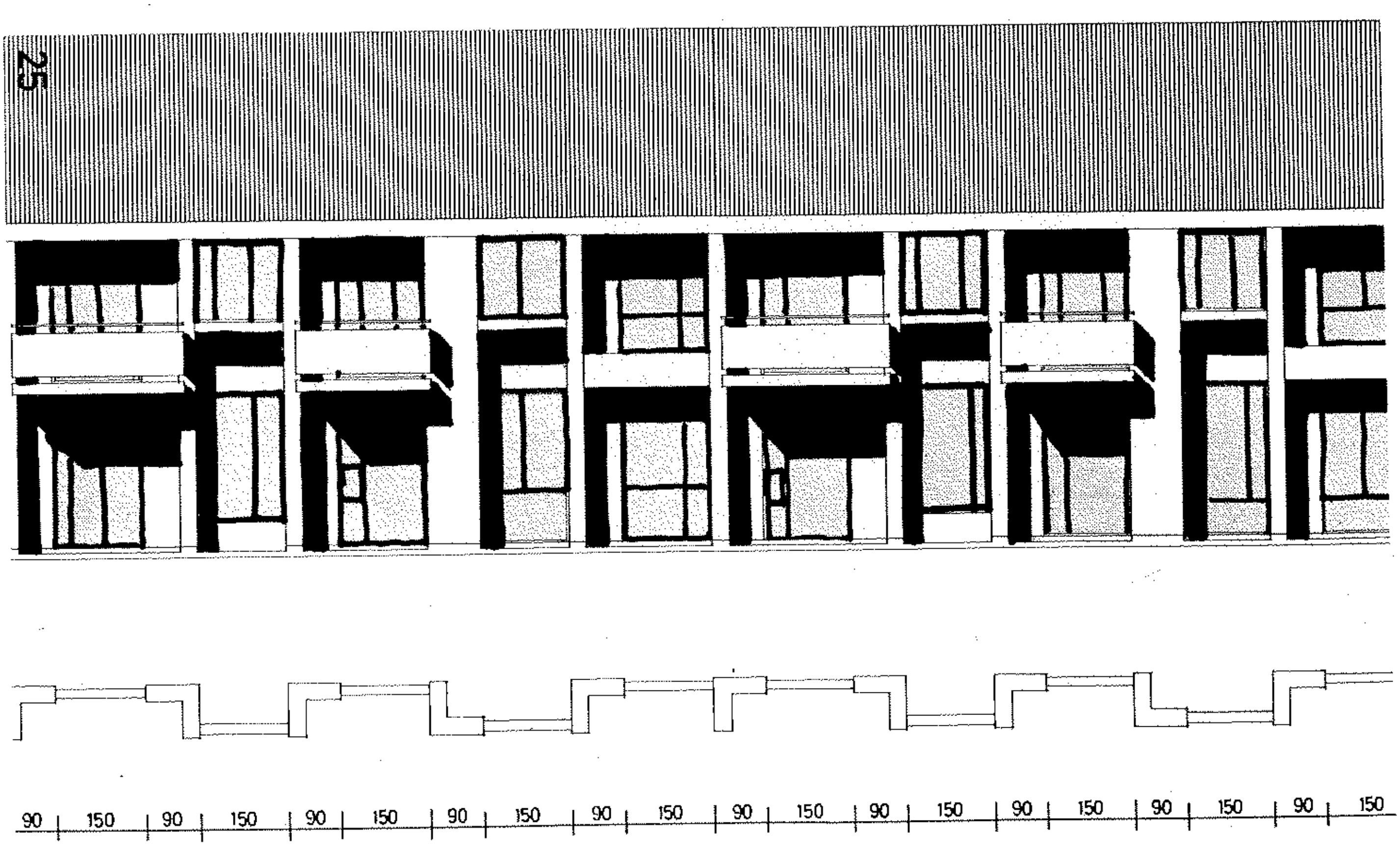

**DE TWEELING STRUKTUUR MET TWEE RUIMTEMATEN (230 / 370)**





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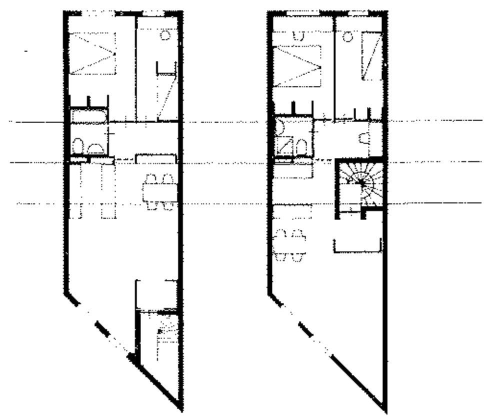
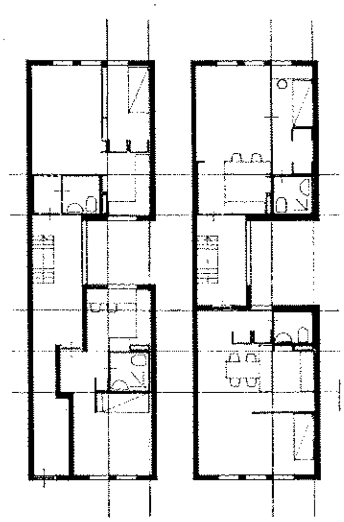
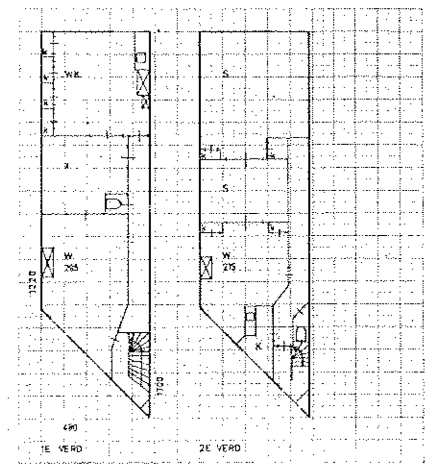
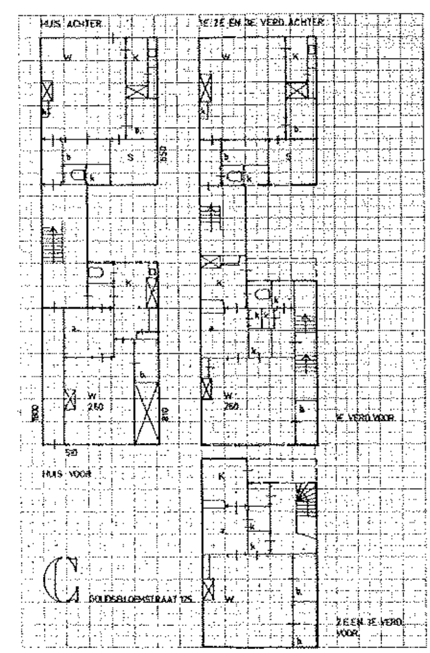
*Illustraties 1.10 en 1.11*
*Studie naar de verzelfstandiging van de buitenmarges.*
*Hierin werd gezocht naar een beperkt aantal geprefabriceerde dragende gevelementen waarmee tegelijkertijd een margegebied vorm zou krijgen. De elementen waren verticale, in zichzelf stabiele, l-vormige elementen waarmee een plastische gevel ontstond die de marge naar keuze binnen- of buitenruimte kon doen zijn.*
*Studie voor de Nederlandse Baksteen Industrie, 1968.*
*Illustratie 1.11*
*Gevelfragment van de marge-studie volgens 1.10.*

*Illustrations 1.10 and 1.11*
*A study which lead to the outside margins becoming independent.*
*This study looked for a limited number of prefabricated, loadbearing façade-elements capable of creating at the same time a margin-area. The elements were vertical, L-shaped, and in themselves stable giving relief to the façade and thus allowing the margin to be either an interior or an exterior space.*
*A study carried out for the Dutch Brick Industries, 1968.*
*Illustration 1.11*
*Detail of the façade according to the margin-study 1.10.*









*Illustraties 1.12-a, 1.12-b en 1.13-a, 1.13-b*
*Toepassing van zônes en marges bij een studie Voor een saneringsprojeet.*
*Uit een analyse van de bestaande plattegronden van te saneren woningen zijn zônes en marges bepaald. Deze zijn vervolgens de basis voor het bepalen van verdere indelingsmogelijkheden wanneer de te saneren woningen leeggehaald zouden worden om opnieuw te worden ingedeeld met industrieel vervaardigde inbouwelementen.*

*Studie van ir J. Th. Boekholt, Technische Hogeschool Eindhoven - Afd. Bouwkunde.*

*Illustrations 1.12a, 1.12b and 1.13a, 1.13b*
*The application of zones and margins in a study for and urban renewal.*
*From an analysis of the existing floorplans of homes up for renewal the zones and margins are determined. After these homes had been cleared these zones and margins would form the basis for the determination of new lay-outs partitioned by industrially made detachable units.*
*A study by ir J. Th. Boekholt, Technical University of Eindhoven — department of architecture.*

## continue zônering

Wanneer een zône een hulpmiddel is om ruimten in een groter verband te ordenen dan mogelijk is bij de plattegrond van één specifieke woning, dan behoeft de toepassing van dit hulpmiddel zich niet te beperken tot het probleem van een enkel bouwwerk. Een zône is een hulpmiddel voor het ontwerpen van een structuurprincipe. Een structuurprincipe kan toegepast worden in een stedebouwkundig probleem. Dan kan op zijn beurt de zône ook weer een hulpmiddel zijn voor de stedebouwkundige problematiek. Wanneer structuren in een bepaald patroon worden geordend tot een stedebouwkundig geheel, zijn daarmee ook zônes in een bepaald patroon geordend over het stedebouwkundig plan. Het moet dan in principe ook mogelijk zijn eerst de zônes in een gegeven patroon te ordenen om daarna het stedebouwkundig plan en eventueel de structuren op basis daarvan te ordenen. Dit uitgangspunt geeft aanleiding tot het begrip continue zônering.
Zônes en marges kunnen een continu raster vormen. Dit raster kan in één richting dan wel in twee richtingen gegeven worden. In zo'n raster kunnen in een stedebouwkundig geheel alle structuren worden getekend die deze zelfde zônering tot grondslag hebben. Er kan dan bij voorbaat bepaald worden waar de gevels van structuren zich zullen bevinden: n.l. in de daarvoor geeigende marges. Daardoor kunnen ook de mogelijke gevelafstanden uit de continue zônering worden afgeleid. Dan moet het ook mogelijk zijn om andere elementen in het stedebouwkundig plan, zoals b.v. de profielen van straten en de afmeting van tuinen, op basis van deze continue zônering te bepalen. Hierdoor wordt het mogelijk om voor een bepaald stedebouwkundig gebied op basis van een continue zônering de mogelijke afmeting van alle infrastructuren te geven, die in dat gebied met elkaar vervlochten moeten worden: de wegen, de groenvoorzieningen, het water en de bebouwing. Als deze elementen onderzocht en bekend zijn kan een stedebouwkundig plan worden ontwikkeld door ze met elkaar te combineren. Het raster, gevormd door de continue zônering, geeft dan een hulpmiddel om een dergelijke compositie snel te overzien en de plaats van de verschillende elementen op eenvoudige wijze te kunnen vaststellen. Hierdoor kunnen de verschillende ontwerpers, die bezig zijn in een zelfde stedebouwkundig plan, hun arheid coördineren en is wederom communicatie vereenvoudigd. Alternatieve oplossingen en mogelijkheden kunnen gemakkelijker met elkaar worden vergeleken en er is ook een gemeenschappelijke grondslag geschapen voor vergelijkende berekening van de benodigde oppervlakte voor alternatieve oplossingen.
Met het principe van de continue zônering is een geheel nieuw terrein van studie aangegeven. Dit terrein ligt nog vrijwel geheel braak. Er is alleen nog sprake van incidentele studies waar op pragmatische wijze vanuit dit principe is gewerkt. Deze tastende studies doen echter vermoeden dat het principe van de continue zônering kan worden uitgebouwd tot een formeel hulpmiddel dat ons in staat kan stellen het complexe beslissingsproces, dat ten grondslag ligt aan het ontstaan van stedebouwkundige gebieden beter te kunnen beheersen.
Waar een continue maatraster een hulpmiddel is om afmeting en plaats van materiaal te coördineren, is een continue zônering een hulpmiddel om in een complex probleem de plaats en de relatie van ruimten te coördineren. Plaats en relatie van ruimten is het onderwerp van het architectonisch en stedebouwkundig ontwerpen.

*Illustratie 2.1-a*
*Het principe van de continue zônering is het eerst naar voren gekomen bij een studie voor begane grond woningbouwstructuren. Daarbij werd als uitgangspunt gekozen een continue opeenvolging van zônes en marges in één richting. (studie van de werkgroep woningcyclus,*
*Ministerie van Volkshuisvesting:*
*F. H. van Gigch*
*M. H. Bonsang* — *Ir P. Dinjens*
*Bouwcentrum:* — *L. Becht*
*S.A.R.: H. van Olphen, Ir. F. M. de Jong, Ir M. F. Th. Bax*

*Illustratie 2.1-b*
*Op basis van de gekozen continue sanering kan worden genoteerd welke perceeldiepten voor een gegeven stedebouwkundig plan in aanmerking zouden kunnen komen. Dergelijke notities van mogelijke bestemmingen voor zônes en marges kunnen ook worden gedaan voor andere stedcbouwkundige elementen, zoals wegprofielen, groenstroken, etcetera.*

*Illustraties 2.1-c, 2.1-d en 2.1-e*
*Op de gegeven continue zônering kan een structuurprincipe worden ontworpen. Een structuurprincipe kan worden gebaseerd op afspraken voor plaatsing van structuurmateriaal, puien, en andere tot de structuur behorende elementen. Zulke afspraken kunnen eveneens in een stuk van de continue zônering worden genoteerd. (2.1-c)*
*Illustraties 2.1-d en 2.1-e geven een suggestie van hoe op basis van deze plaatsingsafspraken een vrije schakeling van de structuurvorm kan worden gerealiseerd.*

## continuous-zoning

When a zone is an aid to the arranging of spaces in a wider context than is possible in the floorplan of one specific house, than the application of this aid does not necessarily have to be limited to the problem of one single building. A zone is an aid in the design of a structural principle. A structural principle can be applied to a problem of town-planning. That means that the zone in turn can also be of a help to the problems of town-planning. When structures are in a certain pattern arranged into an urban entity, then the zones are also arranged in a certain pattern across the town-plan. Therefore it must be possible in principle to arrange in the first place the zones in a given pattern, then the town-plan and if need be to arrange also the structures on the basis of this. This startingpoint leads to the idea of a continuous-zoning.

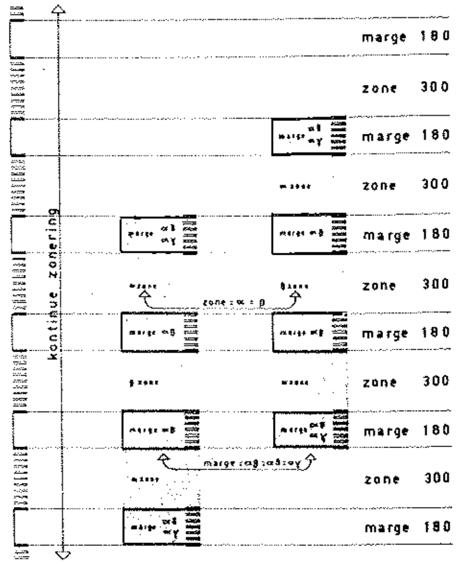
Zones and margins can form a continuous grid. This grid can be used in one or two directions. In such a grid all the structures in an urban entity can be drawn which are based on the same zoning. In advance can then be decided where the façades of the structures are to be placed n.l. in the thereto appropriate margins. Consequently the possible distances between the façades can also be derived from the continuous-zoning. Then it must also be possible to determine the other elements in the town-plan like streetprofiles, the size of the gardenplots etc. In this way the possible dimensions of all the systems of public services and utilities to be interwoven into a certain area of a town-plan like roads, greenery, water and buildings can be given on the basis of a continuous-zoning. When these factors have been investigated and the results are known an urban plan can be developed by combining the one with the other. Consequently the grid formed by the continuous-zoning is an aid in rapidly surveying such a composition and in determining by a simple method the places of the various, different elements. Due to this different architects busy on the same town-plan can combine their labours and again communication is simplified. Alternative solutions and possibilities can be the more easily compared with each other. Also a common ground has been created for a comparative computation of the required area for alternative solutions.

With the principle of continuous-zoning a completely new field of study has been opened up. This field has as yet scarcely been explored. One can only speak of incidental studies where in a pragmatic way this principle has been used. These first groping studies do however indicate that the principle of continuous-zoning can be extended to a formal tool capable of giving us a better control over the complex decision-procedure which lies at the basis of the establishment of urban areas.
Where as a continuous modular grid is an aid in co-ordinating the size and the place of the material, a continuous-zoning is an aid in co-ordinating the place of and the relation between the spaces in a complex problem. The place of and the relation between the spaces are the subject of architectural and town-planning.

*Illustration 2.1a*
*The principle of continuous-zoning first appeared in a study about low rise housingstructures. A continuous succession of zones and margins in one direction was chosen as its starting-point. (A study by the researchteam 'buildingcycle'; The Ministry of Housing: F. H. van Gigch, M. H. Bonsang*
*The Dutch Building Centre: ir P. Dinjens, L. Becht*
*S.A.R.: H. van Olphen, ir F. M. de Jong, ir M. F. Th. Bax*

*Illustration 2.1b*
*On the basis of the chosen continuous-zoning it is possible to deduce the depths of the plots, which could be considered in a given town-plan. Such like deductions concerning the possible destinations of zones and margins could also be made for the other factors in town-planning like streetprofiles, greenery etc.*

*Illustrations 2.1c, 2.1d and 2.1e*
*It is possible to design a structure based on the given continuous-zoning. This structure principle can be based on conventions for the placing of structural material, fronts and other elements belonging to the structure. Such conventions can also be laid down in a piece of continuous-zoning (2.1c).*
*The illustrations 2.1d and 2.1e suggest how on the basis of these conventions of positioning a freedom of linking within the structure can be attained.*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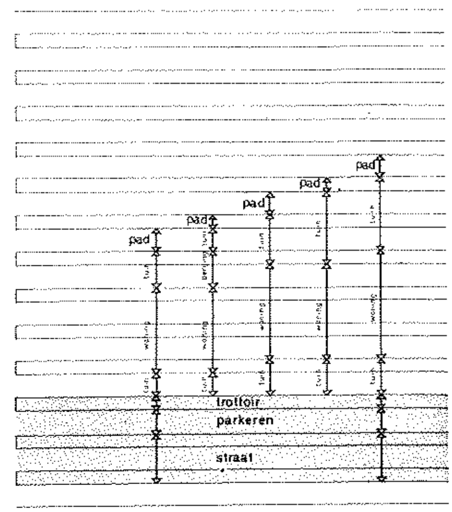
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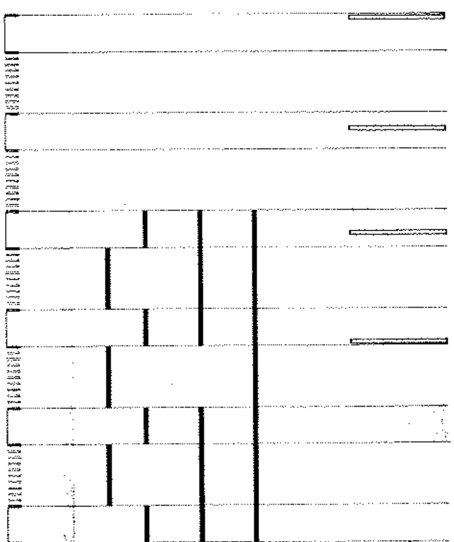
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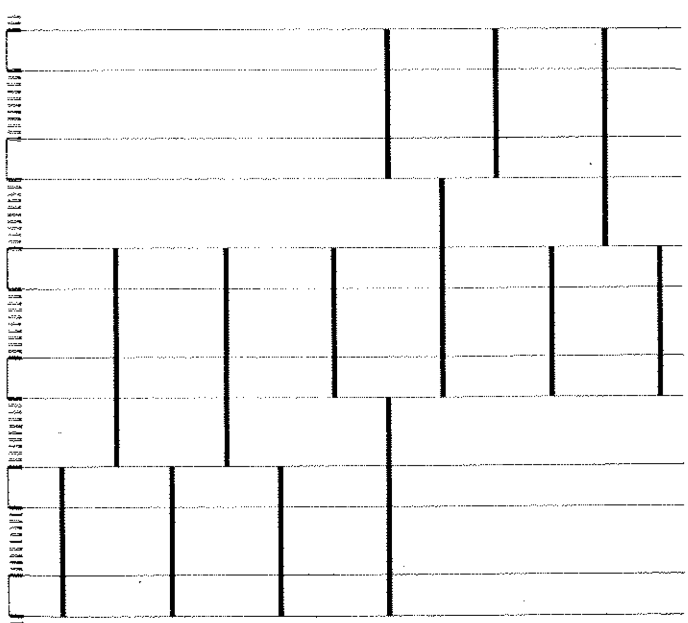

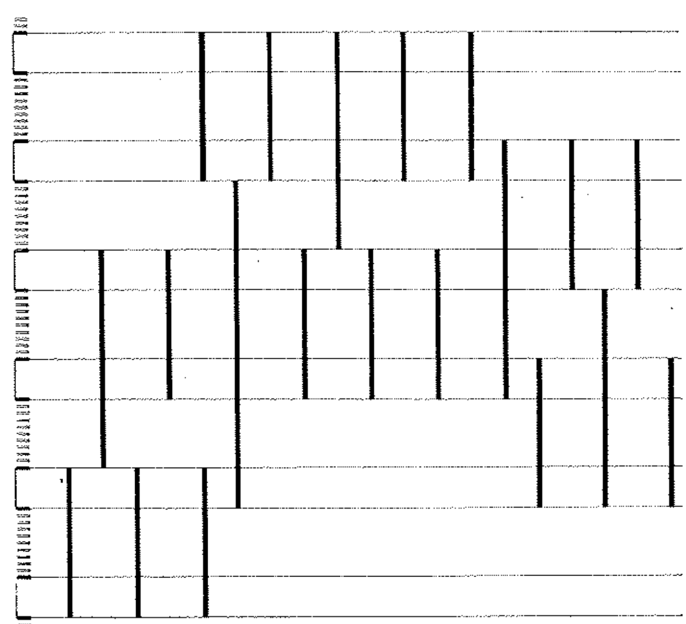

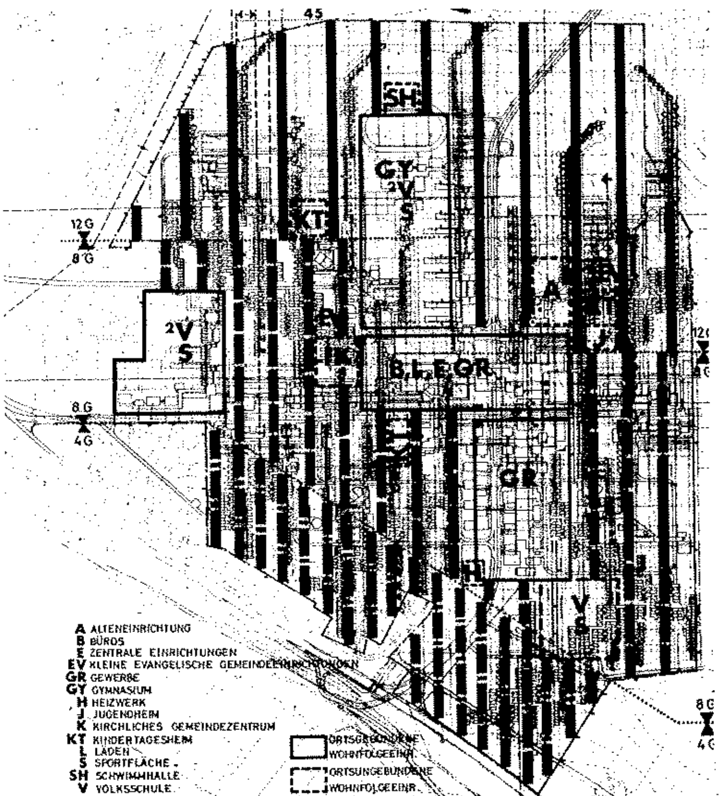
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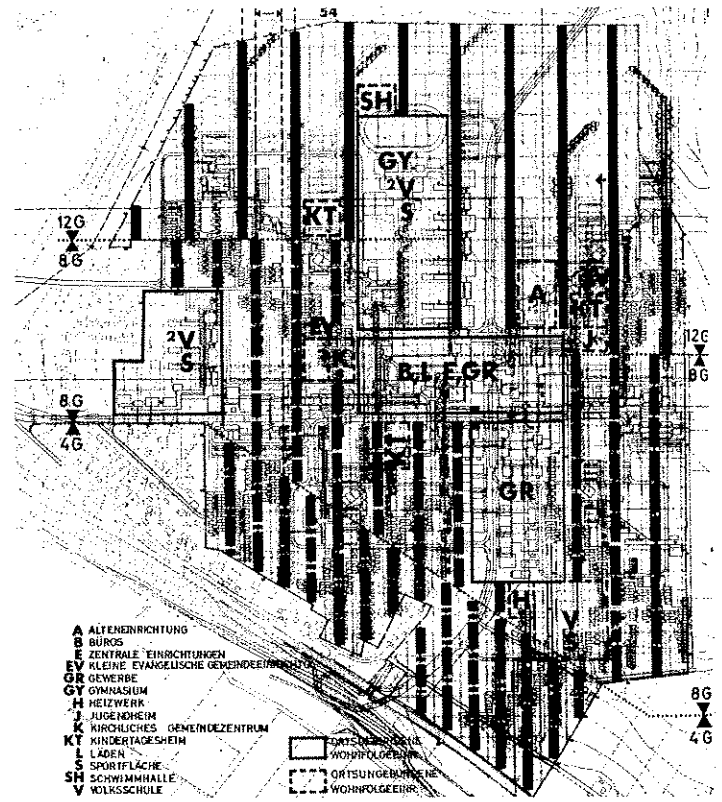
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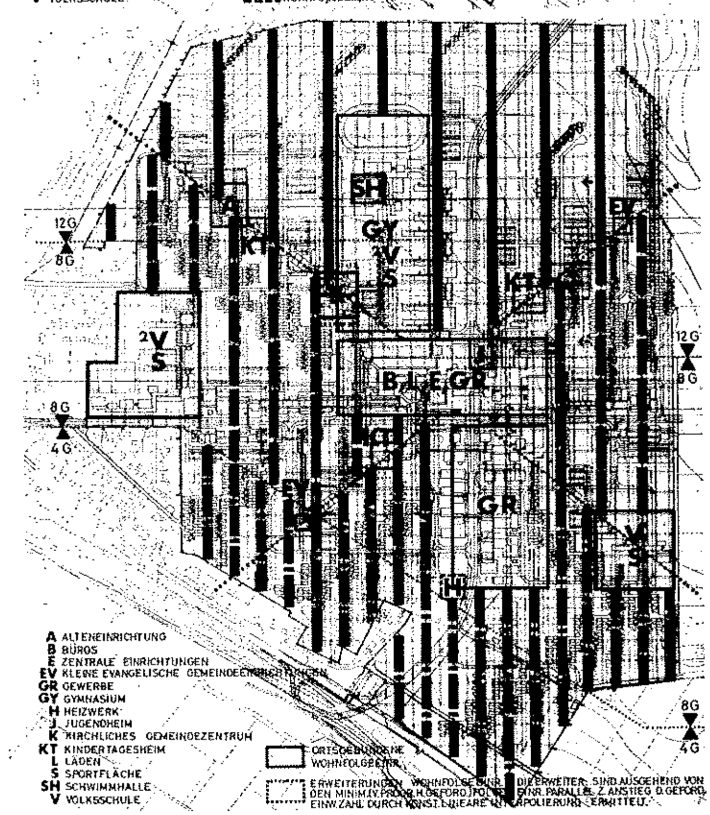
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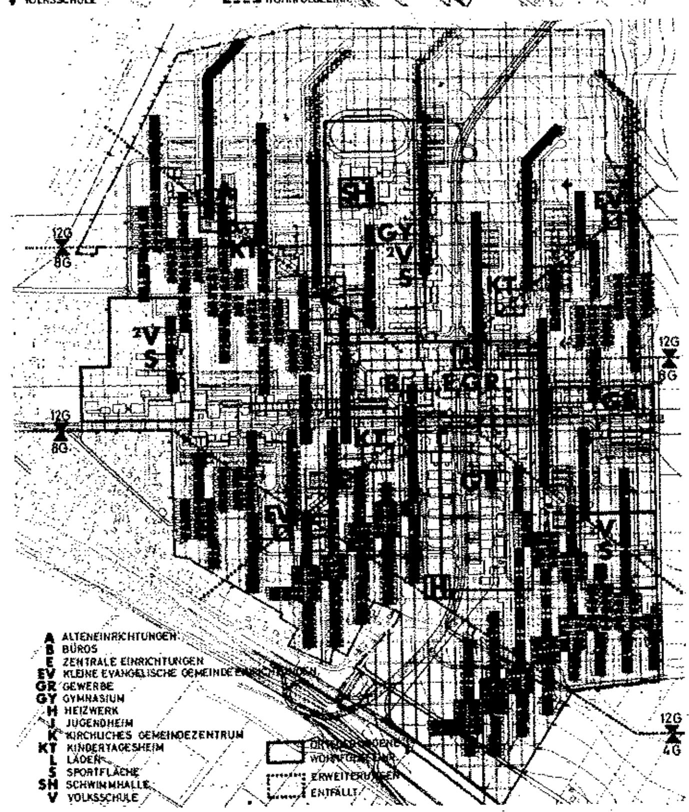
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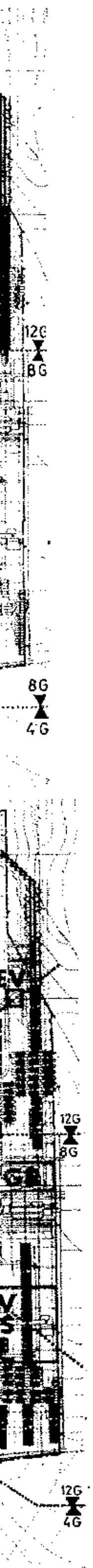
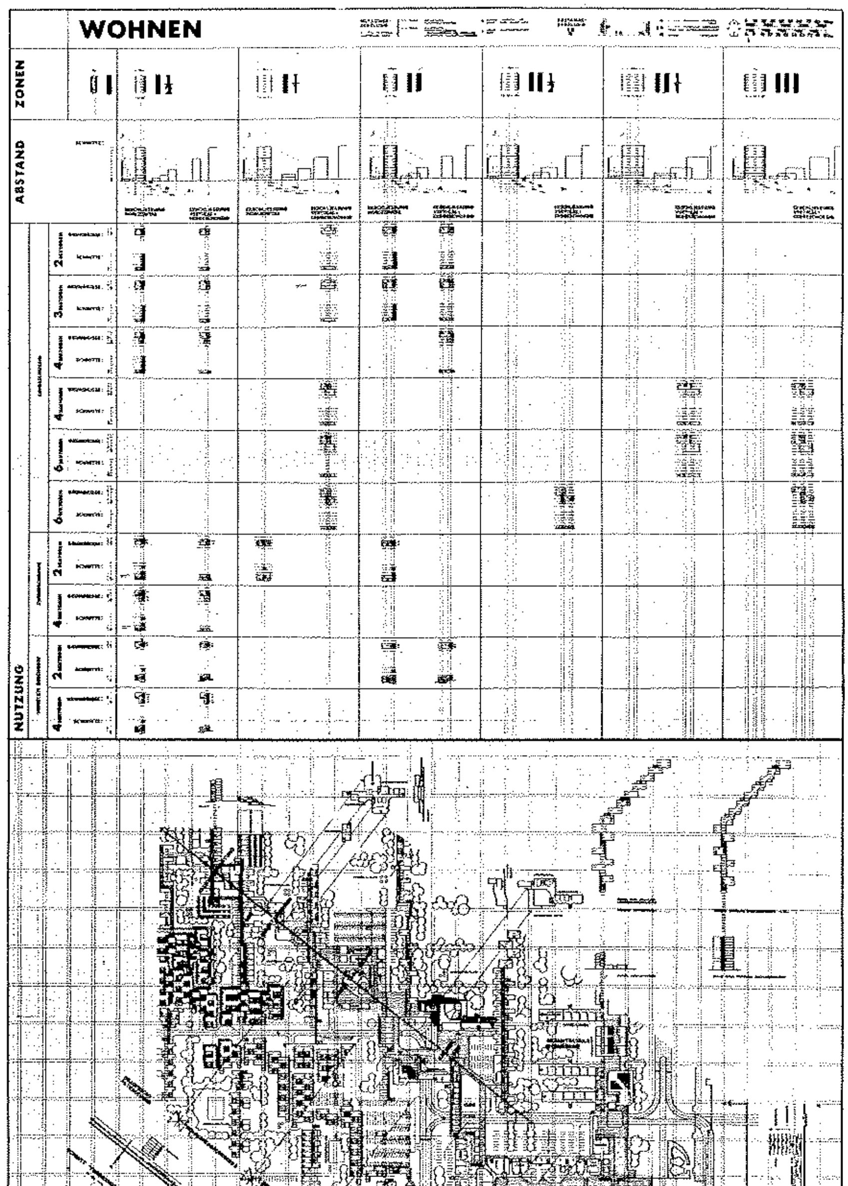



*Illustraties 2.2-a, 2.2-b en 2.2c*
*Drie varianten van eenzelfde stedebouwkundig plan op basis van een continue zônering en een daaruit ontwikkeld maatraster. De drie varianten geven weer hoe verschillende alternatieven van de vermenging van hoog- en laagbouw gevonden kunnen worden, waarbij dan hoog- en laagbouw-structuur zijn ontwikkeld op basis van dezelfde zônering. Plan voor Hamburg Mummelmansberg, 1968.*
*Prof. J. B. Bakema,*
*Prof. J. B. Weber, architekten*
*met de studenten: K. Velemann,*
*C. Nibbes,*
*V. Sonnenschein.*

*Illustrations 2.2a, 2.2b and 2.2c*
*Three variants of the same town-plan on the basis of a modular grid developed out of a continuous-zoning. The three variants reflect how the various alternatives of mixing high rise and low rise accommodation have been found, whereby both the high rise and the low rise structures have been developed on the basis of the same zoning.*
*Town-plan for Hamburg Mummelmansberg, 1968 — prof. J. B. Bakema and J. B. Weber, architects and the students: K. Veleman, C. Nibbes and V. Sonnenschein.*



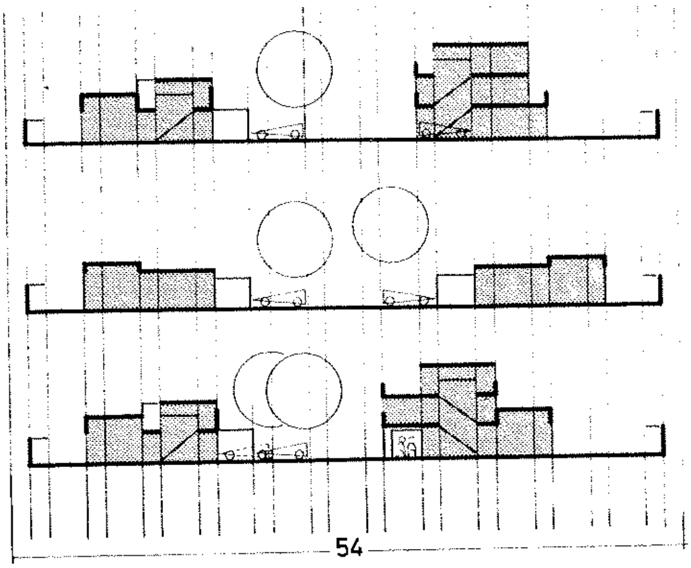

*Illustraties 2.2-e en volgenden.*
*Fragment van een analyse van mogelijke structuurvormen en de daarbij toepasbare ruimten als grondslag voor een stedebouwkundig plan op basis van continue zônering. (Plan Hamburg Mummelmansberg). Op basis van de gegeven zônes kan een uitvoerige analyse worden gemaakt van de mogelijke ruimtelijke functies en hun combinatiemogelijkheden. De daaruit resulterende structuurvormen zijn op hun beurt elementen, die dan in het continue zôneringsraster worden geplaatst om een stedebouwkundig plan te formeren.*

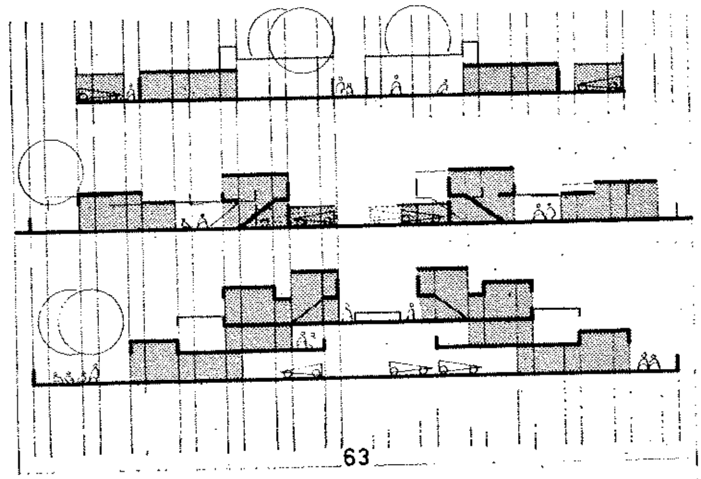
*Illustrations 2.2e and the following*
*Part of the analysis of possible structures and their appropriate spaces used as the foundation for a town-plan on the basis of continuous-zoning. (town-plan Hamburg Mummelmansberg). On the basis of the given zones a detailed analysis can be made of the possible functions in that space like living, kitchen, bathroom etc. and combinations of those. The structures resulting out of this are in their turn elements to be placed in a continuous-zoning grid in order to create a town-plan.*

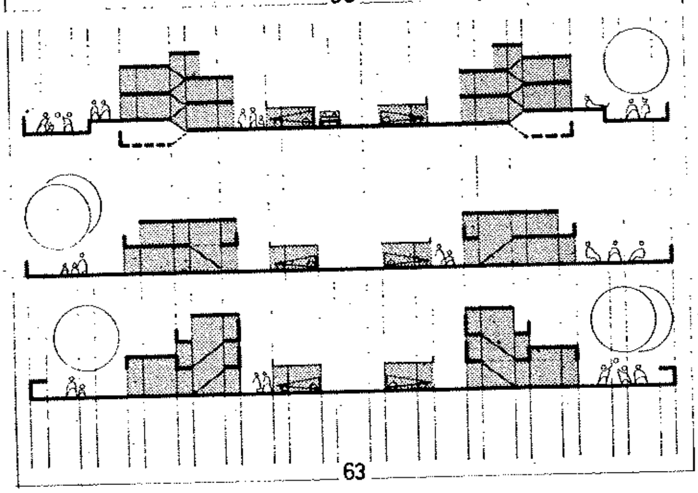
*Illustraties 2.3-a, 2.3-b, 2.3-c 2.3-d 2.3-e*
*Een studie van diverse mogelijke stedebouwkundige profielen bij verschillende structuurvormen, allen gebaseerd op een continue zônering.*
*Studie voor het plan Maarssenbroek, architektencombinatie de Jong, van Olphen, Bax - 1969.*

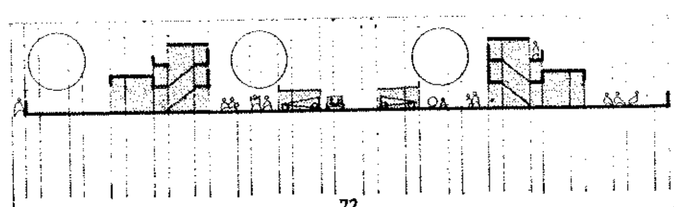
☐

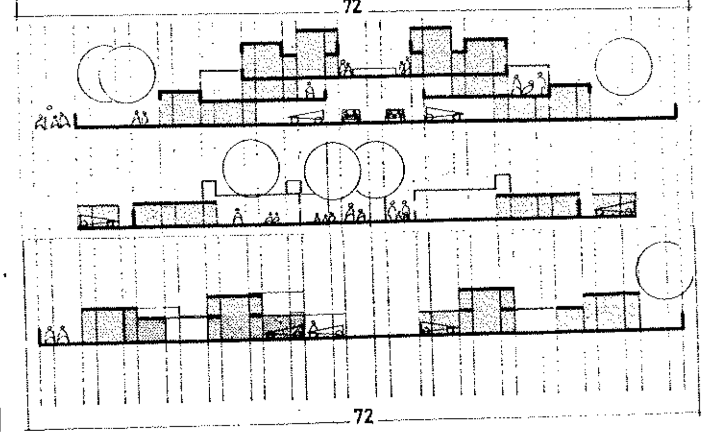
*Illustrations 2.3a, 2.3b, 2.3c, 2.3d and 2.3e*
*A study of the various possible profiles for town-planning in different structures, all based on a continuous-zoning.*
*A study made for the town-plan of Maarssenbroek by the architects' combination of De Jong, Van Olphen, Bax — 1969.*

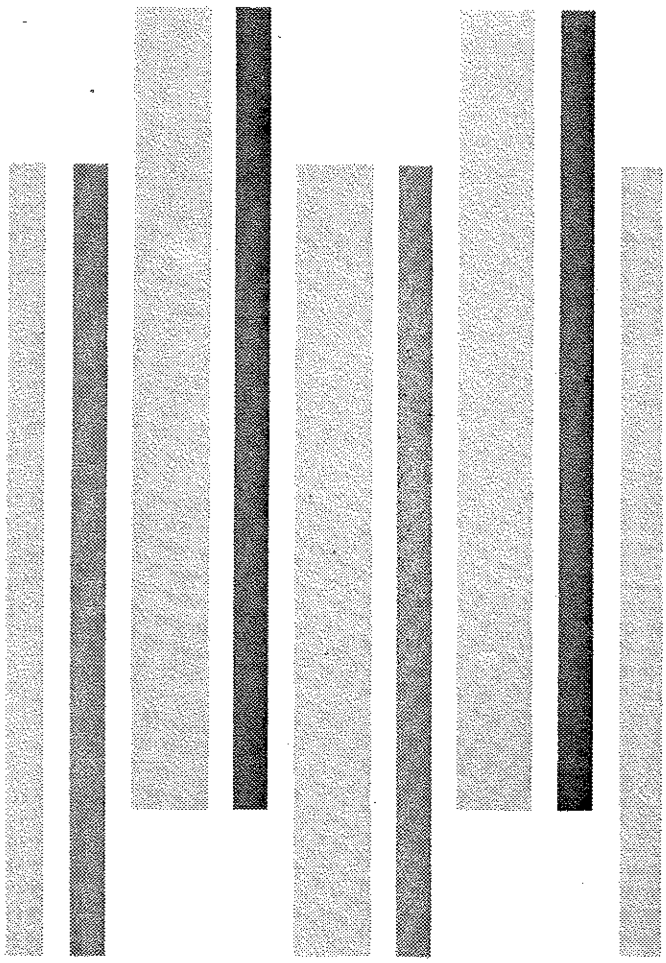


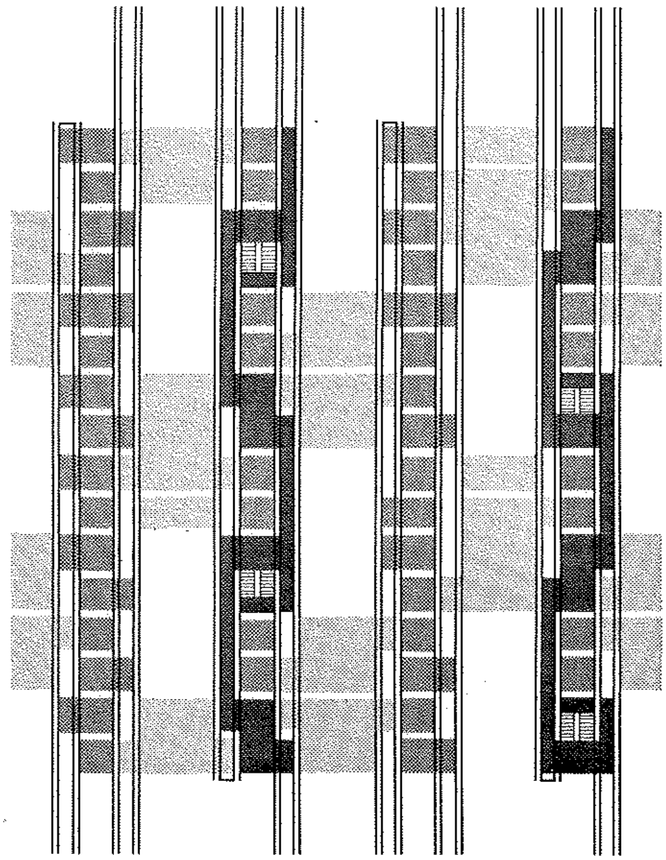



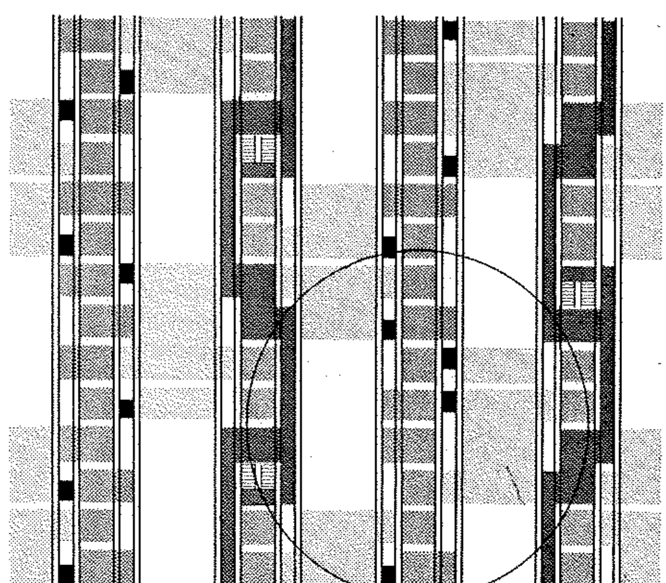





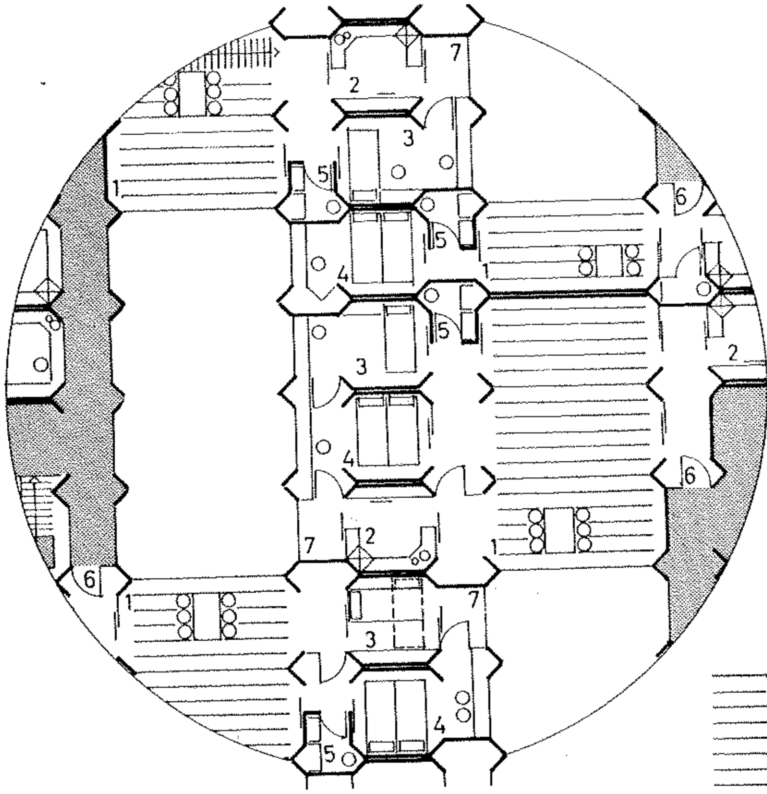
2 - 4 a



2 - 4 b



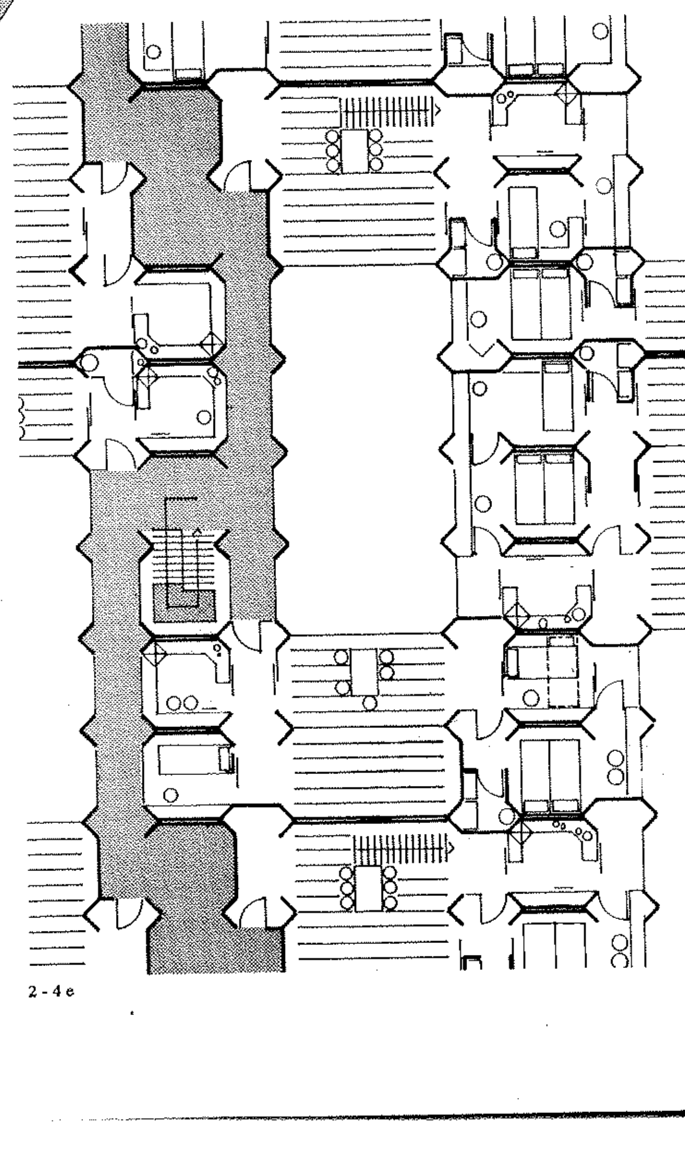
2 - 4 c



2-4d

*Illustraties 2.4-a, 2.4-b, 2.4-c, 2.4-d 2.4e*
*Studie voor een structuur bestaande uit verdieping-hoge liggers, die op grote hoogte boven het maaiveld worden gespannen en waartussen woningen geformeerd kunnen worden. Tussen de liggers in ontstaan zônes voor specifieke verblijfsruimten en algemene verblijfsruimten. De liggers zelf zijn margegebieden en tegelijkertijd ook gebieden voor voorzieningen en circulatie. De studie was bedoeld om vanuit het denken van zônes en marges te komen tot een nieuwe woonvorm. Er ontstaat door het plaatsen van de liggers een continue zônering waar op tal van manieren circulatiepatronen met de daaraan liggende woningen geformeerd kunnen worden. (Studie van H. van Olphen, 1967 - gepubliceerd in Forum, volume 20-nr. 4.)*

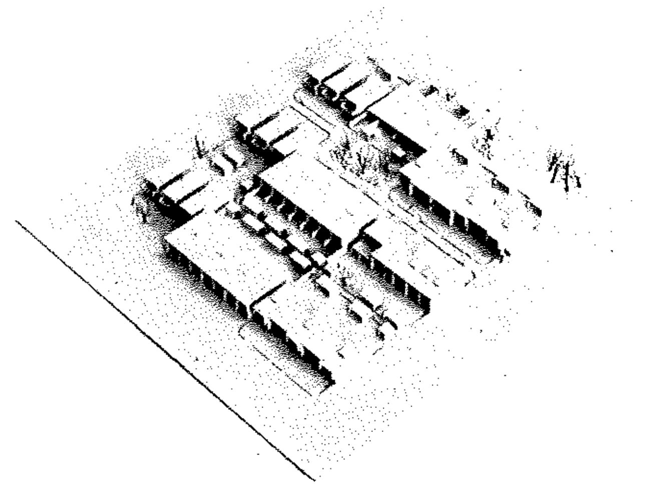
*Illustrations 2.4a, 2.4b, 2.4c, 2.4d and 2.4e*
*A study for a structure consisting of story-high girders placed at a great height above ground-level with the possibility of creating houses in between them. Specific living-spaces and general living-spaces were made. In the zones, created by the girders, the girders themselves were margin-areas and at the same time also areas for services and circulation. In thinking about zones and margins this study aimed at arriving at a new type of dwelling. By the positioning of the girders a continuous-zoning is created, in which in a number of ways the circulation patterns and the houses connected by them can be formed. (A study by H. van Olphen, 1967 — published in Forum, volume 20 — no. 4).*

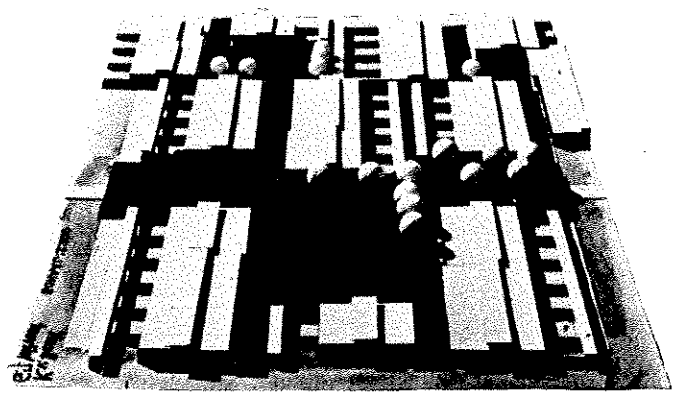


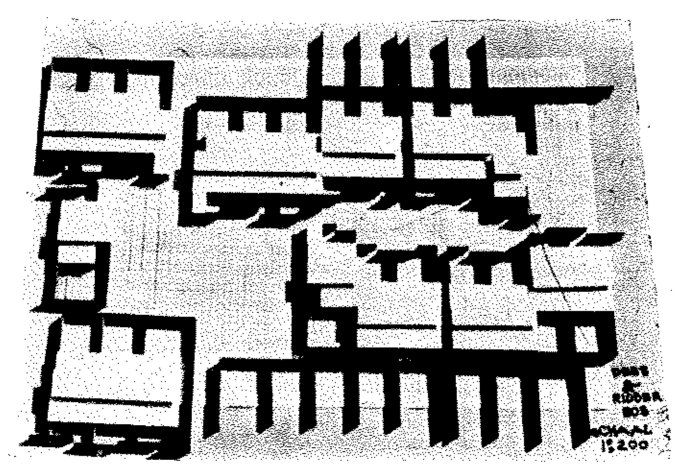
2-4e

*Illustraties 2.5-a en volgenden.*
*Opgave voor de eerstejaars studenten voor de Afdeling Bouwkunde te Eindhoven.*
*Gevraagd werd om op basis van een gegeven continue zônering een stukje van een wijk te ontwerpen door het in de zônering te plaatsen van beganegrond woningen. Voor de woningen werden alleen een paar overspanningsmaten gegeven.*
*Hier was de continue zônering vooral nuttig als een gegeven, waardoor door verschillende studenten allerlei variabele oplossingen ontwikkeld konden worden die alle voldeden aan een tevoren vastgesteld normenpatroon. Hierdoor kon de aandacht vooral gericht worden op de architectonische vorm van de bebouwing en de combinatie van stedebouwkundige ruimten.*

*Illustrations 2.5a and the following*
*An exercise for the first-year students of the Department of Architecture at the Technical University Eindhoven. They were asked to design part of a district on the basis of a given continuous-zoning by the positioning of low rise houses in the zoning. Only a few dimensions of spaces for the houses were given.*
*In this case the continuous-zoning was especially useful as a premise from which different students could develop all sorts of variable solutions all capable of meeting a previously defined set of standards. Consequently they were able to direct their attention especially to the architectural shape of the built-up area and to the combination of urban spaces.*

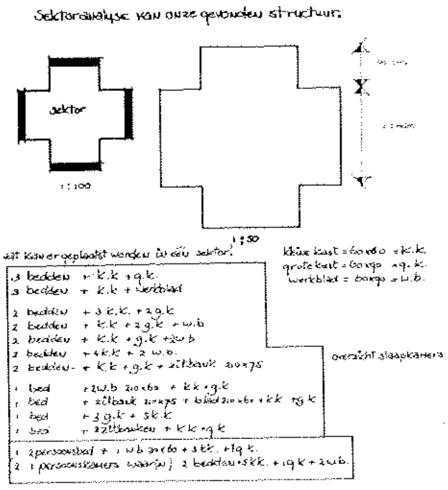


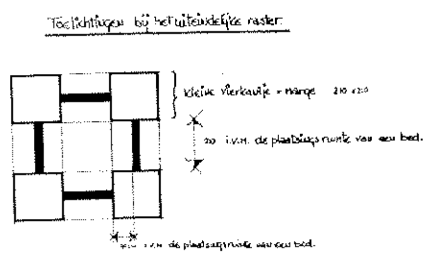


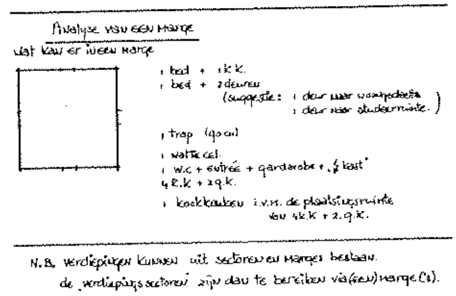


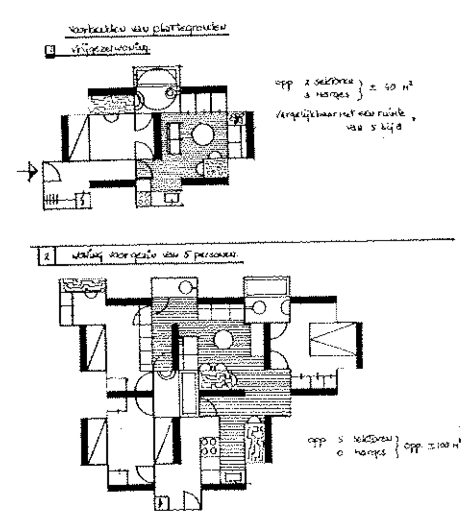
*Illustraties 2.6-a en volgenden.*
*Studie op basis van een continue zônering in twee richtingen. Op een gekozen continue zônering in twee richtingen zijn plaatsingsafspraken gemaakt voor structuurmateriaal en is een analyse gedaan voor de mogelijke ruimtevormen die daardoor ontstaan. Deze ruimten kunnen op hun beurt op tal van wijze gecombineerd worden tot verschillende woningplattegronden. Dit structuurprincipe geeft dan op zijn beurt aanleiding tot het ontwikkelen van stedebouwkundige patronen. (Studie van eerstejaars studenten aan de Afdeling Bouwkunde te Eindhoven.*

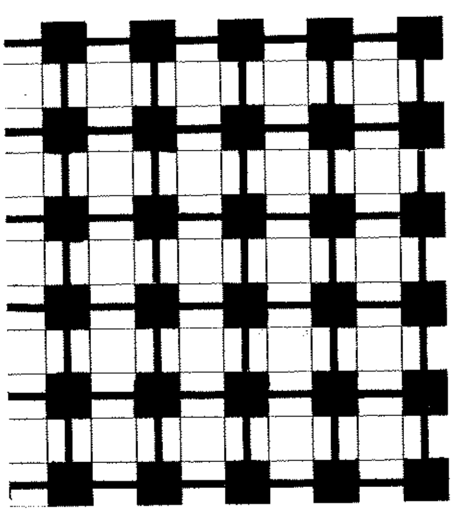
*illustration 2.6 - a*
*and the following*
*A study on the basis of a continuous zoning in two directions. Based on a selected continuous zoning in two directions positionery conventions have been decided upon for the structual material and an analysis has been made of the possible shape of the spaces thus created. In their turn these spaces can be combined in a number of ways to different floorplans. The structure-principle in its turn gives rise to the development of urban patterns.*
*A study by first-year students of the department of architecture — Technical University at Eindhoven.*
*Jaap Margry, Jo Smolenaars, Niek van Vugt, Jo Coenen.*

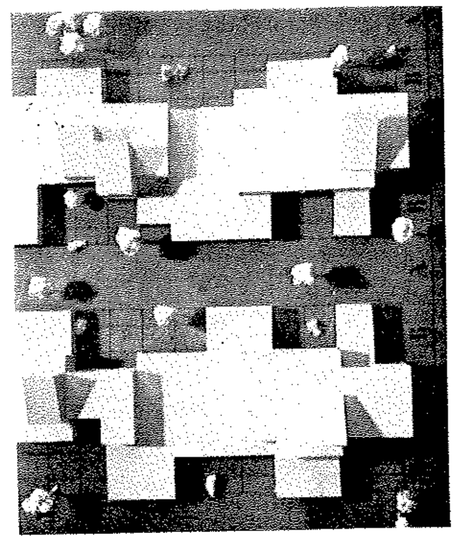


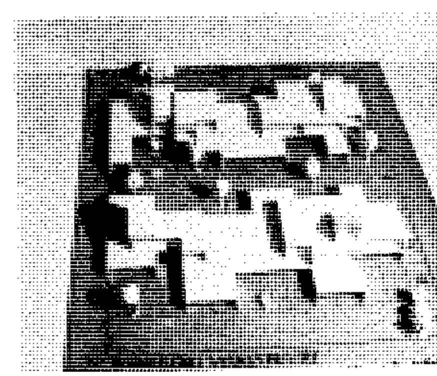






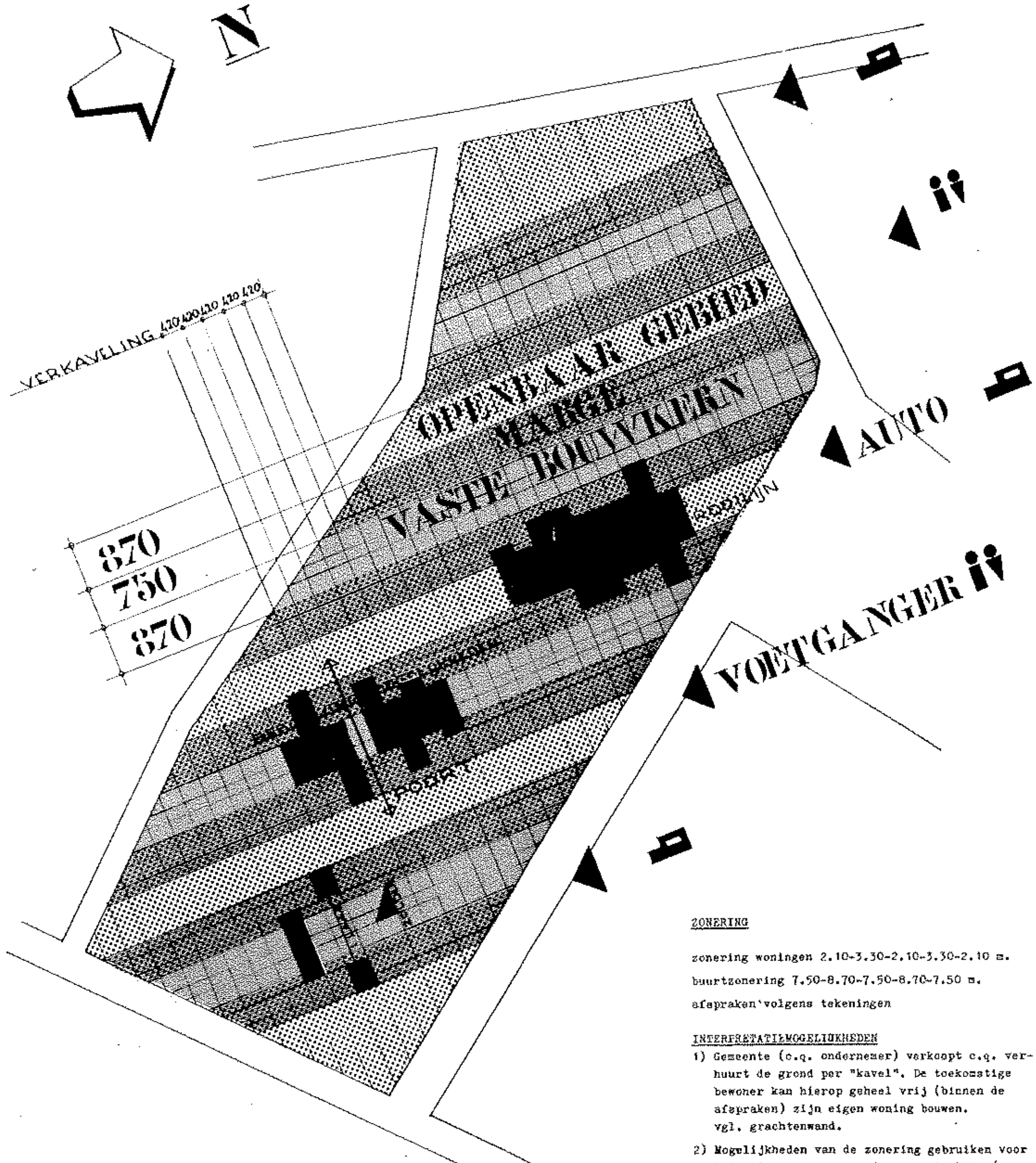






*Illustraties 2.7a en 2.7b*
*Zônering voor een woonbuurt.*
*Studie van 5 eerstejaars studenten, Afd. Bouwkunde — T.H.E. Deze studie betreft de toepassing van een continue zônering waarbij zones voor openbaar gebied en een z.g. vaste bouw zijn bepaald waartussen een ruime marge wordt geboden. Op basis van deze zônering worden 3 verschillende mogelijke beslissingsprocedures geschetst waarin steeds op een andere wijze de beslissingsbevoegdheid van ontwerper respectievelijk bewoner worden bepaald. (Zie interpretatiemogelijkheden 1, 2 en 3.)*

*illustrations 2.7-a and 2.7-b*
*Zoning of a housing-estate.*
*A study by five first-year students of the department of architecture — Technical University at Eindhoven.*
*This study is concerned with the application of a continuous zoning whereby the zones for public space and the zones for so-called permanent structures have been determined within between a wide margin. On the basis of this zoning three different ways of decision-making have been outlined. In each case the field of decision of the architect respectively the inhabitant has been defined differently. (see possibilities of interpretation 1, 2 and 3).*




ZONERING

zonering woningen 2.10-3.30-2.10-3.30-2.10 m.
buurtzonering 7.50-8.70-7.50-8.70-7.50 m.
afspraken volgens tekeningen

INTERPRETATIEMOGELIJKHEDEN

1) Gemeente (c.q. ondernemer) verkoopt c.q. verhuurt de grond per "kavel". De toekomstige bewoner kan hierop geheel vrij (binnen de afspraken) zijn eigen woning bouwen. vgl. grachtenwand.
2) Mogelijkheden van de zonering gebruiken voor het ontwerpen van een draagconstruktie (woonstruktuur). Deze struktuur wordt verhuurd (c.q. verkocht). De bewoner maakt hierin zijn huis hierin zelf of d.m.v.een inbouwpakket.
3) Aan de hand van nadere gegevens omtrent de toekomstige bewoners het ontwerpen van een woonbuurt met komplete woningen, zodanig dat men uit b.v. 5 woningtypen een keuze kan maken. De woningen moeten later op eenvoudige wijze heringedeeld kunnen worden (scheiding konstruktie en afbouw).

16-12-1969, atelier reijenga

hein abels
hans de bruyn
cees donkers
rob geraedts
roger spitz

WOONBUURT

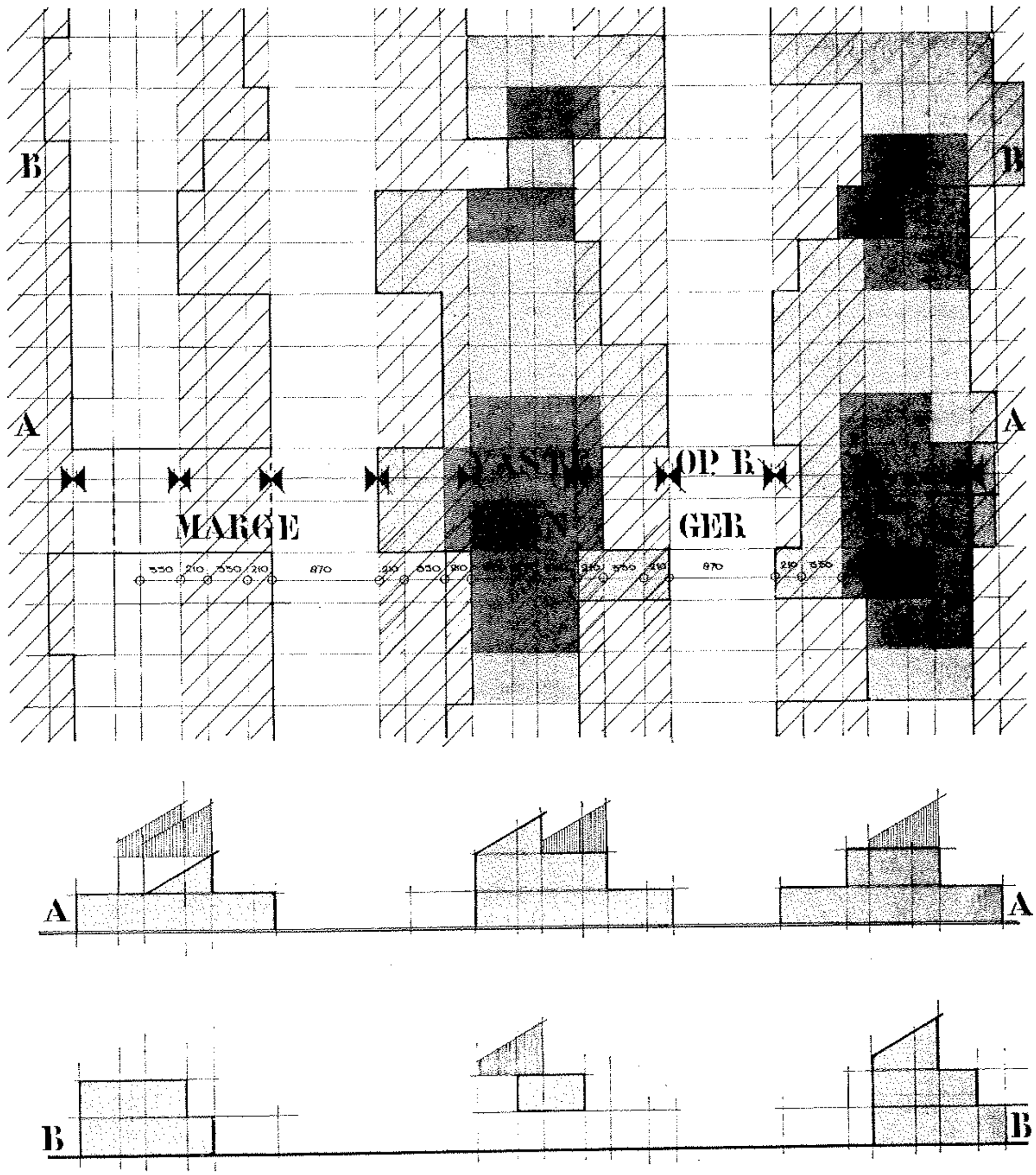
- woonbuurt voor circa 50 woningen
- het wonen is gekonditioneerd d.m.v. een zonering
- zonering noord-zuid; hierdoor bezonning aan voor- en achterkant van de woningen.

ZONERING

ZONES - openbaar gebied: hierin mag niet gebouwd worden
- vaste kern: steeds aanwezige bouwlaag (hierin leidingen en eventueel stijfheid)

MARGES - hierin mag onder bepaalde voorwaarden worden gebouwd.

# ZONERING WOONBUURT SITUATIE 1:500




ZONERING
- stedebouwkundige zonering 870-750-870-750
  de marges zijn hierin grof gearceerd, de zones gekonditioneerd
  als "vaste bouwkern" en als "openbaar gebied"
- zonering woningen 330-210-330-210
  per rij woningen zijn er 4 zones en 5 marges
  maximaal 3 zones met bijbehorende marges mogen worden bebouwd

- 30% grijstint: begane grond
- 60%         eerste verdieping
- 90%         zolder

<u>welke</u> zones worden bebouwd bepaalt de bewoner
waar verdiepingen en zolders <u>kunnen</u> worden gemaakt
is in de zonering bepaald

de vorm van de woonstraten wordt mede bepaald door
de gekozen woningplattegronden
het "gemeenschappelijke" en het "individuele" bepalen elkaar wederkerig

THE 16-12-1969
atelier Reijenga

cees donkers, rob geraerdts,
hein abeln, hans de bruyn
roger spitz

**ZONERING WOONBUURT** **SCHAAL 1 : 200**

## stedelijk weefsel

Omdat de drager een stuk onroerend goed is, dat per definitie in het leven wordt geroepen in de publieke sfeer, kan de drager in principe aanleiding zijn tot het vormen van een infrastructuur. Een stelsel van dragers of een continue bebouwing op basis van een dragersprincipe kan een infrastructuur vormen die in een categorie valt met infrastructuren als een wegenstelsel, een stelsel van groenvoorzieningen, een stelsel van kanalen of leidingen zoals wij die in de stad vinden.
Een stad is opgebouwd uit infrastructuren. Behalve de infrastructuren vinden we ook nog andere publieke voorzieningen; de grote monumentale gebouwen, pleinen, allerhande bijzondere bebouwingen die samen met de infrastructuren de stad vormen.
Een stedelijk weefsel kan worden gedefinieerd als een vervlechting van infrastructuren. Er zijn talloze weefsels denkbaar. Het principe volgens welke de infrastructuren worden vervlochten kan worden gezien als de karakteristiek van een specifiek weefsel. Met behulp van een weefsel op deze wijze gekarakteriseerd kunnen nog tal van stedelijke gebieden worden ontworpen.
Een stedelijk weefsel geeft dus een thema aan. Als dit thema bekend is, is bekend hoe de verschillende infrastructuren zich ten opzichte van elkaar verhouden. Met behulp van dit thema kan vervolgens de structuur van de stad worden bepaald: dat is het gehele net van wegen en gemeenschappelijke voorzieningen waarin de bijzondere bebouwingen en de centrale ruimten opgenomen kunnen worden. Wanneer de karakteristiek van het stedelijk weefsel is vastgelegd, kan van daaruit enerzijds de stad worden ontworpen, anderzijds kan worden gedetailleerd. De stedebouwer vindt in het stedelijk weefsel een thema waarin hij het grote geheel kan besturen. De architekt vindt in het stedelijk weefsel een kader waarin hij een klein deel van een stad architectonisch kan uitwerken.
Wanneer op basis van zônes en marges een structuurprincipe ontworpen wordt kan vervolgens de vraag gesteld worden hoe dit structuurprincipe deel uit kan maken van stedelijke weefsels. Het ligt dan ook voor de hand om voor het karakteriseren van de samenvlechting van verschillende infrastructuren, waarvan dan de draagstructuur er een is, de zônes en de marges eveneens als hulpmiddel voor plaatsbepaling en maatbepaling te hanteren. Wanneer een continue zônering is ontworpen kan daarop de positie van een structuur die correspondeert met de gekozen zônering worden bepaald. Maar dan kan daarop ook de positie van wegen, groenvoorzieningen en andere infrastructuren worden vastgelegd. Hiermee wordt de continue zônering een rooster dat zich leent voor de notitie van een stedelijk weefsel en wat vervolgens bruikbaar kan zijn om met dat stedelijk weefsel stedelijke gebieden vorm te geven.
De hierboven geschetste gedachtengang opent een nieuw gebied van studie dat nog vrijwel geheel braak ligt. Een doelgericht onderzoek naar de samenstelling en de bruikbaarheid van diverse stedelijke weefsels zou de bij het ontwerpen van structuren ontwikkelde methodiek toepasbaar kunnen maken in de problematiek van de stedebouw. Er zou dan in de methodiek een continuïteit ontstaan van het kleinste vertrek naar de grote stad.

## the urban tissue

A support structure is a piece of real estate that can be realised in the public sector. Consequently it is in principle possible for the support structure to lead to the institution of a system of public services. A system of support structures or a built-up area based on a structureprinciple can create a system of public services in the same category as the other systems of public services found in the towns like a network of roads, the spacing of the greens, a system of public utilities etc. Except for the systems of public services we also find other public provisions: large public edifices, squares, all kinds of special buildings. They in conjunction with the systems of public services shape the town.
An urban tissue can be defined as an interweaving of the various systems of public services. An endless number of tissue are conceivable. The principle according to which these systems are interwoven can be seen as the characteristic of a specific tissue. With the help of a tissue characterised in this way an even greater number of urban spaces can be designed. An urban tissue indicates a theme. If this theme is known it will also be known how the various systems bear in proportion to one another. Next with the aid of this theme the structure of the town can be determined: that is the complete network of roads and public utilities, including the special buildings and central spaces. When the characteristic features of the urban tissue have been decided upon, it becomes possible from there on the one hand to design the town land on the other to detail it. The town-planner meets with a theme in the urban tissue which be can use to guide the whole. The architect discovers a basic pattern in that same urban tissue which he can use to detail a small part of the town.

When on the basis of zones and margins a structural principle has been developed the question can be posed how this structural principle can be made part of the urban tissue. It is obvious that in characterizing the interweaving of different systems of which the support structure is one, zones and margins can also be used in stipulating and dimensions. When a continuous-zoning has been decided upon the position of a structure corresponding to the chosen zoning can be determined. But also the position of the roads, the public greens and the other public services can be fixed. Herewith the continuous-zoning becomes a grid which lends itself to the notation of the urban tissue and of that what can be useful in that urban tissue for the creation of urban areas. The train of thought outlined in this report opens up a new field of study, which has as yet scarcely been explored. A purposeful research into the composition and usefulness of the various urban tissues could indesigning structures make the developed methodology applicable to the problematics of town-planning. Consequently in the methodology there would be a continuity from the smallest room to the largest city.

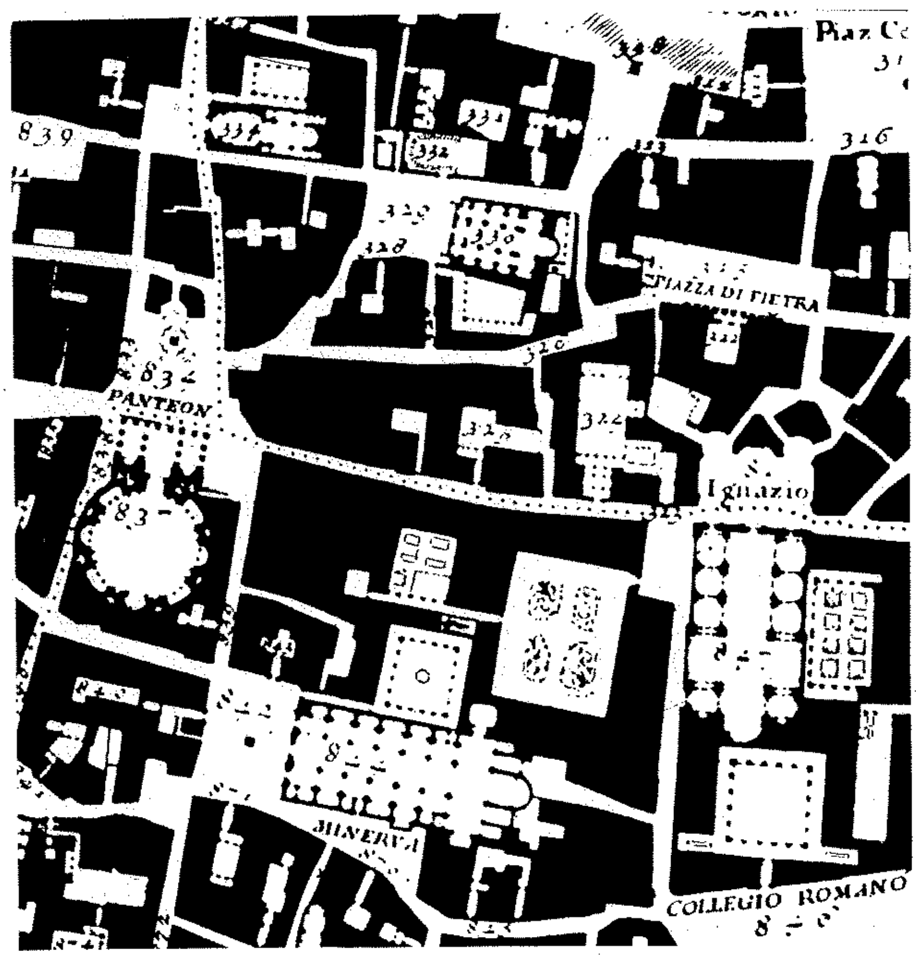
*Illustratie 3.1.*
*Fragment van een kaart van Rome uit de 17e eeuw van Nolly. Op de kaart zijn de bijzondere bebouwingen voor publiek gebruik, zoals de kerken en de pleinen, in plattegrond uitgetekend. Wat op deze kaart zwart is, is eigenlijk het stedelijk weefsel. Het stedelijk weefsel dat het alledaagse èn niet-bijzondere vertegenwoordigt in een stad heeft nooit de belangstelling van de architekten en de historici gehad. Het is aan dit tijdperk, waarin het alledaagse problematisch is geworden, overgelaten om de weefsels uit de geschiedenis te bestuderen en onbewust nieuwe weefsels voor deze maatschappij te ontwerpen. infrasiestructuur zich slechts in één richting*
*Illustratie 3.2.*
*Plattegrondfragment van de Jordaan.*
*Hier kan sprake zijn van een karakteristiek en duidelijk herkenbaar weefsel. De elementen zijn bebouwing, grachten, wegen parallel aan de grachten, wegen loodrecht op de grachten en tuinen; deze elementen zijn op een heel duidelijke wijze ten opzichte van elkaar geordend. Is het principe van deze ordening eenmaal bekend dan kan men een hele stadswijk (als de Jordaan) op basis daarvan ontwerpen. Bijzondere bebouwing, zoals de Noordermarkt en kerk, en de hofjes, kunnen op een vanzelfsprekende wijze in het weefsel worden ingepland.*

*Illustration 3.1*
*Part of a seventeenth century map of Rome by Nolly.*
*On his map the floorplans of public buildings like churches and squares have been drawn. Whatever is black on this map belongs in fact to the urban tissue. And the urban tissue enbodying the commonplace and the bothing-special in a town has never had the attention of architects and historians. It is left to this age in which the commonplace has become problematical to study the urban tissues in history and to design unconsciously new tissues for this present society.*
*Illustration 3.2*
*Part of a map in a working-class quarter in Amsterdam: 'De Jordaan'*
*Here it is possible to speak of a characteristic, clearly recognizable urban tissue. The elements in it are buildings, canals, roads parallel to the canals, roads perpendicular to the canals and gardens. And they have very clearly been arranged in relation to each other. Once the principle of this arrangement is known it is possible on the basis of this to redesign a complete district (like 'De Jordaan'). Special buildings like the Noordermarkt and -church and the almshouses can be logically interwoven into the tissue.*

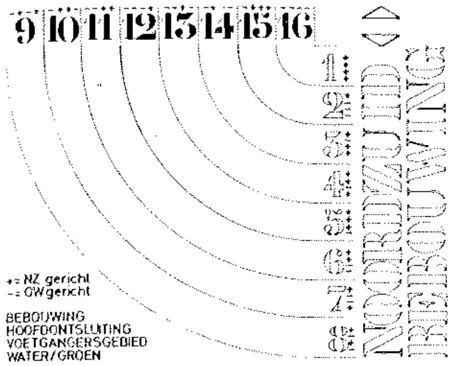
*Illustratie 3.3-a, 3.3-b, 3.3-c enz.*
*Nieuwe weefsels kunnen ontworpen worden door een notitie van de wijze waarop een gegeven aantal infrastructuren met elkaar in verband worden gebracht. De hier geïllustreerde serie geeft een groep van weefsels die allen zijn opgebouwd uit vier infrastructuren: de bebouwing, de hoofd-ontsluitingsweg (met de secundaire ontsluitingswegen daar loodrecht op), groenstroken en voetgangerscirculatie. Als uitgangspunt is gekozen, dat iedere infrastructuur zich slechts in één richting lineair kan voortzetten. De infrastructuur kan bijvoorbeeld ook noord-zuid of oost-west lopen. Hiërmee zijn in principe zestien verschillende weefsels mogelijk.*

*Illustrations 3.3a, 3.3b, 3.3c etc.*
*New tissues can be designed by noting down the way in which a given number of public services are related to each other. The series illustrated show a group of urban tissues all consisting of four of these public services namely the buildings, the principal accessroad (and the secondary accessroads perpendicular to it), the public greens and the pedestriancirculation. As a starting-point has been chosen that each system of public services is capable only of extending in one direction linearly. Any system of public services can run north-south or east-west. In this way there is in principle the possibility of sixteen different urban tissues.*

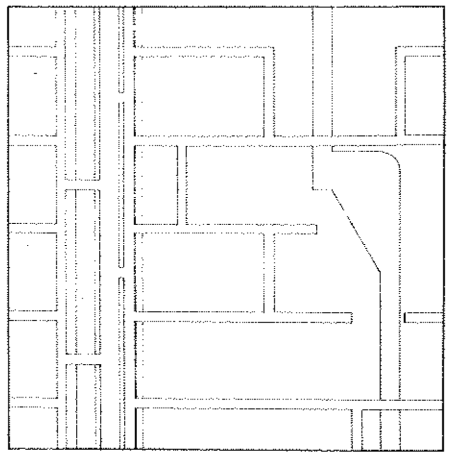
3.2




3.1



3.3 - a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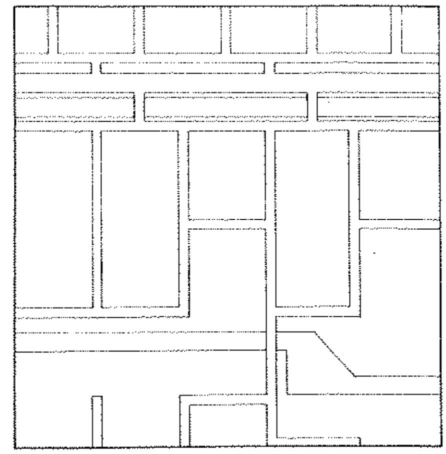
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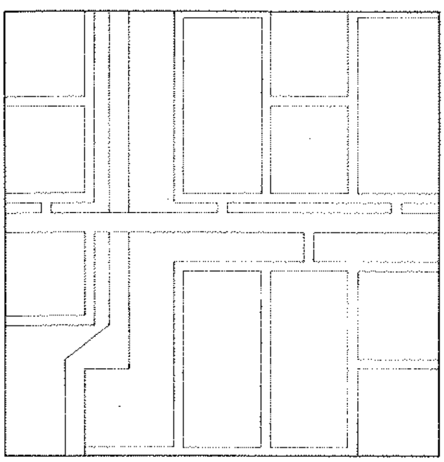
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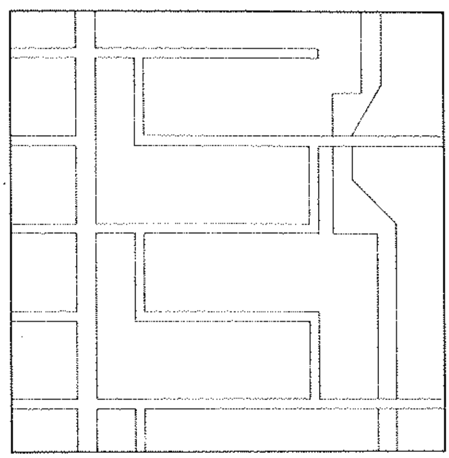
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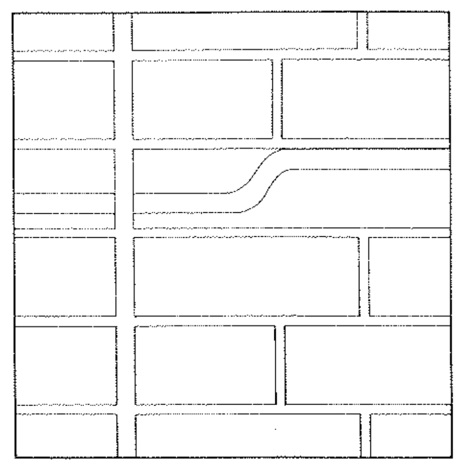
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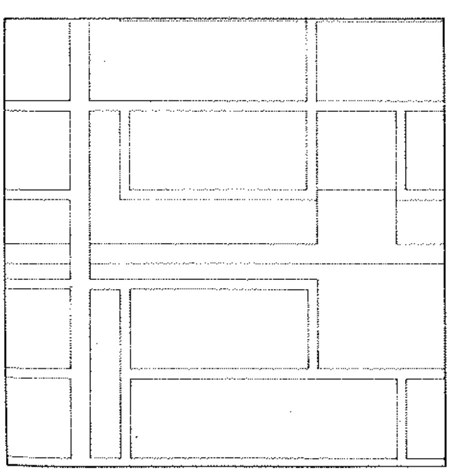
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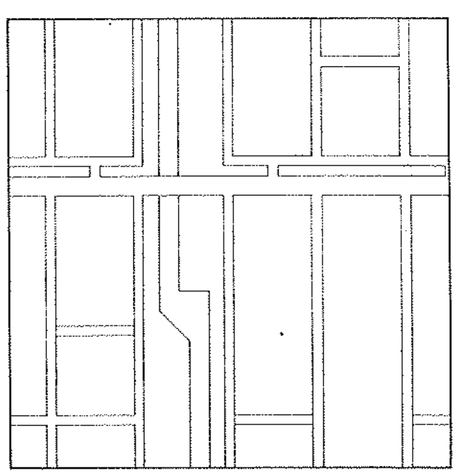
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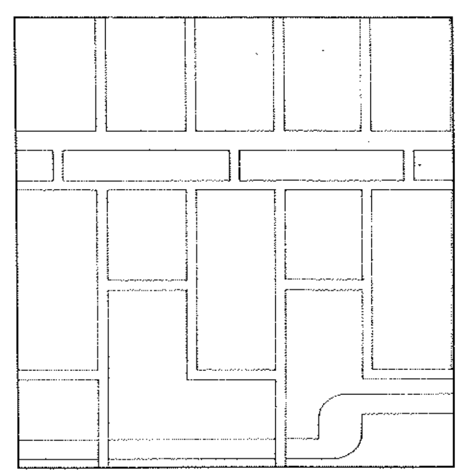
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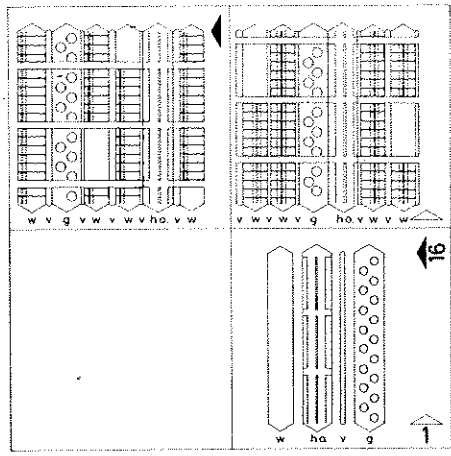


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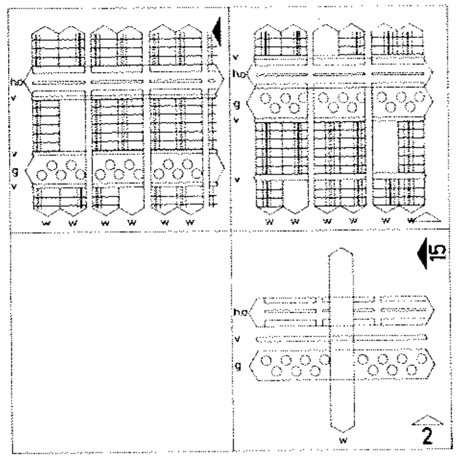


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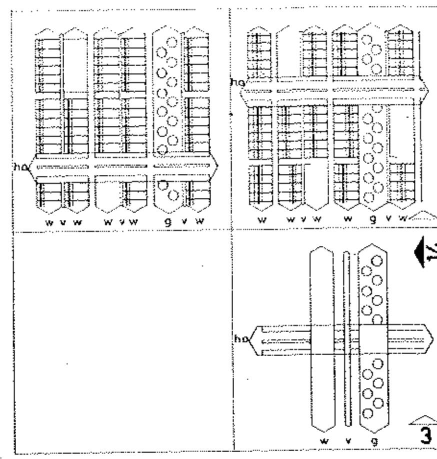


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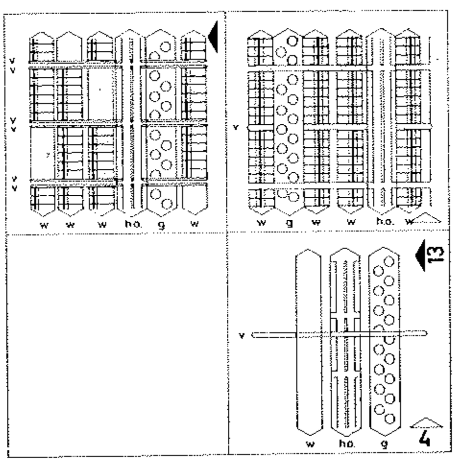
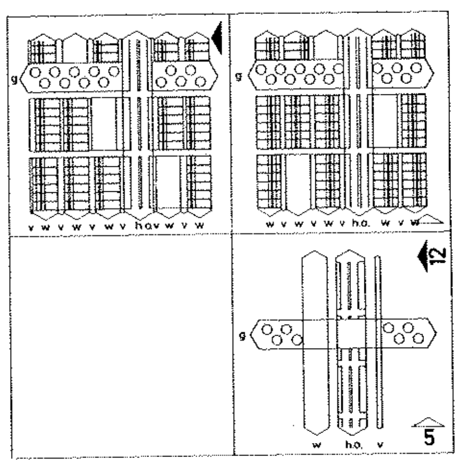



3.3 - m

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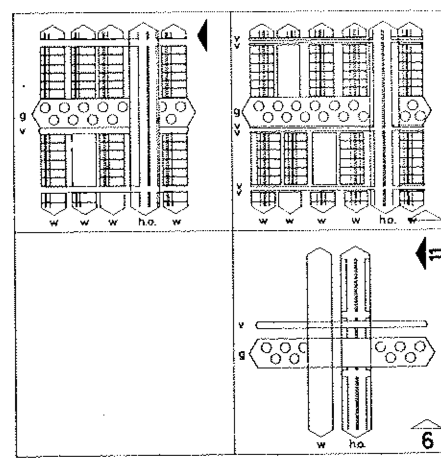
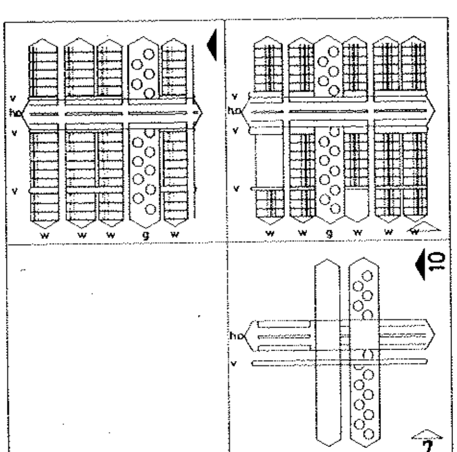
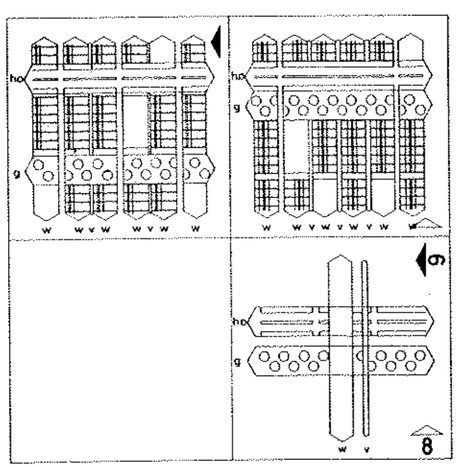


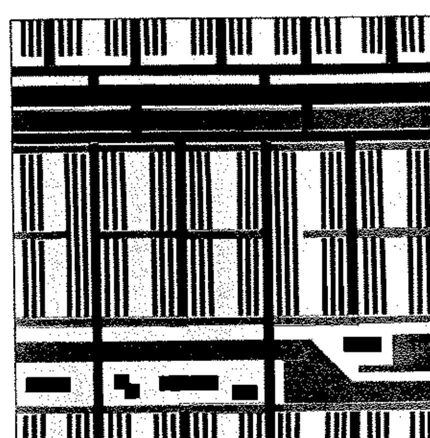

3.3 - o




3.3 - p



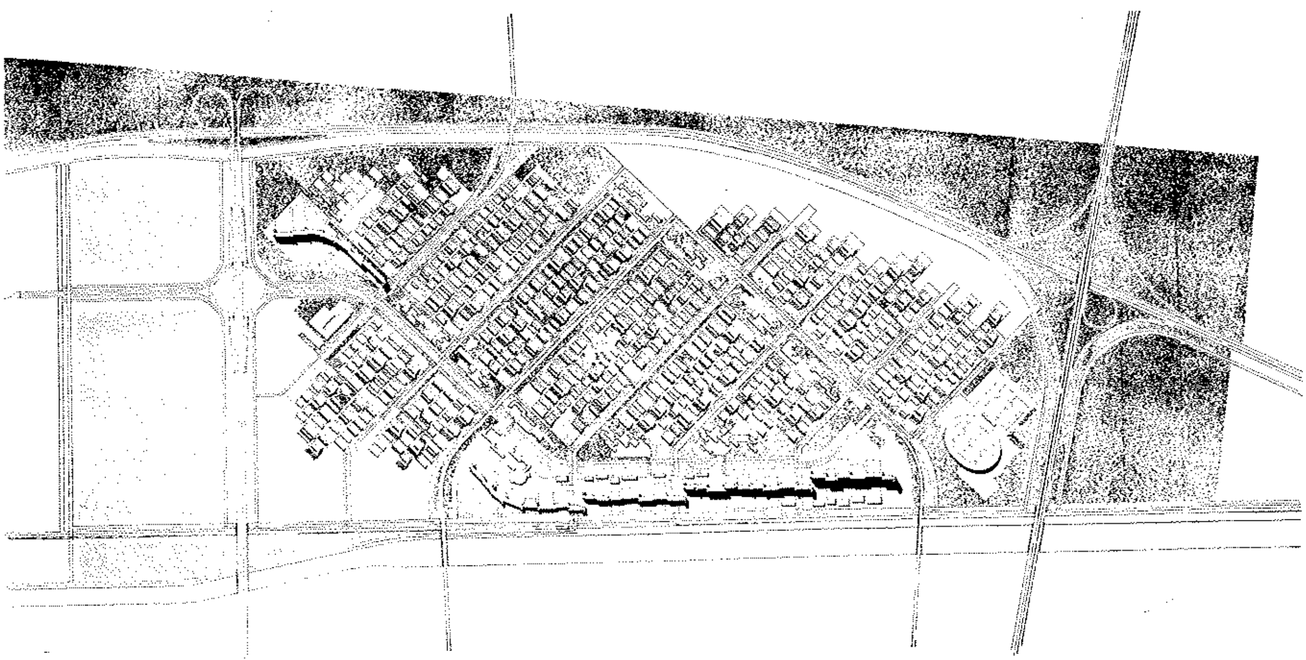

3.3 - q



3.3 - r

*Illustratie 3.4.*
*Het plan van de Jong, van Olphen en Bax voor Maarssenbroek is gebaseerd op een van de varianten voor een weefsel zoals dit in de illustratie 3.4. is uiteengezet. Uitgaande van dit weefselprincipe kan voor een gegeven situatie van een stedelijk geheel de stedelijke structuur worden ontworpen. Het wegenstramien kan worden bepaald en de afstanden van verschillende wegen ten opzichte van elkaar kunnen nog vrij worden gekozen. Ook worden dan de gebieden bepaald voor stedelijke voorzieningen. Hun plaats en afmeting kunnen worden genoteerd als bijzondere elementen in een continu patroon van het stedelijk weefsel zelf.*

*Illustration 3.4*
*The design by De Jong, Van Olphen and Bax for Maarssenbroek is based on one of the variants for an urban tissue as explained under illustration 3.4. Starting from this principle the urban structure can be designed for a given situation. It is possible to decide upon the network of roads, while the distances of the different roads in relation to one another can still be freely chosen. Also the areas reserved for public utilities are determined. Their place and dimensions can be seen as a special element in the continuous pattern of the urban tissue itself.*



## sectoren

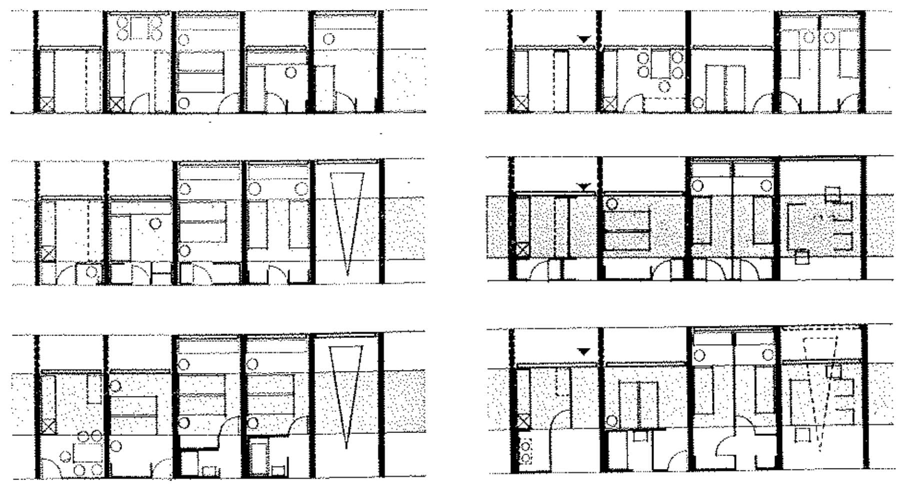
Per definitie is een sector een stuk van een zône, met de daaraan grenzende marges, dat vrij indeelbaar is. Het begrip zône zelf kent immers maar een dimensie; de breedte van de zône. Door daar een tweede dimensie aan toe te voegen ontstaat de sector. Wanneer men een bouwwerk maakt, ontworpen met behulp van zônes, zal het materiaal van dat bouwwerk de zônes dus ook in sectoren verdelen. Wanneer men een drager gaat onderzoeken op zijn indelingsmogelijkheden zal men een gedeelte van die drager bepalen tot woning en de indelingsmogelijkheden onderzoeken. Dit in te delen oppervlak wordt dus doorkruist door zônes en is daarom ook te zien als een combinatie van sectoren. Een woning in een drager is dus altijd te zien als combinatie van meerdere sectoren. Heel vaak zullen deze sectoren door het structuurmateriaal bepaald zijn door de plaats van kolommen of dragende wanden. Hierdoor zijn de sectoren in een structuur dus eigenlijk de ruimtelijke eenheden wàaruit de structuur is opgebouwd. De sector is dus heel vaak een ruimtelijke eenheid. De ruimtelijke mogelijkheden die de structuur biedt kunnen dus herkend worden door de groepering van sectoren te bestuderen. Nu is het mogelijk om van een gegeven sector de indelingsmogelijkheden te onderzoeken. Men kan van een sector nagaan welke functies er in kunnen worden geplaatst. Een dergelijke sectoranalyse is een goed hulpmiddel om te onderzoeken welke plattegronden voor woningen in een structuur mogelijk zijn. Omdat een sector meestal van beperkte afmetingen is, is het aantal indelingsmogelijkheden uitgaande van een bepaald functioneel programma meestal te overzien. Wanneer men eerst de sectoren op hun indelingsmogelijkheden heeft onderzocht, kan daarna de woning als geheel worden onderzocht, als een combinatie van sectorindelingsvarianten. Natuurlijk ontstaat een woningplattegrond niet door een klakkeloze combinatie van indelingsvarianten van sectoren. Maar wanneer men eenmaal inzicht heeft in de indelingsmogelijkheden van de sectoren, wordt het veel gemakkelijker om een inzicht te krijgen in de mogelijke woningplattegronden.
Een drager bevat nog geen woningplattegronden en dus ook nog geen vertrekken. De sector is daarom de kleinst herkenbare ruimtelijke eenheid waaruit de architectuur van een drager is opgebouwd. Heeft men zijn sectoren eenmaal goed gekozen en is bovendien vastgesteld hoe de sectoren onderling geschakeld kunnen worden dan is daarmee de drager als ruimtelijk en architectonisch thema bepaald. Met behulp daarvan kunnen complexe dragerssystemen worden ontworpen tot stedebouwkundige eenheden zonder dat het nodig is, dat men van tevoren woningen ontworpen heeft. Waar tot nu toe de architekt en de stedebouwer voornamelijk werkten door een schakeling van woningen, die te voren ontworpen waren, kunnen zij nu werken door een systeem van combinaties van sectoren. Hierdoor wordt het mogelijk architectonisch en stedebouwkundig werk te verrichten zonder dat tevoren de definitieve plattegronden bekend hoeven te zijn van de woningen die deel uit zullen maken van het ontworpen complex. Daarmee is de sector een onmisbare schakel geworden in de continuïteit van de kleinste naar de grootste maat.

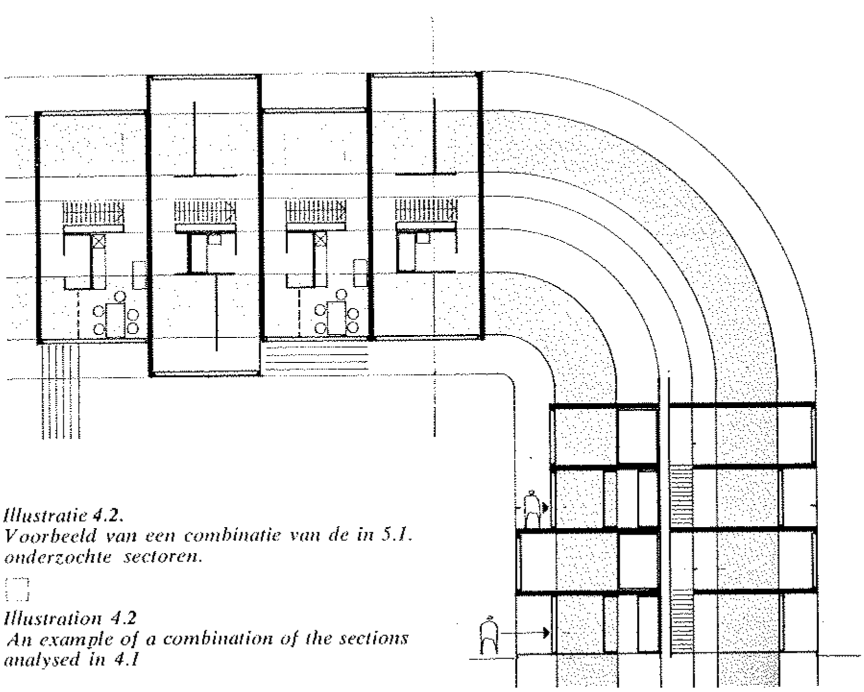
## sections

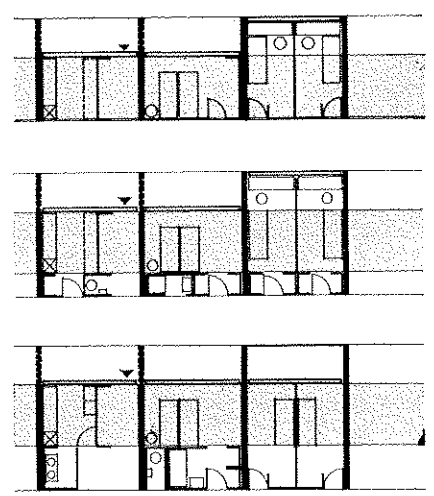
A section in this report is defined as a part of a zone and its adjoining margins, which can be freely partioned. The zone itself knows but one dimension: the width of the zone. But by the addition of a second dimension a section is created. When a building is designed by the aid of zones, then the materials used in the construction will decide the zones into sections. When a support structure is analysed in order to discover which lay-outs are possible, then part of this support structure will be reserved for living-accommodation and its lay-outs will be analysed. Thus the area which is to be partioned is traversed by zones. And therefore it is to be thought of as a combination of sections. Consequently a dwelling in a support structure can always be seen as a combination of more than one section. These sections are very often determined by the structural material. For instance by the positioning of columns or of load-bearing walls. In this way the sections in a structure are in fact the spatial units used to build up the structure.
Thus a section is very often a spatial unit. The spatial possibilities inherent in the structure can be recognized by studying the arrangements of the sections. And it is possible to analyse the lay-outs in a given section and the functions which can be placed within it. Such a section-analysis is a great help in discovering which floorplans of houses are possible in a certain structure. A section is mostly of limited dimensions therefore the number of lay-out possibilities based on a certain program of functions are usually easily calculated. When first the sections have been analysed according to their lay-out possibilities, then the dwelling as a whole can be analysed as a combination of these lay-out variants of sections. Naturally the floorplan of a dwelling is not created by the gratuitous combination of lay-out variants of sections. But once insight has been achieved into the lay-out possibilities of sections, it becomes much easier to gain insight into the possible floorplans of dwellings.
There are yet no floorplans in a support structure and therefore also no rooms. Consequently the section is the smallest recognizable spatial unit used in building up the architecture of a structure.
Once the sections have been well-chosen and also the decision has been made on how the sections are to be linked together. Then at this point the support structure is to be defined as an architectural and spatial theme. By the aid of which complete systems of support structures can be developed into urban units without the necessity of designing the dwellings beforehand. Up to now the architect and the town-planner have for the most part been engaged in linking together dwellings which had already been designed. From now on they can do their work by the means of a system of combinations of sections. In this way it becomes possible to engage in architecture and town-planning without foreknowledge of the definitive floorplans of the dwellings which are to be part of the designed complex. Herewith the section has become an indispensable link in the continuity of the smallest to the largest dimensions.

*Illustratie 4.1.*
*Een analyse van α-sectoren van respectievelijk 3 m, 3.90 m, 4.50 m en 4.80 m breed bij eenzelfde zónering.*
*Studie vóór de N.V. Elementum, Maassluis - maart 1968.*

*Illustration 4.1*
*An analysis of α-sections in an identical zoning by a width of 3 m, 3.90 m, 4.50 m and 4.80 m respectively.*
*A study undertaken for Elementum Ltd., Maassluis, march 1968 (Larssen-Nielsen system).*

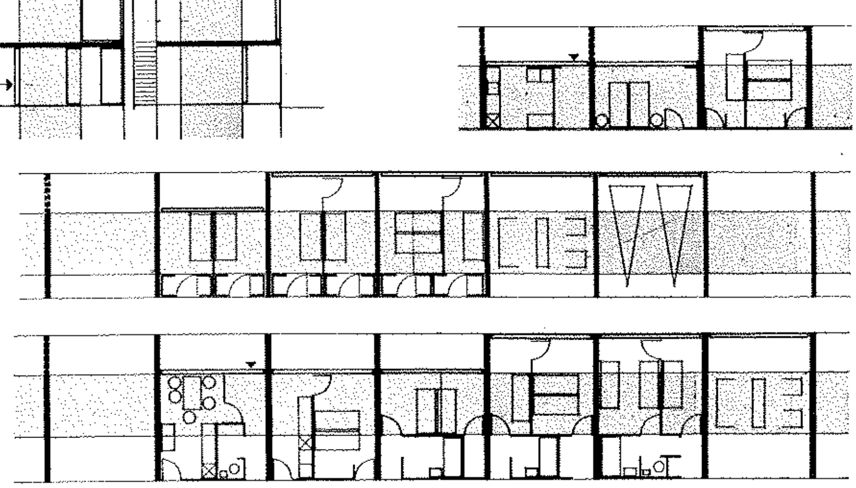






*Illustratie 4.2.*
*Voorbeeld van een combinatie van de in 5.1. onderzochte sectoren.*

*Illustration 4.2*
*An example of a combination of the sections analysed in 4.1*



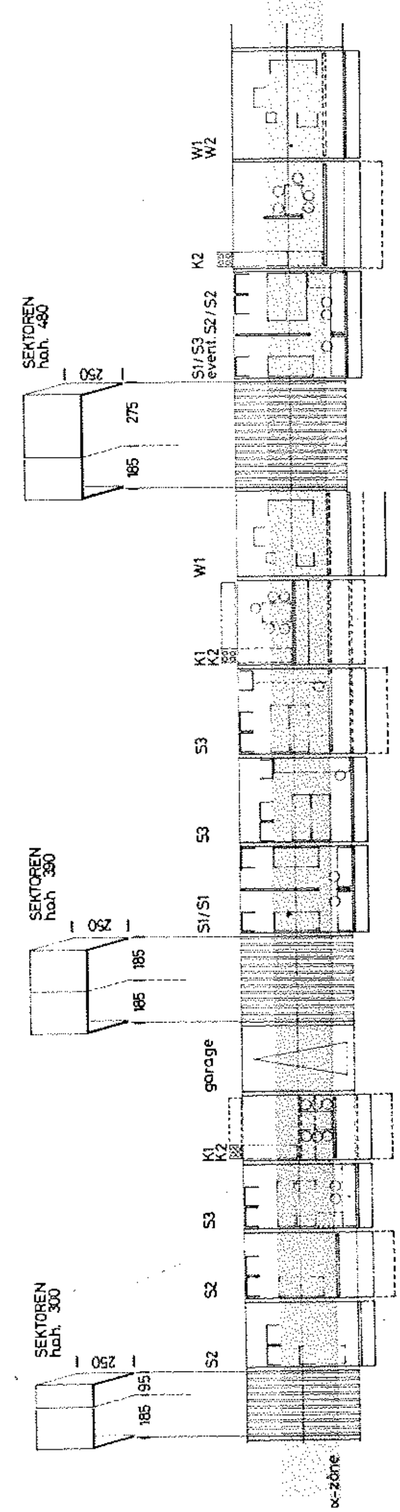
*Illustratie 4.3-a, 4.3-b, 4.3-c.*
*Studie voor een structuur waarin de α-sectoren als een zelfstandige structurele eenheid worden gezien. De drager wordt beschouwd als een combinatie van twee parallel lopende reeksen α-sectoren. Vandaar de naam Tweelingstructuur. De afstand tussen de twee α-sector-reeksen is in principe variabel, waardoor de diepte van de woning nader bepaald kan worden.*
*4.3-b*
*De woning kan worden gezien als een combinatie van sectoren. De kleinste woning kan bestaan uit twee tegenover elkaar liggende α-sectoren. Doordat in dit voorbeeld twee sector-breedten zijn gebruikt kunnen tal van reeksen α-sectoren worden opgezet in verschillende ritmen van de twee maten a en b.*
*Door dit stelsel wordt op een simpele wijze steeds op basis van dezelfde twee sectoren een grote variatie van combinatiemogelijkheden geschapen.*
*4.3-c*
*Omdat de sectoren van geringe breedte zijn, zijn hiervan tevoren vrijwel alle representatieve indelingsvarianten te bepalen. Door deze speciale combinatie van sectoren waarin, door de afstand tussen de beide α-reeksen ruim te kiezen. een groot middengebied in de woning ontstaat, kenmerken de plattegronden zich ook door een grote zelfstandigheid van de sector. Deze zelfstandigheid wordt benadrukt door de keuze van een brede marge die dikwijls toelaat, dat de bij de functie in de sector behorende voorzieningen, zoals kastenwanden en sanitaire cellen, geplaatst kunnen worden. Hierdoor wordt het principe, dat de woning een combinatie van sectoren is, gebruikt om tot een duidelijk herkenbaar woningtype te komen met zijn eigen specifieke kwaliteiten. Steeds wordt om een centrale gemeenschappelijke woonruimte een reeks sectoren gevonden voor specifieke functies.*

*Zie illustratie 1.7 p. 166*

*Illustrations 4.3a, 4.3b and 4.3c*
*4.3a A study of a structure in which the α-sections can be seen as an independent structural unit. The support structure is considered to be a combination of two series of α-sections running parallel. Hence the name 'twinstructure'. The distance between the two series of α-sections is in principle variable. In this way the total depth of the support structure and consequently the depths of the dwellings themselves can be specified later.*
*4.3b A dwelling can be thought of as a combination of sections. The smallest floorplan can consist of two α-sections lying opposite each other. In this example two section-widths have been employed therefore a number of series of α-sections can be introduced in the different rhythms of the two sectionsizes a and b. This system achieves in a simple way a great variation in the combinations while always basing itself on the same two sections.*

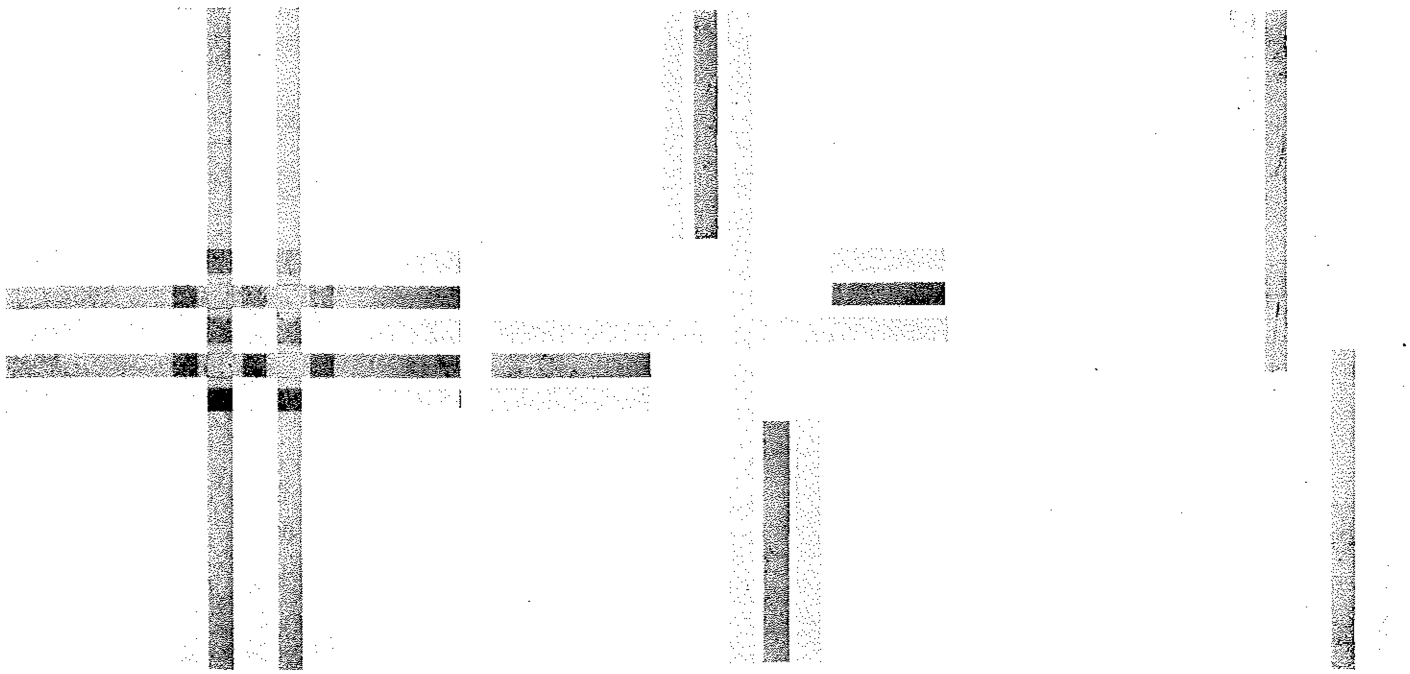
*4.3c Since the sections are not very wide, nearly all the representative lay-out variants in them can be determined beforehand. When a wide distance has been chosen between the two α-series, a wide central area is created within the house by the special combination of the sections. Thus the floorplans are also characterized by a very great independence of the section. This independence is emphasized by the choice of a wide margin often permitting the services belonging to the function in this section like cupboard units and sanitary cells to be placed there. In this way the principle — a dwelling is a combination of sections — is applied in order to arrive at a clearly recognizable type of dwelling with its own specific qualities. There is always a serie of sections for specific functions to be found around a common central living-area.*

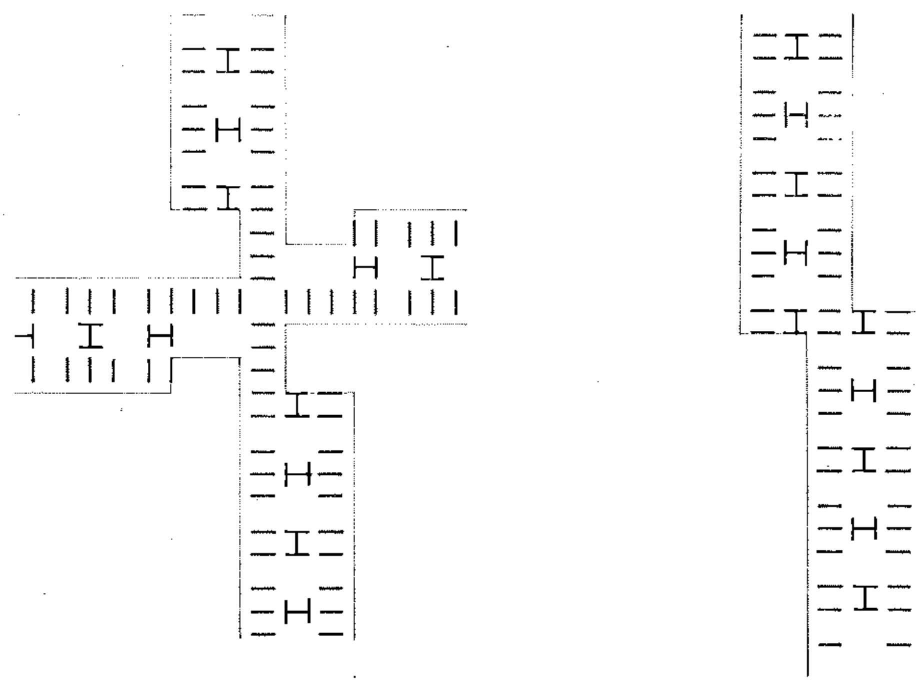
*look for illustration 1.7 p. 166*




*Illustratie 4.4.*
*Weergave van de gebruikswaarde van sectoren die ontstaan uit een standaard bekistingssysteem. Publikatie I.B.B. - SARblad 38.*

*Illustration 4.4*
*A reproduction of the utility value of sections created by a standard system of shuttering. A publication of the I.B.B. (a Dutch Construction Firm in Leyden) — S.A.R. paper 38.*



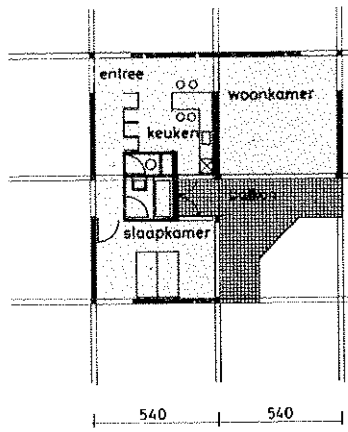


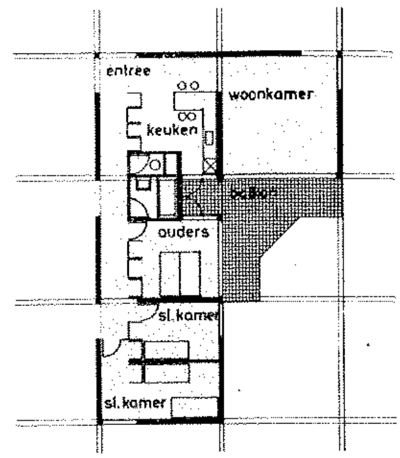
*Illustratie 4.5.*
*Schakeling van sectoren tot grotere architectonische eenheden die wederom kunnen dienen voor het ontwikkelen van stedelijke weefsels.*

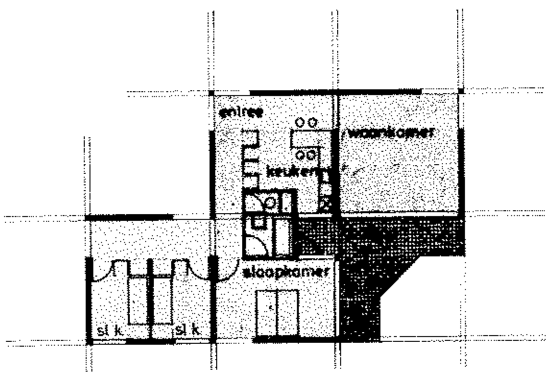
*Illustration 4.5*
*The linking of sections into larger architectural units which in their turn can be used in the development of urban tissues.*

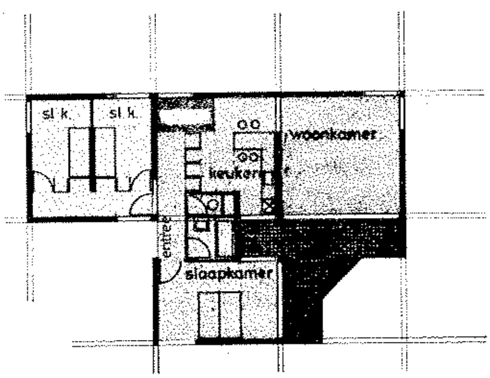
*Illustratie 4.6.*
*Combinatie van sectoren in quadratische vorm. Door de keuze van een sector met een aantal standaardindelingen is een thema bepaald waaruit door schakeling van de sectoren verschillende woonplattegronden ontstaan. Omdat eigenlijk alleen sprake is van α-sectoren ontstaan ondiepe woningen met een grillige gevellijn.*
*Blz. a t/m h van rapport 48. Studie in opdracht van Philips Pensioen Fonds.*

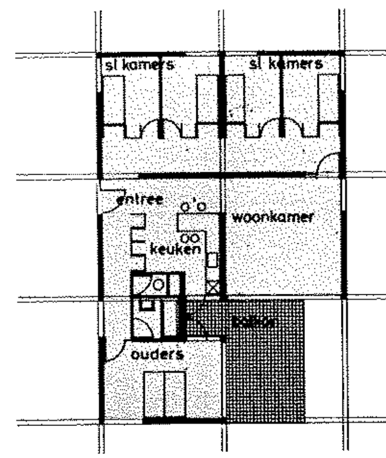
*Illustration 4.6*
*A combination of square sections. In the choice of a section with a number of standard lay-outs the theme has been determined by which through the linking of sections different floor-plans are developed. As in fact there is only question of α-sections shallow houses with irregularly shaped façades are created.*
*Pages a — i of report 48. A study undertaken for Philips' Pension Fund.*

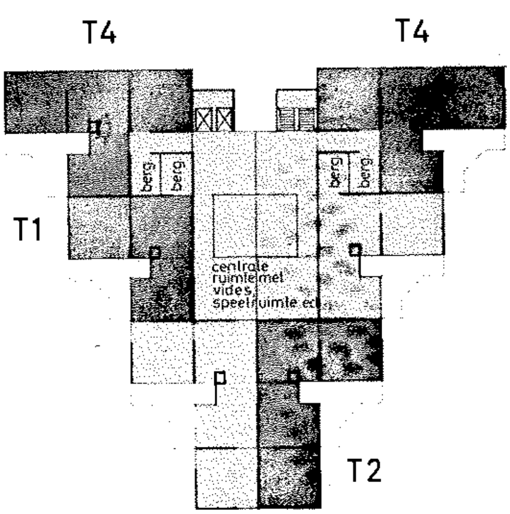


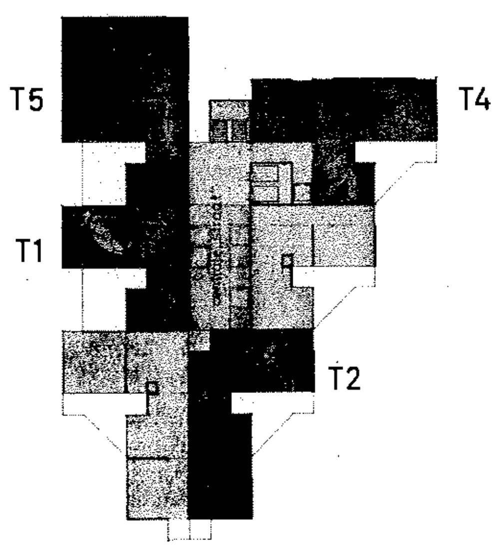



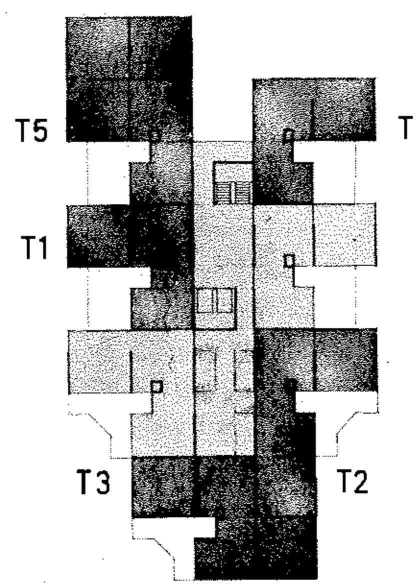




## inbouwpakket

Het inbouwpaket is de verzameling van al datgene waarover de bewoner beslissen kan. Een inbouwpakket behoeft dus helemaal niet te worden samengesteld uit industrieel vervaardigde onderdelen. Ook de gemetselde muur kan in principe tot het inbouwpakket behoren wanneer die muur loopt onder het beslissingsveld van de bewoner en als zodanig in de structuur geplaatst wordt. Wanneer men echter vanuit dit principe denkt in industrieel vervaardigde elementen, die als duurzame gebruiksgoederen door de bewoner kunnen worden gekozen, ontstaat de mogelijkheid tot ontwikkeling van geheel nieuwe produkten. Wij hebben dan niet meer te maken met bouwkundige onderdelen in de traditionele zin van het woord, zelfs niet met industrieel vervaardigde bouwkundige onderdelen. Het gaat om gebruiksprodukten die door de gebruiker herkend kunnen worden als bruikbaar en daarom de moeite van het kiezen waard. De bewoner denkt niet in termen van techniek of produktiemogelijkheden maar denkt in termen van bruikbaarheid. En een gebruiksprodukt is bijna altijd een samenstel van verschillende technische produkten en handelingen. We moeten bijvoorbeeld gaan denken aan een element voor de functie wassen veel meer dan aan een wasbak. de functie wassen, veronderstelt bijvoorbeeld het samenstel van een wasbak met aan- en afvoerleidingen, met de spiegel en het planchet er boven, met het stopcontact voor het scheerapparaat en de lichtbron die er bij hoort. Waar de technicus misschien een deur onderscheidt van een deurkozijn, zal de bewoner gebaat zijn bij een element dat hij neer kan zetten op de plaats waar hij van de ene ruimte in de andere wil komen, terwijl hij toch die ruimten van elkaar af wil kunnen sluiten. Bij dit element hoort dan misschien ook het stopcontact en de lichtknop met de lichtbron die hij kan gebruiken om de ruimte die hij binnengaat te verlichten. Langs deze lijn van denken moet het mogelijk zijn om een gehele reeks nieuwe produkten te definiëren die in onderlinge combinatie en schakeling de door de structuur geboden ruimten bewoonbaar kunnen maken.
Op dezelfde wijze is een pui-element niet een stuk gevel maar een produkt dat de bewoner in staat stelt om zijn relatie tussen binnen- en huitenruimte te bepalen. Hoe zien zulke elementen er uit; welke functies moeten ze vervullen; in welke mate moeten ze uitwisselbaar en veranderbaar zijn; moet de gehele gevel uit zulke elementen worden opgebouwd of kan worden volstaan met een gevel die tot de structuur behoort maar die bepaalde openingen biedt waarin deze elementen geplaatst kunnen worden? Het zijn allemaal vragen die slechts willen illustreren dat voor het ontwikkelen van een werkelijk door de bewoner herkenbaar en bruikbaar inbouwpakket oude bouwkundige problemen vanuit een geheel andere gezichtshoek hekeken moeten worden. Er ligt hier nog een geheel terrein braak.
De zogenaamde sanitaire cel is in deze problematiek een hoofdstuk apart. Deze hevindt zich nu nog in het stadium waarin de keuken zich bevond voordat Bruynzeel in Nederland kwam tot de samenstelling van een uit een gebruiksoogpunt gedefinieerde serie onderdelen die combineerbaar waren tot wat men nu de keuken noemt. De sanitaire cel als duurzaam gebruiksgoed gezien, moet worden losgekoppeld van de structuur, als een doos die op verschillende manieren geplaatst kan worden waarvan de leidingen door middel van 'stopcontacten' uit de structuur verbonden worden.

## the set of detachable units

The set of detachable units includes all that which comes within the occupant's field of decision. A set of detachable units does not necessarily have to be composed of industrially made parts. In principle a brickwall can also belong to the set of detaebable units on the condition that this wall comes within the occupant's field of decision and that as such it can be placed into the structure. However, thinking along the lines of industrially made elements which can be chosen as durable consumergoods by the occupant the possibility arises of developing completely new products. Our concern is no linger with architectural elements in the traditional sense of the word, not Our concern is no longer with architectural elements, but with consumergoods recognised by the consumer as useful and therefore worth choosing. An occupant does not think in terms of technique or productionmethods, but in terms of usefulness. Consumergoods are rearly always made up out of various technical products. We should for instance concentrate more on an element used for the function 'to wash' than on the washbasin itself. For example the function 'to wash' presupposes an arrangement of a washbasin with mains and drains, with a mirror and a shelf, with a plugpoint for shaving-apparatus and the necessary light.
A technician may differentiate between a door and a doorframe, but an occupant will henefit more by an element which he can place at will anywhere he wants to connect up spaces and wants to be able to close them off again. Perhaps a plug, a switch and a lamp to light up the space he is entering, could belong to such an element. Along this line of thought it must be possible to define a whole new range of products, which can by combining and linking together make the spaces inherent in the structure inhabitable.

Similarly a front-element is not a piece of a façade, hut a product allowing the occupant to determine the relation between the interior and the exterior. What do such elements look like? Which functions must they be capable of performing? To what extent must they be changeable and interchangeable? Does the whole façade have to be constructed from such elements or is it sufficient for a façade to belong to the structure and to offer certain openings in which these elements can be placed? These are all questions only meant to illustrate how in the development of a really recognizable, serviciable set of detachable units for the use of the occupant, old architectural problems must be looked at from another angle. This field has not yet been touched upon.
Among these problems the so-called sanitary cell comes under a different heading. This cell is still at the same stage as the kitchen before we arrived at the competition of a serie of component parts defined by their uses and capable of being combined into what is now called the kitchen. The sanitary all must be considered among the durable consumergoods. These will have to be disconected from the structure. The cell becomes an independent box which can be placed in different position. The only restriction being that its piping has to connect up with 'plugs' in the support structure. This box in its turn is not an unit, but the result of combining elements with their own existence and function. When one attempts to follow this line of thought to its logical conclusion it becomes obvious that a reorganisation of the piping, the sanitary elements and apparatuses is

Die doos is op zijn beurt geen eenheid maar het resultaat van de samenstelling van wederom op zichzelf gedefinieerde onderdelen die een eigen functie te vervullen hebben. Wanneer men deze gedachte consequent probeert door te trekken blijkt een nieuwe organisatie nodig van leidingen, wandelementen en toestellen. De barrière die overwonnen moet worden om tot deze organisatie te komen is wederom niet in de eerste plaats van technische aard maar verlangt een afrekening met clichématige in zwang zijnde oplossingen. De gedachte dat een sanitaire cel dan als een kant-en-klaar-produkt van de lopende band kan rollen is dan even clichématig als de gedachte dat een sanitaire cel zou moeten bestaan uit gemetselde en betegelde wanden waar de leidingen in opgenomen zijn. Het wordt dan wenselijk dat een cel opgebouwd kan worden uit elementen die onderling verwisselbaar zijn naar behoefte van de gebruiker en die door de voordeur naar binnen gebracht kunnen worden om ter plaatse te kunnen worden samengesteld tot een geheel. De analogie met de moderne keuken is evident.

De filosofie van een inbouwpakket als een samenstel van gebruiksprodukten heeft ook invloed op de vorm van de structuur. Een doelmatig ontworpen structuur moet als het ware een vanzelfsprekende oriëntatie bieden over de mogelijke plaatsing van de elementen. De goede structuur is er een die de gelegenheid biedt om met een minimum aantal inbouwelementen steeds een groot aantal bewoningsmogelijkheden te creëren. Dit kan weer betekenen dat een goede structuur een inbouwsystematiek ten grondslag heeft. Een structuur kan bijvoorbeeld zodanig ontworpen worden dat goede woonmogelijkheden kunnen ontstaan door uitsluitend elementen lineair te schakelen en op deze wijze te voorkomen dat ingewikkelde oplossingen en de daarbij samengaande moeilijke aansluitingsdetails voorkomen worden. Een goede structuur moet het inbouwen kinderlijk eenvoudig maken. Dit uitgangspunt stelt hoge eisen aan de ontwerper van de structuur.

□

needed. The banier, which has to be taken, in order to arrive at such a reorganisation, is again not in the first place one of a technical nature, but one which demands the settling of accounts with the fashionable stereotype solutions. The idea that a sanitary cell could come off the assembly line as a ready-made product is just as stereotype as the thought that a sanitary cell should consist of masoned and tiled walls with built-in piping. It then becomes desirable for a cell to be assembled from elements interchangeable according to the consumer's needs and capable of being carried in through the frontdoor in order to be combined on the spot. The analogy to the modern kitchen is obvious. The idea of a set of detachable units as being a collection of consumergoods also has its influence on the shape of the structure. A well-designed structure must point as it were to the possible positionings of the elements. A structure can be considered good when it succeeds in creating a great number of lay-out possibilities by the use of a minimum number of detachable units.
Again this may mean that a good structure has at its basis a system of arrangement of detachable units. For instance a structure can be designed in such a way that good lay-out possibilities are created solely by linking elements linearly. In this way the occurence of complex solutions and their attendant difficult detailing of the connections has been avoided. A good structure must make this building-in process childishly simple. And this starting-point makes high demands upon the designer of the structure.

## het afbouwpakket

De traditionele afbouwtechniek ziet afbouw als het aanbrengen van een aantal technische voorzieningen, zoals daar zijn: separaties, diverse leidingsystemen, sanitair, verwarmingsapparatuur, vloerafwerking, wandafwerking, enz. Iedere technische voorziening is het produkt van tenminste één aparte bedrijfstak. Iedere voorziening op zich wordt aangebracht in één of meer arbeidsgangen.
De traditionele afbouwtechniek berust op het gedeeltelijk gelijktijdig, gedeeltelijk na elkaar ter plaatse aanbrengen van verschillende technische voorzieningen. Dit samenvoegen is in wezen een vervlechten van al deze voorzieningen tot een homogeen geheel. Bij voltooiing van de woning zijn de voorzieningen niet meer afzonderlijk herkenbaar of weghaalbaar. Zij verdelen zich meestal over de gehele woning en het is niet mogelijk om één voorziening uit het geheel te lichten zonder ook andere voorzieningen aan te tasten.
De noodzaak tot vervlechting maakt het nodig, dat de desbetreffende voorziening ter plaatse wordt opgebouwd uit betrekkelijk kleine onderdelen. Daardoor blijft de hoeveelheid arbeid ter plaatse aanzienlijk en is de mogelijkheid voor industrialisatie beperkt tot de fabricage van onderdelen. De assemblage moet op de bouwplaats geschieden.
Er zijn veel pogingen gedaan om deze assemblage voor een meer of minder groot gedeelte in prefabricage te doen geschieden. Daarbij kan een onderscheid gemaakt worden tussen verschillende uitgangspunten. Steeds echter wordt gezocht naar een beperking van de mate van toepassing van een bepaalde technische voorziening of van een concentratie van een technische voorziening binnen een beperkt gebied.
Bij een beoordeling van dergelijke maatregelen moet de volgende overweging zeer zwaar wegen:
Gaat men uit van de veronderstelling, dat in de toekomst de industriële produktie een rijkere woning-aankleding mogelijk zal maken, dan mag verwacht worden, dat een bepaalde technische voorziening zich steeds meer over de gehele woning zal vertakken. Dat betekent bij voorbeeld t.a.v. sanitair in iedere slaapkamer een wasbak; naast de natte cel een douchecel voor de hoofdslaapkamer. Dat betekent voor elektra een steeds grotere hoeveelheid elektrische apparatuur, die door het hele huis gebruikt moet kunnen worden. De tendens zal dan gaan naar een ingewikkelde vervlechting.

De concentratie van een bepaalde technische voorziening tot een afzonderlijk produkt is b.v. te zien bij de z.g. 'sanitairwand'. Daardoor wordt voorkomen, dat voor aan- en afvoer van water, afval e.d. een ingewikkelde vervlechting nodig is. Daarbij wordt het onmogelijk deze voorzieningen elders in de woning aan te brengen. Tegelijkertijd is zo'n 'sanitairwand' al een fragment van een tevoren bepaalde plattegrond en zijn daarom de plattegrondvariaties gering. Ten slotte is bij zo'n wand geen duidelijke scheiding tussen ruwbouw en afbouw. Gaat men dus uit van zo'n scheiding en beoogt men het fabriceren van produkten, die in onderlinge samenhang een wijde variatie van plattegronden mogelijk maken,

## finishing technique

Traditionally finishing work in the building industry is understood to cover the installation of certain provisions of a technical nature such as partitions, various piping systems, sanitary and heating equipment, floor and wall coverings, etc., work which is the responsibility of at least one separate branch of the industry and taking one distinct operation, often several, to incorporate. Conventional techniques are based on methods whereby these provisions are partly fitted at the same time, partly one after the other. The final achievement essentially means combining all these provisions so that they form one homogeneous entity and on completion of the building they are no longer recognisable individually nor can they be removed as such. Such provisions are usually distributed throughout the building and it is impossible to extract one of them from the unit without affecting several others.

The need for creating one interwoven entity makes it inevitable that such provisions be incorporated as comparatively small components in situ. This means that the amount of work carried out on the actual building site remains considerable and limits industrialisation to the manufacture of components which are then assembled near or in the building.
Many attempts have been made to replace such assembly work by a varying degree of prefabrication, the solutions differing according to the underlying principles. Nevertheless all these solutions aim at restricting the application of a particular technical provision or a concentration of provisions within one specific limited area.
When assessing such measures the following consideration plays a very important role:
Assuming that industrial production will enable buildings to be more lavishly equipped it can also be expected that a given technical provision will increasingly spread its ramifications throughout the structure. Such a concept could involve, for instance, extending the sanitary fittings to include a washbasin in every bedroom or adding a shower unit to the wet cell for the main bedroom. Electrically this means more appliances capable of being used throughout the house. Such a trend results in a complex interwoven design.

The concentration of a given technical provision into a separate product can be illustrated with the so-called 'sanitary wall', which avoids a complicated system of pipes for the supply and drainage of water, effluents and the like. At the same time such a 'wall' makes it impossible to fit these provisions elsewhere in the building and since it forms part of a predetermined floorplan it restricts variations of the latter. Finally the 'sanitary wall' does not allow for a clear distinction between the initial and finishing building stages. If therefore such a wall is considered and it is also intended to manufacture products which enable a wide variation of floorplans drawn up in combinations then this solution loses its advantages.

The alternative of the 'technical core' incorporating the toilet, heating equipment, shower and kitchen sink represents the concentration of all the technical provisions within a few square feet. Unfortunately this solution restricts even more the choice of possible floorplans and the flexibility of the

dan verliest deze oplossing zijn waarde.
De z.g. 'technische kern' waarin toilet, verwarmingsapparatuur, douche, en gootsteen voor keuken gecombineerd worden, is een concentratie van alle technische voorzieningen op enkele vierkante meters. Ook hiervoor gelden in nog grotere mate de bezwaren van plattegrondmogelijkheden. Ook hier berust de idee meer op een technische wenselijkheid dan op een streven naar verrijking van woonmogelijkheden. Dit conflict is gedurig te signaleren bij de pogingen tot rationalisatie van de afbouwtechniek. Het is nu eenmaal zo, dat aangenaam wonen, samengaand met een eenvoudig gebruik van de door de woning geboden voorzieningen, aangepast bij de menselijke gedragspatronen, niet automatisch samengaat met simpele ordelijke leidingsystemen. Beiden zijn eerder omgekeerd evenredig. Ordelijke concentratie van alle technische voorzieningen verlangt een leven - om - de - apparatuur - heen — dat niet erg natuurlijk aandoet.
De mens is eerder geneigd de apparatuur om zich heen te groeperen en dat resulteert zelden in een overzichtelijk systeem van technische voorzieningen. Wèl in overzichtelijke woonpatronen. De hele moeilijkheid zit hier in het feit, dat men uitgaat van de gedachte, dat een technische voorziening, omdat hij nu eenmaal door een herkenbaar ambacht tot stand wordt gebracht, een onderdeel is waaruit de woning is opgebouwd. De neiging ontstaat dan zo'n voorziening te verzelfstandigen. Want industrialisatie is gebaseerd op produktie van verzelfstandigde onderdelen. Maar het streven naar verzelfstandiging van een technische voorziening is niet reëel en daarom heeft het denken in technische voorzieningen alleen nut in de traditionele afbouwtechniek.
De 'technische voorziening' bestaat als herkenbaar object alleen in ons denken, maar laat zich niet als zodanig in de fabriek produceren.
Kennelijk heeft deze denkwijze zijn grenzen. De verdeling van de woning in technische voorzieningen; de produktie van de woning als een vervlechting van zulke voorzieningen; het zijn denkschema's ontstaan vanuit de bouwtechniek-ter-plaatse; vanuit het onderscheiden van loodgieters, elektriciens, metselaars, stukadoors en tegelzetters, die ieder zo'n voorziening voor hun rekening nemen. Maar geen van deze lieden maakt iets, dat voor de industrieel herkenbaar is als te produceren object. Ook is een verdeling van de woning in technische voorzieningen niet herkenbaar voor de leek. Toch gaat het in het industrieel proces om duidelijk herkenbare dingen, die de producent de gebruiker aan kan bieden. De leek ziet zijn woning niet als een systeem van separaties, plus een systeem van verwarmingsapparatuur, een elektrisch systeem, een systeem van wandafwerking, een systeem van vloerafwerking, een systeem van rioleringen, enz. Hij ziet een woning als een samenstel van ruimten en herkenbare dingen. Hij ziet kasten, keukens, slaapkamers, w.c.'s, douches enz.
Wonen is altijd het gelijktijdig gebruik van verschillende voorzieningen. Wonen is niet: het gebruikmaken van de verwarming en daarna het gebruikmaken van het water en daarna van de afvoer, en daarna van de separaties en daarna van de elektriciteit. *Wonen is het gelijktijdig gebruiken van in onderlinge samenhang gegroepeerde technische voorzieningen.* Het gedragspatroon van de mensen bepaalt in welke samenhang deze groepering van technische voorzieningen plaatsvindt. In zoverre het gedragspatroon in herkenbare zelfstandige hoofdstukken te verdelen is, in zoverre zijn ook verschillende groeperingen van voorzieningen te onderscheiden in de woning. Zo is een keuken een organische groepering van technische voorzieningen; zo is een natte cel dat; zo is ook het keukenblok geplaatst in de woonruimte dat, evenals een kastenwand, met diverse voorzieningen daarin, een zinvolle groepering kan zijn.
De gebruiker groepeert de dingen, die hij nodig heeft, naar het gebruik dat hij ervan maakt. Hij kookt, hij komt zijn woning binnen (dat is ook een afgeronde groep handelingen), hij bewoont zijn eigen privéruimte (de eigen domein ruimte van Van Tijen), hij wast zich, enz. En hij leeft gezamenlijk met gezamenlijke gebruikmaking van weer andere groeperingen van voorzieningen. Hij ziet een buitenwand met raam, verwarming, gordijnen, zonwering bijelkaar. Hij ziet een erker, een balkon enz. Het industriële produkt zal daarom een gebruiksprodukt moeten zijn. Dat is een door het gebruik bepaalde groepering van voorzieningen, die als een zelfstandig herkenbaar geheel geproduceerd kan worden. Zo'n gebruiksprodukt loopt van het keukenkastje, via de kastwand — tevens separatie — via de natte cel en het kookblok, naar de geprefabriceerde specifieke ruimte-cel. Gaat men op deze wijze denken in gebruiksprodukten, dan denkt men dus in herkenbare groepen van voorzieningen en dan is de afbouw van een woning in een draagstructuur het samenvoegen van zulke groepen tot een groter geheel.
Dit betekent dat de totale vervlechting van voorzieningen per woning wordt verdeeld in vervlechtingen per produkt. Deze laatste vervlechting kan in de fabriek geschieden. Op de bouwplaats is geen vervlechting meer nodig, slechts aansluiting van de produkten op leidingstelsels, die (per definitie) tot de draagconstructie behoren. Er is dan slechts sprake van montage.
Van een dergelijke denkwijze is natuurlijk veel meer te zeggen dan in de hier volgende notities wordt gegeven. Aanvaardt men deze uitgangspunten, dan ontstaan niet alleen nieuwe produktie-technische mogelijkheden, maar ontstaan ook geheel nieuwe architektonische en ruimtelijke vrijheden, die een enorme verrijking van de wooncultuur kunnen betekenen. Deze mogelijkheden liggen vooral in het onderscheid tussen gebouwde ruimten en industrieel vervaardigde ruimten, uit de samenvoeging waarvan dan de woning ontstaat. Dit onderscheidt maakt nieuwe wegen van rnimtelijk denken mogelijk, waarover nog veel te zeggen is.

accommodation. In this case too the concept is based more on a technical desirability than on an attempt to improve living facilities. This conflict occurs whenever attempts are made to rationalize the finishing stages in building. Fact remains that comfortable living coupled with the simple use of the facilities offered by the building as adapted to human patterns of behaviour does not automatically go together with straightforward internal distribution systems. Indeed these two aspects are inversely proportional. A rational concentration of all the technical provisions dictates a mode of living around the appliances which does not come naturally. Man is more inclined to group equipment around himself and this does not result in a straightforward system of technical provisions; it does however allow for logical living patterns. The difficulty lies in the fact that the basic concept is one in which the technical provision, just because it is produced by a recognisable profession, represents a component which goes to make up the building. The tendency is then for such a provision to become independent, mainly because industrialisation is based on the production of independent components. Yet the endeavour to make a technical provision independent is not realistic and thinking based on such provisions is only of use in conjunction with traditional methods of finishing.
As a recognisable object the 'technical provision' only exists in our mind but it cannot be produced as such in the factory.

Evidently such a line of thought has its limitations: the division of the dwelling into technical provisions; the realization of the dwelling as an integral combination of these provisions — these are concepts created by on-site building methodes — prompted by the distinction between plumbers, electricians, bricklayers, plaster and tilers, who each taken on the responsibility for one of these provisions. Even so, none of these tradesmen produce anything which the industrial recognizes as an object he can manufacture. Likewise a subdivision of the house into technical provisions cannot be distinguished by the layman. Any industrial process, however, involves items that are clearly recognizable and which the producer can offer to the user. The layman does not look upon his house as a system of separate partitions containing a heating system, an electrical system, wall and floor coverings, a system of drains, etc.: he considers his home as a collection of rooms with tangible things such as cupboards, kitchens, bedrooms, toilets, showers, etc.

Living means making simultaneous use of various provisions and not using the heating system, followed by the hot water, then the drain, next the partition and then the electricity. *No, living requires the simultaneous use of technical provisions grouped into a related combination.* The pattern of behaviour of man determines the manner in which these technical provisions are grouped together so that if his behaviour can be subdivided into distinct independent chapters, various groups of provisions can be singled out in the house accordingly. Such groups include, for instance, the bathroom, the kitchen and even the cupboard wall which, since they make various provisions available, represent logical groups.
The user arranges the things he requires

according to the use he makes of them: he cooks, enters his house (also a finite group of actions), he lives in his own private space (the own space referred to by Van Tijen), he washes, etc. He also spends his time at home together with other groups of provisions; he sees the outer wall with its window, radiator, curtains and sunblind as a related group, he takes in the French window and the balcony in one glance, etc. As a result the industrial product will have to be a user article, i.e. a group of provisions defined by usage which can be produced as a recognizable independent entity. Such a user product ranges from the kitchen cupboard to its wall — also a separation — and via the bathroom and kitchen units to the specific prefabricated room unit. If this line of thought is adopted in the case of user products recognizable groups of provisions are defined, whereupon the final stages of building construction based on the load bearing frame consists of combining such groups into a larger unit.
This means that the overall combination of provisions per dwelling is subdivided into combinations per product, the latter being capable of assembly in the factory. Interconnection is then no longer necessary at the building site, the products only having to be coupled to the piping systems which (by definition) belong to the load-bearing structure. All that is left therefore is erection.
Much more can be said about such a concept than is given in the captions on the following pages. Once these principle are accepted they not only enable new technical production to be realized but novel freedom of action is created both from an architectonic and a spatial aspect which in turn could mean a considerably richer mode of living. These possibilities are prompted mainly by the difference between rooms built on site and those produced industrially which when combined make up the house. This difference makes new lines of thought feasible with regard to space concerning which much remains to be said.

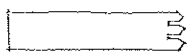
*Illustratie 5.1*
*Vergelijking van de traditionele afbouwtechniek in de woningbouw waarbij de verschillende technische voorzieningen als zelfstandige eenheden van produktie worden beschouwd, met de door de SAR voorgestelde inbouwtechniek waarbij voor de gebruiker functioneel herkenbare elementen als zelfstandige eenheden worden gezien. Deze inbouwelementen bevatten bijna altijd een combinatie van technische voorzieningen die in de fabriek worden aangebracht. Het verschil tussen de beide benaderingswijzen is het verschil tussen de traditioneel ambachtelijke benadering en de industriële benadering bij de produktie van gebruiksgoederen. De illustraties zijn een gedeelte uit een rapport voor het Bestuur van de SAR van 5 april 1965.*

*Illustration 5.1*
*A comparison between the traditional finishing technique in housebuilding whereby the various technical provisions are considered to be the product of pendent trades and the building-in technique suggested by the S.A.R., whereby elements recognized by the consumer as functional are thought of as independent units. These detachable units rearly always include a combination of technical provisions installed at the factory. The difference between these two approaches lies in the difference between the approach of traditional craftmanship and the industrial approach in the production of consumergoods.*
*The illustrations are part of a report intended for the board of management of the S.A.R. — 5 april 1965.*

*Samenstelling van de woning op traditionele wijze. Denken in 'technische voorzieningen'. Afbouw = afzonderlijk aanbrengen van technische voorzieningen in één of meer arbeidsgangen.*

□

*Traditional method for assembling the house. Concept based on 'technical provisions'. Finishing stage of building = separate installation of technical provisions in one or more operations.*



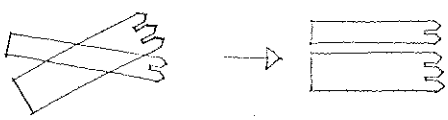
*voorzieningen* *arbeidsgangen*

*Provisions* *Operations*

*De navolgende vormen van rationalisatie zijn denkbaar:*

□

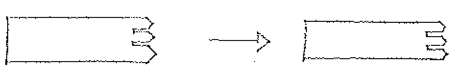
*The following forms of rationalisation are feasible:*



*1. Het niet elkaar hinderen van arbeidsgangen t.b.v. verschillende voorzieningen.*

□

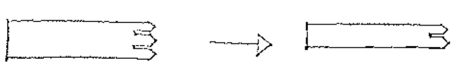
*1. Avoidance of interference between operations in connection with various provisions.*



*2. Vereenvoudiging van één of meer arbeidsgangen.*

□

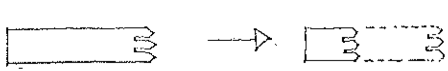
*2. Simplification of one or more operations.*



*3. Uitschakelen van een arbeidsgang.*

□

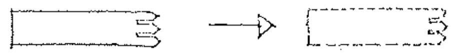
*3. Elimination of an operation.*



*4. Beperking en vereenvoudiging van een technische voorziening.*

□

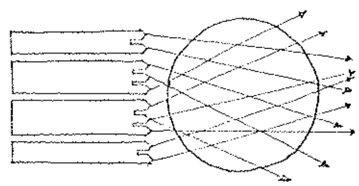
*4. Limitation and simplification of a technical provision.*



*5. Uitschakelen van een technische voorziening. Vervlechting tot homogeen produkt is altijd noodzakelijk.*

□

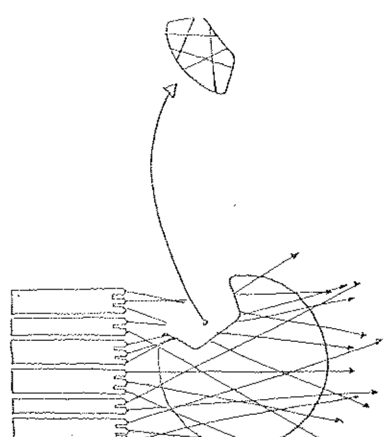
*5. Elimination of a technical provision. Combination into a homogeneous product remains essential.*



*Vraag: Hoe kan men de arbeid voor de vervlechtingen reeds elders (in de fabriek) doen plaatshebben?*

□

*Question: How can the work required to achieve the intimate combination be carried out beforehand elsewhere (in the factory)?*



*Antwoord: Verdeling van de woning in onderdelen, die reeds een deel van de vervlechtingen in zich hebben.*

□

*Answer: By subdividing the house into components which already contain part of such a combination.*

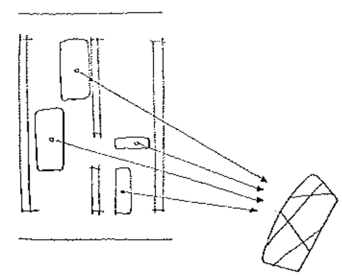
**wat zijn dat voor onderdelen?**

*Dat kunnen bijvoorbeeld zijn: kastenwand, keukenunit, natte cel, slaap cel. Dus onderdelen, die zijn afgestemd op een specifiek gebruik en daardoor als eenheid voor de gebruiker herkenbaar zijn.*

□

**what type of components are involved?**

*They could be, for instance:*
*the cupboard wall*
*the kitchen unit*
*the wet cell*
*the sleeping cell*
*In other words components adapted to a specific use and which can therefore be recognized by the user as an integral unit.*



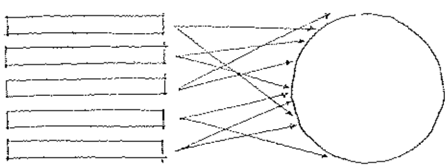
| | | |
|---|---|---|
| *Kastenwand* | *heeft in zich een vervlechting van:* | |
| | *scheiding* | |
| | *berging* | |
| | *schilderwerk* | |
| | *eventueel leidingen* | |
| *Keukenunit* | *heeft in zich een vervlechting van:* | |
| | *aanrecht* | |
| | *waterleiding* | |
| | *warmwaterreservoir* | |
| | *kasten enz.* | |
| *Natte cel* | *heeft in zich een vervlechting van:* | |
| | *sanitair* | |
| | *ruimte scheidende wanden* | |
| | *deuren* | |
| | *leidingen* | |
| | *elektra enz.* | |
| *Slaap cel* | *heeft in zich een vervlechting van:* | |
| | *ruimte scheidende wanden* | |
| | *sanitair* | |
| | *elektra enz.* | |

□

*The cupboard wall contains a combination of:*
*the partition,*
*the storage space,*
*paint,*
*possibly leads.*
*The kitchen unit contains a combination of:*
*the sink and draining board,*
*the water pipes,*
*the hot-water tank,*
*cupboards, etc.*
*The wet cell contains a combination of:*
*sanitary equipment,*
*partitions,*
*doors,*
*leads and pipes,*
*electric appliances, etc.*
*The sleeping cell contains a combination of:*
*partitions,*
*sanitary equipment,*
*electric appliances, etc.*

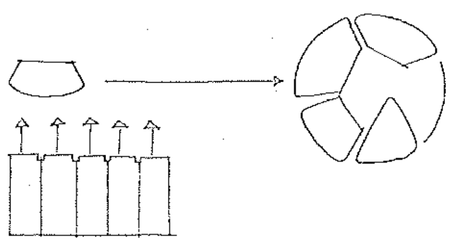
*Bij verdeling van de woning in technische functies maakt een gesplitst produktie-apparaat een homogeen produkt (1).*
*Bij verdeling van de woning in gebruiksfuncties maakt één homogeen produktie-apparaat gesplitste produkten (2).*

*If the house is divided into technical functions the divided product equipment represents a homogeneous product (1).*
*If the house is divided into utilisation functions the homogeneous product equipment represents divided products (2).*



*1. Gesplitst produktie-apparaat*
*Vervlechting*
*Homogeen produkt*

*1. Divided product equipment*
*Integral combination*
*Homogeneous product*

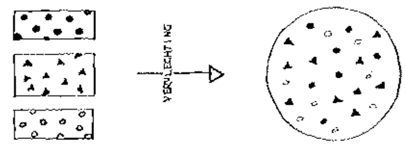


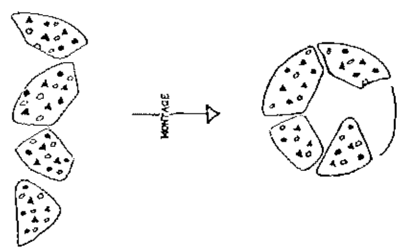
*2. Homogeen produktie-apparaat*
*Montage*
*Gesplitst produkt*

*2. Homogeneous product equipment*
*Assembly*
*Divided product*

*Het samenstellen van een woning uit technische voorzieningen betekent een vervlechting van die technische voorzieningen, hetgeen in principe voor elke technische voorziening een serie verschillende handelingen verlangt (1).*
*Het samenstellen van een woning uit specifieke gebruiksprodukten betekent montage van die produkten, hetgeen in principe voor elk produkt een identieke handeling is, nl. het aansluiten op de infrastructuur (2).*

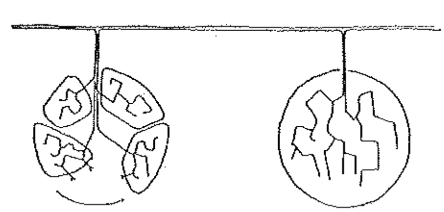
*The assembly of a house from technical provisions involves the integral combination of these provision, which in principle requires a series of different operations for each provision (1).*
*The assembly of a house from specific consumer products means the manufacture of these products, which in principle represents an identical operation for each product, i.e. its incorporation into the infrastructure (2).*




*Bij verdeling van de woning in technische voorzieningen is het vervlechten van een leidingsysteem met de andere technische voorzieningen noodzakelijk om door de gehele woning dat leidingsysteem te hebben (1).*
*Bij verdeling van de woning in specifieke gebruiksprodukten behoeven slechts de daartoe benodigde produkten te worden aangesloten op de infrastructuur om toch door de gehele woning dat leidingsysteem te hebben, aangezien die produkten in zichzelf een leidingsysteem kunnen bezitten (2).*
*Het leidingsysteem in een gebruiksprodukt kan bovendien tegelijk de ruimte(n) daar omheen bedienen.*

*When dividing the house into technical provisions the integral combination of a piping system with other technical provisions is essential if that system is to be available throughout the house (1).*
*When dividing the house into specific user products only the relevant products have to be connected to the infrastructure while still providing the system of piping throughout the building since such products can themselves possess a system of pipes (2).*
*Moreover a piping system within a user product can at the same time serve the room(s) around it.*



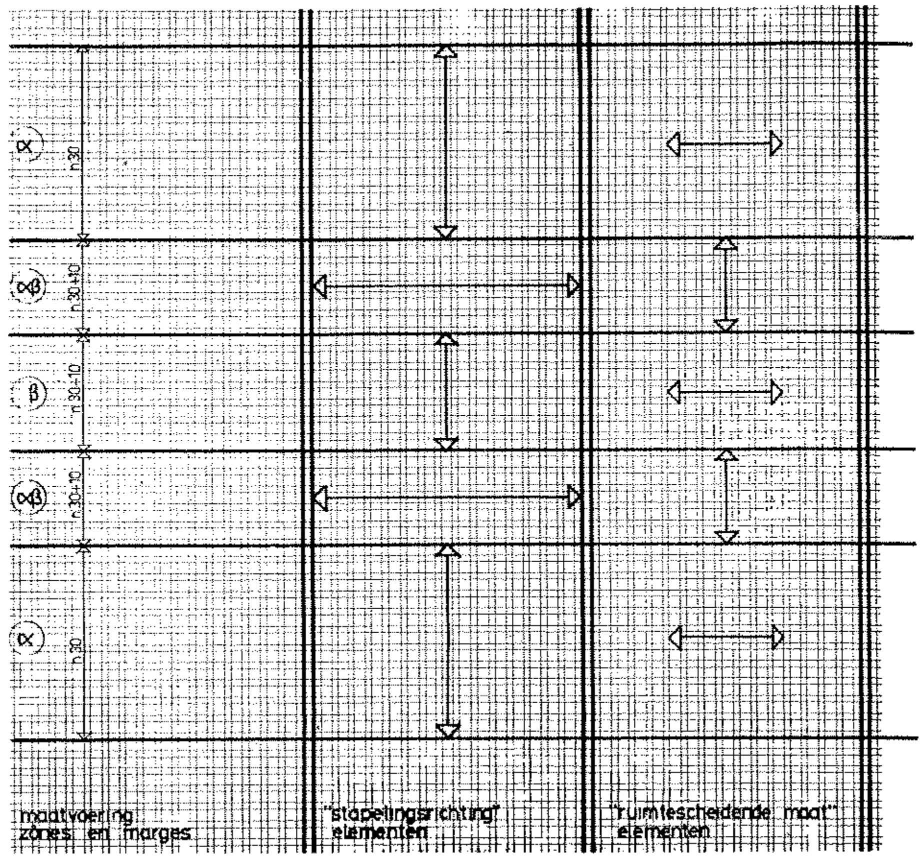
**denken in technische voorzieningen of denken in gebruiksprodukten?**

Het denken in afzonderlijke voorzieningen, die ter plaatse worden samengevoegd, heeft dan plaats gemaakt voor: het denken in afzonderlijke produkten, die ter plaatse worden samengevoegd, welke produkten reeds alle nodige voorzieningen in zich hebben.
Wat zijn dat voor produkten?
Dat zijn produkten, die herkenbaar zijn door hun gebruiksfuncties (prefab natte cel, keukenunit).
Zij worden door de gebruiker als zelfstandig herkenbare produkten gezien.
In het denkproces van de z.g. rationalisatie worden de voorzieningen als zelfstandige eenheden gedacht en als zodanig in de arbeidsverdeling behandeld, maar in het uiteindelijke produkt zijn zij niet als zelfstandigheid herkenbaar en niet als zelfstandigheid produceerbaar. Vandaar de noodzaak tot vervlechting en het noodzakelijk hoog percentage arbeid ter plaatse. Dit denkproces denkt 'functioneel' op basis van technische functies.
Het alternatief stelt een denkpatroon dat 'functioneel' denkt op basis van de gebruiksfuncties.
Verdeling van de woning in technische functies:
niet als produkt herkenbaar.
altijd arbeid voor vervlechting ter plaatse nodig.
noodzakelijkerwijs veel kleine onderdelen ter plaatse of grote onderdelen met geen of minimale variatiemogelijkheden.
vermindering van arbeid ter plaatse slechts in beperkte mate aanwezig.
vergroting van hoeveelheid technische voorzieningen geeft meer arbeid ter plaatse.
Verdeling van de woning in gebruiksfuncties:
herkenbare produkten.
minimale arbeid ter plaatse (vervlechting in fabriek).
maximale variatie van arrangementen bij minimaal aantal elementen.
vergroting van hoeveelheid technische voorzieningen door de gehele woning geeft niet meer arbeid ter plaatse.

**thinking along technical provisions or along user products?**

Thinking along the lines of individual provisions assembled in situ has made way for:
Thinking along the lines of individual products assembled in situ, such products already containing all the necessary provisions.
What type of products are involved?
They are products that are recognizable because of their user functions (prefabricated wet cell, kitchen unit); they are regarded by the user as independently recognizable products.
With regard to the rationalisation process the provisions are considerated to be independent units and are treated as such in the work distribution although in the final product they are no longer recognizable as independent units and are not produceable as such. This is the reason for integral combination and hence the requirement for a high percentage of work on site. The line of thought involved thinks 'functionally' on the basis of technical functions.
The alternative represents a method of thinking which thinks 'functionally' on the basis of user functions.
Division of the house into technical functions:
not recognizable as product;
always requires combination on site;

of necessity much smaller components on site or larger subunits with no or very little possibility of variation;
reduction of work on site only possible to a limited extent;
greater number of technical provisions results in more work on site.
Division of the house into user functions:
recognizable products;
minimum work on site (combined in the factory);
maximum variation of arrangements with minimum number of elements:
greater number of technical provisions throughout the building does not result in more work on site.

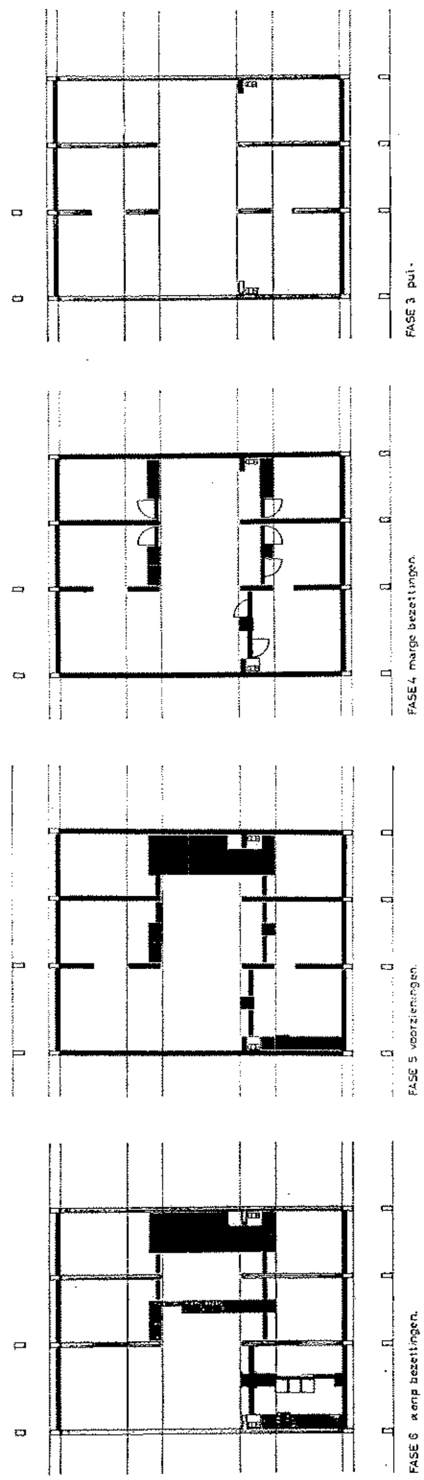



*Illustratie 5.2.*
*Studie van een inbouwsystematiek.*
*Zônes en marges waaraan spelregels verbonden worden voor de plaats en functie van ruimten maken het ook mogelijk om spelregels te formuleren voor het plaatsen van inbouwelementen. De zogenaamde inbouwsystematiek. De illustratie geeft een voorstel weer om in zônes alleen elementen te schakelen in de richting loodrecht op de gevel en in marges alleen elementen te schakelen in de richting evenwijdig aan de gevel. Deze richtingen komen overeen met de ruimten en scheiden de functies van de elementen in de betreffende zônes of marges.*
*Fragment uit een rapport voor het Bestuur van de SAR, maart 1966.*

*Illustration 5.2*
*A study focusing on a system for arangement of detachable units. When rules concerning the place and the function of the spaces are drawn up for zones and margins, they can also be drawn up for the placing of detachable units. The so-called 'arangement system'. The illustration demonstrates the idea of using in the zones only elements perpendicular to the façade and in the margins only elements parallel to the façade. These directions coïncide with the separately functions of the elements in the zones or margins concerned.*
*A fragment of a report for the board of management of the S.A.R. — march 1966.*

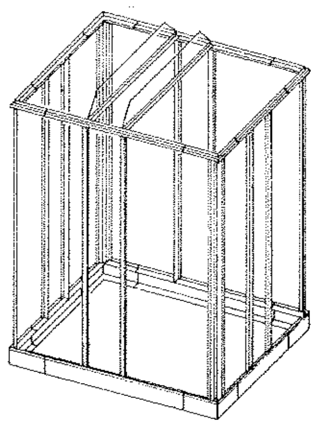
*Illustratie 5.3-a, 5.3-b, 5.3-c, 5.3-d*
*De toepassing van een inbouwsystematiek waarbij steeds elementen lineair worden geschakeld in het gebied van een zóne of een marge in verschillende opeenvolgende fasen. Hoewel iedere structuur die in de SAR-methodiek wordt ontworpen dezelfde inbouwelementen kan bevatten en dus de vorm en de afmeting van de inbouwelementen in principe niet afhankelijk zijn van een structuurontwerp, kan het ontwerp van een structuur sterk van invloed zijn op het aantal elementen die nodig zijn voor het formeren van een woning, alsmede op de eenvoud van het plaatsen van de elementen. De illustratie geeft weer hoe in het principe van de eerder besproken zogenaamde Tweelingstructuur het aantal elementen drastisch beperkt kan worden, omdat alleen gewerkt wordt met cellen en kastenelementen. Er worden geen enkelvoudige wandelementen toegepast. Dit structuurtype maakt een inbouwsystematiek mogelijk waarin alleen in de marges elementen worden geplaatst die in de ruimten scheidende functies vervullen. Met deze simpele uitgangspunten kunnen op heel eenvoudige wijze een zeer groot aantal bewoningsmogelijkheden binnen een gegeven groep sectoren gerealiseerd worden.*

*Illustrations 5.3-a, 5.3-b, 5.3-c, 5.3-d*
*The application of an arrangement system whereby the elements are always linked linearly in the area of the zone or margin in successive stages.*
*Although each structure designed according to the S.A.R.-methodology is capable of holding the same detachable units, (Thus shape and size of the detachable units are in principle not dependent on the design of the structure) yet the design of the structure can be of great influence on the number of elements needed to shape a house and on the ease with which the elements are put into position.*
*The illustration shows how based on the principle of the previously discussed twinstructure the number of elements can be drastically limited because only cells and cupboard units are being dealt with. Single wall-elements are not employed. This type of structure makes an arrangement system possible whereby elements are placed only in the margins thereby performing a function in partioning the spaces. Based on these simple starting-points a very great number of occupation-possibilities with a given group of sections can be realised without any difficulty.*

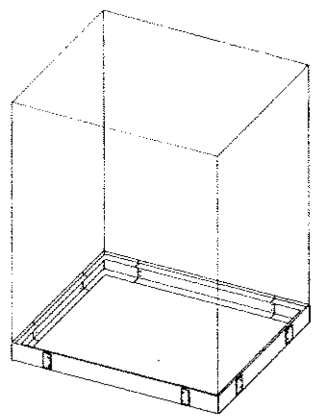



*Illustratie 5.4*
*Overzicht van de titelbladen uit een door de SAR samengestelde onderdelen-catalogus voor sanitaire cellen.*
*Het overzicht geeft weer hoe sanitaire cellen samengesteld kunnen worden uit groepen standaardonderdelen. Iedere groep onderdelen heeft een eigen functie en kan afzonderlijk gefabriceerd worden in massafabricage. In principe kan iedere groep onderdelen betrokken worden bij een andere producent. De loodgieter, de fabrikant van wandelementen en de fabrikant van sanitaire toestellen kunnen dus ieder afzonderlijk een produktieprogramma binnen dit kader opzetten.*

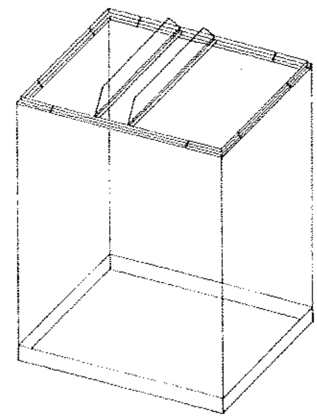
*Illustration 5.4*
*A survey of the title-pages of a catalogue of components of sanitary cells compiled by the S.A.R.*
*The survey shows how sanitary cells can be composed of groups of standard components. Every group of components has its own function and can be mass-produced seperately. Therefore in principle every group of components can be obtained from another producer. The plumber, the producer of wall panels, the maker of sanitary apparatus, each one of them can start his own productionprogram within this framework.*



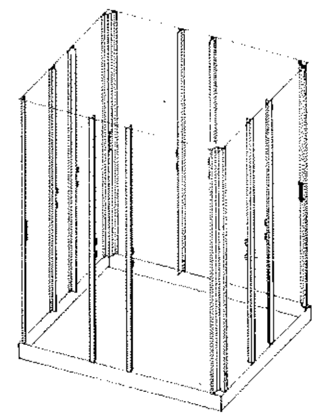
1. frame 14



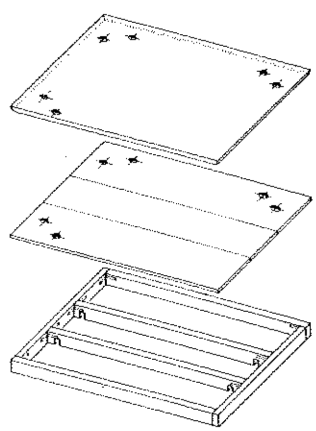
1.1. 1:20. vloerrand 15



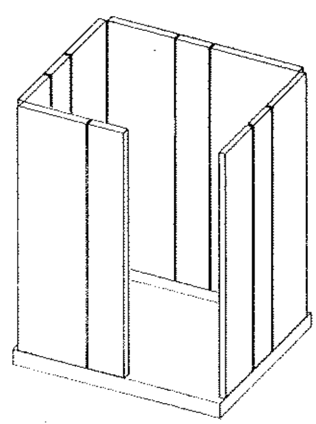
1.2. plafondrand 18



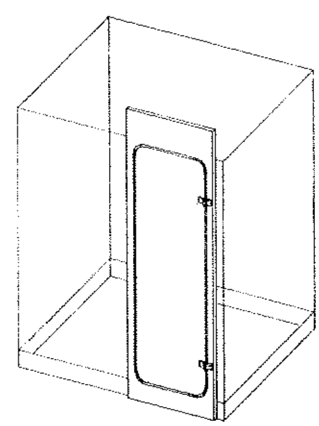
1.3. wandstijlen. 22



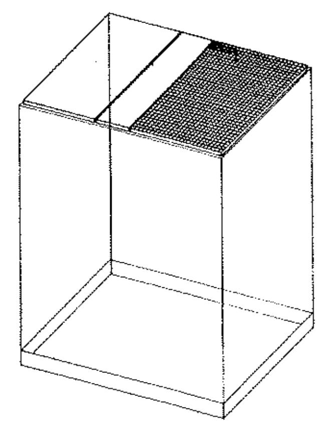
2. vloer 25



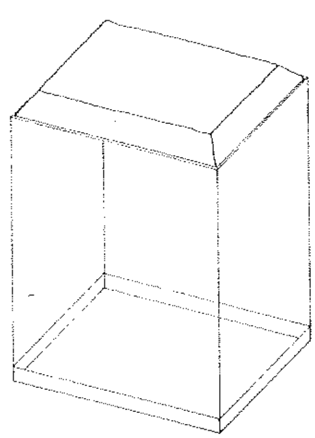
3. 1:20 1:5 wandelementen. 29



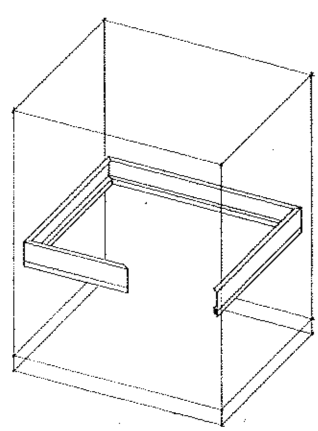
3.4. deurelement. 33



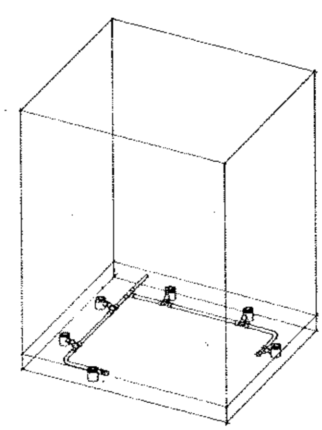
4. plafondelementen 30, 60, 80 35



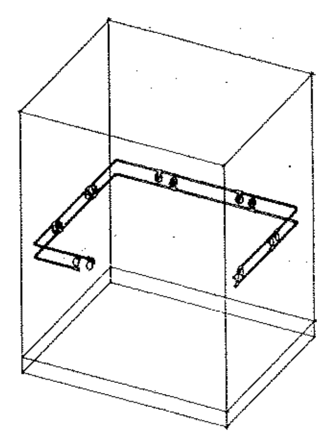
5 dampdichtezak. 39



6. leidingdrager 41



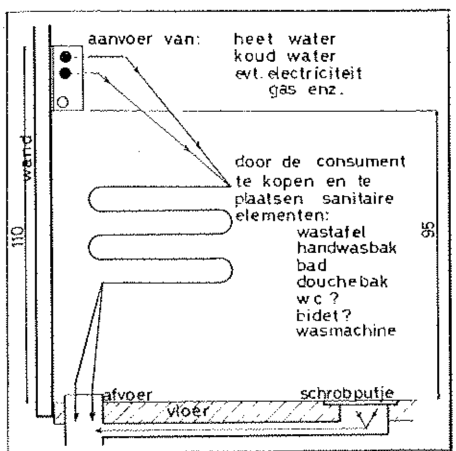
8. afvoerleiding 47

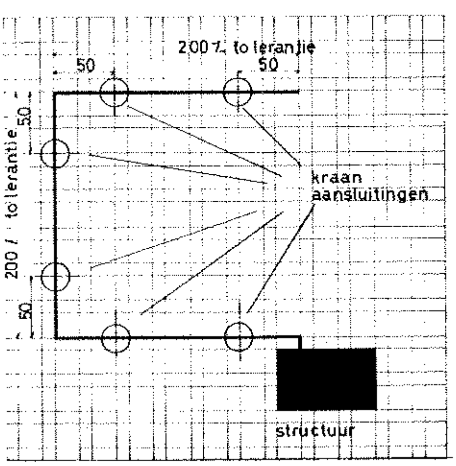


7. aanvoerleidingen 44

*Illustratie 5.5.*
*Schematische weergave van het principe van leidingbeloop in het onder 6.4. geïllustreerde sanitaire celsysteem.*

*Illustration 5.5*
*A schematic representation of the principle of piping in the sanitary cell system illustrated under 5.4*




## normstelling

De ontwikkeling van een taal zoals ook de ontwerpmethodiek een taal is, heeft alleen zin wanneer die taal de gelegenheid biedt om kwaliteitswaarden te hanteren.
Als het alleen gaat om de maat terwille van de maat, of om de techniek terwille van de techniek zijn een modulair stelsel en berekeningsmethoden voldoende. Maar een modulair stelsel en berekeningsmethoden zijn een ontwerpmethodiek is dat overwegingen ten eeen ontwerpmethodiek is dat overwegingen ten aanzien van de kwaliteit van een bouwwerk, de gebruikswaarde en ruimtelijke relaties neergelegd kunnen worden zodat ze voor anderen begrijpelijk zijn en beoordeeld en bediscussieerd kunnen worden.
De grondslag van de ontwerpmethodiek van de SAR was gelegen in de behoefte om te kunnen praten over de kwaliteit van de woning in een nieuwe context. Voor het ontwerpen van een structuur waarin men 'flexibele' plattegronden kan formeren is geen ontwerpmethodiek nodig. Dan kan men volstaan met een modulair stelsel. Maar om een drager te ontwerpen, uitgaande van een bepaald normenpatroon ten aanzien van de woningen die daarin gemaakt kunnen worden, is meer nodig. Om een drager te ontwerpen op een zodanige wijze dat men kan vaststellen dat in die drager woningen in allerlei variaties gemaakt kunnen worden die allen voldoen aan een tevoren bepaald normenstelsel is een ontwerpmethode nodig.
Hier ligt de essentie van het ontwerpproces. In een ontwerpproces worden verlangens, die betrekking hebben op het menselijke gedragpatroon, omgezet in exacte aanwijzingen omtrent de maat en de positie van het materiaal. Een plattegrond die 'goed' is, is een plattegrond die naar ons oordeel voldoet aan een bepaald normenstelsel dat betrekking heeft op het gedrag van mensen. Maar een drager wordt niet gekenmerkt door een plattegrond maar bevat de mogelijkheid voor een grote reeks van mogelijke plattegronden. Voor het ontwerpen van een drager is het dus nodig dat het normenstelsel waaraan al die plattegronden moeten voldoen vertaald wordt in een exacte aanwijzing over de plaats en de maat van materiaal waaruit de drager wordt samengesteld.

Wanneer een zône in het algemeen iets vastlegt over de positie en de afmeting van een bepaald soort vertrekken is met het bepalen van die zône een norm vastgesteld voor deze soort van vertrekken. Wanneer verschillende zônes met elkaar worden gecombineerd wordt daarmee in het algemeen een norm vastgesteld voor de relatie van de bepaalde soorten vertrekken met elkaar. Wanneer men op basis van zônes en marges een afspraak formuleert voor de positie van sanitaire cellen, kastenwanden of andere voorzieningen houdt zo een afspraak tegelijkertijd een normatieve bepaling in.
Dit betekent dat het werken met zônes en marges in principe de mogelijkheid biedt om normen vast te leggen waaraan reeksen van plattegronden moeten voldoen. Wanneer de architekt de vertaler is van kwalitatieve waarden in bouwkundige vorm betekent dit, dat zônes en marges hulpmiddelen zijn voor het architectonische denken.
Deze overwegingen maken duidelijk dat het werken met de spelregels van de SAR een teleurstelling wordt voor een ieder die hoopt op een automatische handelwijze die hem

## setting the standard

The development of a language like that of designmethodology only makes sense when it creates an opportunity for communicating about qualities. If it is only concerned with dimensions for dimensions' sake or technique for technique's sake then it would be sufficient to have a modular system and some methods of calculation. But these of course do not constitute a designmethodology. The essence of a designmethodology lies in the fact that considerations regarding the quality of the building, the utility value, and the spatial relationships can be put forward in such a way that they are intelligible to others. And thus are open to discussion and judgement.
The basis of the designmethodology of the S.A.R. lies in the need to communicate about the quality of a dwelling in a new context. In the designing of a structure capable of holding 'flexible' floorplans a designmethodology is not necessary. In that case a modular system is enough. But more is needed when designing a structure based on a definite set of standards as regards the dwellings it can hold. Then a designmethod is necessary so that it can be determined beforehand that a structure is capable of holding a great variety of different dwellings all meeting the requirements of a previously stipulated set of standards.
Herein lies the essence of the designprocess. During the process of designing the pattern of human behaviour are transformed into precise instructions about the size and the position of the materials. A good floorplan is one which according to our judgement meets the requirements of a certain system of standards as regards human behaviour patterns. However a support structure is not characterised by a floorplan, but by the possibility of holding a great serie of possible floorplans. Consequently in designing a structure is necessary for the set of standards, which all those floorplans have to comply with to be translated into precise directions about the size and the place of the materials used in its construction.

When a zone determines in general on the position and the size of a certain type of rooms then a standard has been set for this type of rooms. When different zones are combined then a general standard is set for the relationship between those types of rooms. When on the basis of zones and margins an agreement is made concerning the position of the sanitary cells, the cupboard-units or other provisions then such an agreement does at the same time set a standard. This means that working with zones and margins does in principle create the opportunity of setting standards, the requirements of which have to be met by series of floorplans. If the architect can be considered the translator of values into their architectural shape, then this means that zones and margins can be used as tools in this process.
These considerations make clear that working according to the S.A.R. rules will be a disappointment to anyone hoping for an automatic procedure to relieve him from the obligation of giving a qualitative judgement. The S.A.R.-methodology is only a useful tool in the hands of him who feels the need to make his qualitative judgement so clear to others, that they can work with it and thus it can be open to discussion.

ontslaat van de verplichting om een kwalitatief oordeel uit te brengen. De SAR-methodiek is alleen een bruikbaar hulpmiddel voor diegene, die de behoefte heeft zijn kwalitatieve oordeel zo expliciet te maken dat anderen er mee kunnen werken en dat er over gesproken kan worden.

*Illustratie 6.1*
*Dit fragment uit een intern rapport geeft een globale opsomming van vier soorten kwaliteitseisen. Hier wordt voor het eerst de behoefte aan verandering als een kwaliteitseis naar voren gebracht.*

*Illustration 6.1*
*Part of an internal report made for the ward of management of the S.A.R. — november 1966. It gives a rough enumeration of four of the types of qualities needed. In this report the first time the desire for change has been put forward as one of the qualities needed.*

I. SOORTEN KWALITEIT EN HUN ONDERLINGE RELATIE

De kwaliteitseisen die men in verband met de woningbouw zou kunnen formuleren, laten zich verdelen in vier soorten, die afzonderlijk beschouwd kunnen worden. Deze vier kwaliteitsgebieden zijn:

1. kwaliteitseisen verband houdende met ruimte behoeften;
2. kwaliteitseisen verband houdende met voorzieningen;
3. kwaliteitseisen verband houdende met de woonomgeving;
4. kwaliteitseisen verband houdende met behoefte tot verandering.

Hieraanvolgend worden deze vier soorten kwaliteitseisen in het kort toegelicht.

1. Kwaliteitseisen verband houdende met ruimte behoeften.

Dit zijn de kwaliteitseisen, waarin wordt geformuleerd welke afmetingen bepaalde vertrekken moeten hebben om de uitoefening van bepaalde functies mogelijk te maken; welke afmetingen nodig zijn voor bepaalde handelingen en bovendien welke relaties tussen verschillende ruimten wenselijk, dan wel niet wenselijk zijn. Het gaat hier dus vooral om die aspecten, die het beste en het eenvoudigste in een tekening zijn vast te leggen. Wanneer men een plattegrond wil tekenen, zijn het in de eerste plaats de onder deze groep vallende eisen, die dan bekend moeten zijn.

2. Kwaliteitseisen verband houdende met voorzieningen.

Met voorzieningen wordt hier eigenlijk datgene bedoeld dat in de door een woning geboden ruimten nog verlangd wordt om het verblijf daarin comfortabel te maken. Sanitair, keuken-apparatuur en bergruimte c.q. kasten zijn alle voorzieningen. Maar ook de maatregelen nodig om een goede geluidsisolatie te bereiken, de aanwezigheid van een lichtnet, gasleidingen, aanvoer van water, afvoer van afvalwater, centrale verwarming en toiletruimten behoren tot de voorzieningen.

3. Kwaliteitseisen verband houdende met de woonomgeving.

Deze eisen hebben betrekking op het milieu waarin de woning zich bevindt. Op de situatie, de bereikbaarheid, de gemeenschappelijke voorzieningen in de vorm van liften, galerijen, trappenhuizen, speelplaatsen, garages en parkeerruimten, vallen eronder alsmede minder meetbare zaken als uitzicht, aangrenzende stedelijke ruimten, verbindingen met werk, winkels, recreatie-gebieden, enz. Kortom de gehele met de woning verbonden zijnde stedebouwkundige problematiek.

4. Kwaliteitseisen verband houdende met behoefte tot verandering.

De behoefte tot verandering en variatie wordt pas betrekkelijk kort als zodanig erkend. Inderdaad worden

No/3 1

worden deze behoeften in het algemeen gesproken in de praktijk van de woningbouw helemaal nog niet als van belang zijnde gehanteerd. Eén van de redenen van de oprichting van de SAR is gelegen in het feit dat architecten deze behoeften zijn gaan herkennen en zijn gaan inzien dat daarvan uit het huisvestingsproces in een nieuw licht kan worden gezien.
Welke kwaliteitseisen in verband hiermede zouden kunnen worden geformuleerd en welke vormen van veranderbaarheid men zou kunnen onderscheiden, wordt in een apart hoofdstuk behandeld. Op dit moment moge volstaan worden met aan te stippen dat het hier gaat om behoeften tot verandering, die zowel kunnen voortspruiten uit individuele verlangens van de bewoner, als wel uit wijziging van de woonopvattingen, uit stijgende welvaart, uit slijtage en veroudering, uit sociale evoluties en uit commerciële belangen.

Overziet men de vier kwaliteitssoorten, die hierboven zijn geschetst, dan wordt duidelijk dat zij niet in gelijke mate de belangstelling genieten van de architecten. Over het algemeen houdt men zich vooral bezig met de formulering van de ruimte behoeften met verwaarlozing van de drie andere gebieden. Men spreekt vooral over de afmetingen van vertrekken en hun onderlinge relatie en het zijn dan ook deze twee aspecten, die zowel in de V&W '65 als in de normstelling, die door Ir. W. van Tijen is ontwikkeld, worden geregeld.

Daarnaast is de laatste jaren een duidelijke groei waar te nemen in de belangstelling voor de behoeften t.a.v. de woonomgeving. Natuurlijk is de stedebouwkundige problematiek van het wonen allang aan de orde. Maar de meer directe relatie tussen woning en woonomgeving, waarbij deze twee zaken al onverbrekelijk met elkaar verbonden worden gezien, is nieuw. Te veel is de ene kwaliteit behandeld door de architect en de andere door de stedebouwer. Te veel ook is de scheiding tussen gebouw - waarin - gewoond - wordt en de situatie waarin het gebouw staat, als reëel aanvaard. We zijn nog ver weg van een duidelijke formulering van normen op dit gebied af, maar het is onmiskenbaar, dat hier nieuwe richtlijnen worden gezocht. Men kan zelfs zeggen dat de belangstelling van de meeste architecten zeer sterk naar dit gebied tendeert.

Voor wat betreft de behoefte aan voorzieningen kan met zeker recht worden gesproken over een verwaarloosd gebied. Het lijkt mij niet overdreven om te stellen dat in de toekomst vooral de groeiende hoeveelheid mogelijke voorzieningen de grootste invloed zal hebben op de problemen van de woningbouw. Overziet men de geschiedenis van de woningbouw van de laatste 50 jaar, dan is niet alleen waar te nemen dat de woning gemiddeld steeds groter wordt, maar ook dat de ruimte, nodig voor voorzieningen van allerlei aard, relatief nog sterker stijgt. Steeds weer is deze tendens onderschat tot schade van de huisvesting. Toch heeft nu juist het voorzieningen pakket de grootste invloed, niet alleen op de maten van de vertrekken, maar ook op de indeling van de woning. De groei van de keuken-apparatuur is maar al te bekend.

No/3 2

Steed zijn keukens gemaakt, die spoedig onvoldoende bleken. De centrale verwarming is een ander voorbeeld. Binnen enkele jaren zal deze voorziening vanzelfsprekend zijn, hetgeen wil zeggen dat geheel andere plattegronden mogelijk worden. De televisie is een voorziening, die nog steeds niet geheel gepeild is ten aanzien van zijn invloed op het woonpatroon en dus de plattegrond. De wasmachine vindt men nu nog in de keuken of de badkamer, maar straks wordt de kleine aparte wascel normaal (Nu reeds binnengesmokkeld in de woning van de woningcyclus in het Bouwcentrum). Ook is er niet veel fantasie voor nodig om te voorspellen dat de sanitaire voorzieningen zich zullen gaan verspreiden over de woning. Reeds nu krijgt bij de grotere woning de ouderslaapkamer een eigen wasbak. Straks zal dit ook gelden voor de kinderkamers. Naast de badcel zal de extra douchecel, verbonden met een slaapkamer, zijn intrede doen. Tenslotte is de hoeveelheid bergruimte een factor. Niet alleen zal er een groeiende behoefte zijn aan een flinke inpandige bergruimte, daarnaast zal ook het aantal kasten zeker sterk stijgen onder invloed van de stijgende hoeveelheid goederen, die men zich kan aanschaffen voor incidenteel gebruik (Zomer- en winterkleding, kampeer- en sportuitrusting, enz.).

Het is op zichzelf wel verklaarbaar waarom dit gehele gebied van behoeften zoveel minder in de discussies is dan de ruimte behoeften op zichzelf. De vraag hoe groot een vertrek moet zijn om daarin bepaalde handelingen te verrichten, kan worden beoordeeld uit betrekkelijk objectieve maatstaven, die worden gevonden uit de studie van de maten van de mens, uit de ruimte die hij nodig heeft om te staan, te liggen, te zitten, te lopen, te wonen, enz. Deze gegevens zijn als onveranderlijk te beschouwen en bieden dus een basis voor berekening. De discussie kan zich toespitsen op de extra ruimte die daaraan toegevoegd kan worden, maar het minimum is in grote mate bepaalbaar vanuit te formuleren uitgangspunten. Ten aanzien van de voorzieningen is dat anders. De hoeveelheid voorzieningen is niet afhankelijk van de menselijke maat, maar van de welvaart en van de initiatieven van een samenleving, die juist op dit terrein zeer expansief is. Bovendien zijn de vragen die zich hier voordoen, sterk gebonden aan de bewoner zelf. Een groeiend voorzieningen pakket betekent keuze mogelijkheid. Keuze ten aanzien van wàt men hebben wil (wasmachine in keuken of badkamer of wascel; bad of douche), maar ook ten aanzien van de verdeling van dit pakket in de woning doet het aantal bruikbare variabelen zodanig stijgen, dat in algemene zin geen eenduidig antwoord mogelijk is over wat "de woning" hebben moet. Daarbij komt dat men hierover wel kan nadenken, maar dat men dan terecht komt in het vlak van de prognose en rekening houden met behoeften voor de toekomst kost geld en ligt derhalve niet in de haalbare kaart van vandaag.
Spreken over voorzieningen is spreken over morgen en spreken over morgen was tot nu toe een weinig vruchtbare zaak in de huisvesting van vandaag.

No/3 3

Het probleem van de voorzieningen leidt dus vanzelf tot het vierde terrein van behoeften en kwaliteiten. Het terrein van de behoefte aan verandering.
Van dit terrein geldt in nog meerdere mate, dat het eerst kort als zodanig wordt herkend. Hoewel het zo langzamerhand "in" is om hierover te spreken, is het nog vrijwel onontgonnen gebied. Het wordt nog hoofdzakelijk betreden met slogans en vage begrippen. Wij kunnen stellen dat het de verdienste van de SAR is, dat deze stichting het eerste lichaam is dat zich tot taak heeft gesteld dit terrein doelbewust te exploreren. Hoe gaan de dingen veranderen? Onder invloed waarvan? In welke mate? Wat betekent dit voor de toekomst? Wat betekent dit voor de mogelijkheden van vandaag? Wat kunnen we in verband hiermee nu doen? Dat zijn de vragen waarmee de SAR zich bezighoudt.

Hieraanvolgend wordt de activiteit van de SAR ten aanzien van de ontwikkeling van kwaliteitsnormen, in het bijzonder voor wat betreft dit vierde gedeelte, nader besproken. In dit hoofdstuk gaat het slechts om de beschrijving van deze vier gebieden in hun onderlinge verband. Dit verband wordt nu toch wel duidelijk in grote lijnen. Pas wanneer de factor "verandering" hanteerbaar is geworden, kan met vrucht verder over de voorziening worden gesproken. Duidelijkheid ten aanzien van de voorzieningen heeft natuurlijk weer invloed op de ruimten waaruit de woning wordt opgebouwd. Er loopt dus een lijn van gebied 4 via 3 naar 1. Dit betekent dat we straks weer meer kunnen zeggen over de ruimte behoeften, wanneer meer bekend is over de kwesties van de veranderbaarheid en de voorzieningen.

No/3 4

*illustratie 6.2*
*Fragment uit een intern raport voor het SAR-bestuur van juli 1965.*
*In dit fragment wordt een poging gedaan een overzicht te geven van de factoren die van invloed zijn op de behoeften die een rol spelen bij de woningbouw.*

*Illustration 6.2*
*Part of an internal report made for the board of management of the S.A.R. — july 1965.*
*Here an attempt has been made to give a survey of the factors which have an influence on the needs playing their part in the building-process.*

De factoren die moeten worden gesignaleerd als mogelijk "producenten van toekomstige behoeften", zijn daarom van tweeërlei soort:

a. De factoren, die rechtstreeks ontstaan zijn uit het expansieve karakter van onze maatschappij;
b. de factoren, die te maken hebben met de achterstand van het huisvestingsproces t.o.v. de totale ontwikkeling van de maatschappij.

De factoren, genoemd onder /a zullen van invloed zijn op de toekomst van onze huisvesting, zolang er sprake is van de expansieve ontwikkeling.
De factoren, genoemd onder /b echter duiden op een storing, die moet worden weggenomen. Wij mogen niet hopen ooit in de behoeften, die verband houden met /a te kunnen voorzien, zolang niet de belemmeringen van /b zijn opgeheven.

De factoren /b zijn dus urgenter, dan die van /a. Maar die van /a zijn niettemin ook zeer urgent. Door eerst na te gaan wat de algemene expansie kenmerkt, is een overzicht van /a nodig. Alleen dit overzicht kan de achterstand waarvan in /b sprake is, illustreren. Daarom is het toch goed /a eerst te stellen in een overzicht van de bedoelde factoren dat hierna volgt.

Ruwweg kan worden gesteld, dat de factoren van /a de opgave weergeven, die de maatschappij stelt aan het huisvestingsproces, terwijl de factoren van /b de gebreken weergeven van het instrument, waarmee de opgave moet worden vervuld. De tekorten van het instrument laten zich pas meten naar de opgave die het moet vervullen.

A. Factoren, die ontstaan uit het expansieve karakter van onze maatschappij.

De technologische ontwikkeling.

Wat morgen mogelijk is, is morgen een behoefte.
Een Amerikaans miljonair heeft eens opgemerkt, dat de rijkdom van een man zich laat meten naar zijn schulden. Iemand, die werkelijk rijk is, is goed voor krediet in enorme bedragen. Schulden in deze zin, betekenen het tegendeel van armoede.

Zo zijn in onze dagen de "behoeften", die kunnen worden gesignaleerd, een maatstaf voor onze welvaart. Men heeft pas een grote auto "nodig" nadat men eenmaal een kleine bezit. Onze welvaart laat zich meten uit een opsomming van onze behoeften. Des te welvarender de technologie ons doet zijn, des te breder kan het front zijn waarop verbetering redelijkerwijs mag worden verwacht en dus wenselijk is. De omvang van onze behoeften is rechtevenredig met ons vertrouwen in de toekomst.
We moeten dus weten wat straks technisch mogelijk zal zijn.

De stijging van de kwantitatieve vraag.
Wat nu mogelijk is, moet morgen òòk mogelijk zijn.
Behoefte ontstaat ook als iets verloren gaat wat men reeds had. Omdat iedereen electriciteit heeft, moet straks iedereen dat ook hebben. De stijging van de bevolkingsgroei kàn met zich meebrengen, dat straks de behoefte ontstaat aan iets, dat nu reeds aanwezig is.
We moeten dus weten hoeveel meer straks nodig zal zijn van wat nu reeds aanwezig is.

De democratisering van de maatschappelijke structuur.
Behoeften ontstaan uit een voorbeeld. De sfeer van onze maatschappij is zodanig, dat wij, wat nu slechts voor enkelen mogelijk is, straks allen willen hebben.
We moeten de privileges van vandaag herkennen als de behoeften van morgen.

De noodzaak tot vervanging van de oude oplossingen door nieuwe.
Behoeften ontstaan soms, wanneer de oude middelen niet meer voldoen in de nieuwe verhoudingen (bv. middelen ten behoeve van de privacy), of wanneer de oude middelen eenvoudig opraken (grond, natuurlijke ruimte). Dezelfde behoeften (aan privacy, aan buitenruimte) zullen dan door nieuwe middelen moeten worden bevredigd. De ontwikkeling van een technologische maatschappij brengt mee, dat steeds minder " vanzelf " gaat, alles moet opnieuw "bedacht" worden.
We moeten weten welke middelen ter voorziening in bepaalde menselijke behoeften vervangen moeten worden door geheel nieuwe.

B. Factoren, die te maken hebben met de achterstand in de ontwikkeling van het huisvestingsproces ten opzichte van de totale ontwikkeling van de maatschappij.

Het gebrek aan inzicht omtrent de gegeven productie-technische mogelijkheden.
Behoeften kunnen ontstaan doordat het productie-vermogen van het productie-apparaat tekort schiet om in de expansieve vraag te voorzien, en omdat het productie-apparaat niet in staat is de groeiende verlangens aangaande het technisch peil en de uitrusting, te voorzien. In een tijdperk waarin overvloedig productie-vermogen een vanzelfsprekendheid schijnt, moet dit betekenen, dat het huisvestingsproces zich bedient van een verkeerd productie-apparaat of in ieder geval, dat er een conflict is tussen dit apparaat en het proces waarvan het deel uitmaakt.
Nog steeds worden de mogelijkheden van industriële productie slechts gezien als hulpmiddel in de bouwproductie, zonder dat wordt gezien, dat de industriële productie-techniek ook rechtstreeks, buiten de bouwproductie om, de huisvesting van de mensen kan dienen.

De afhankelijkheid van het huisvestingsproces van verouderde samenwerkingsstructuren.
Dit punt wordt, evenals enkele andere, apart uitgewerkt. Een enkel voorbeeld van wat wordt bedoeld moge voldoende zijn.
Stedebouwers kunnen nu de uitbreiding van stadsgewesten ontwerpen, die bedoeld zijn om in het jaar 2000 de bevolkingsgroei zodanig op te vangen, dat een gunstige stedelijke structuur ontstaat. Daarmee kan o.a. voorkomen worden, dat een ongecontroleerde aaneenklonting ontstaat van nu nog zelfstandige stedelijke gebieden, maar de groei wordt geleid naar een nieuwe structuur in grotere samenhang dan vandaag het geval is. Echter weten zij nu reeds, dat de nodige stappen van goedkeuringen, onteigeningen, wijzigingen van gemeente-grenzen en uitvoerende bevoegdheden om tot realisatie te komen, reeds meer tijd zullen eisen, dan de 35 jaar die beschikbaar is tot dat deze realisatie voltooid moet zijn.

Hier is dus geen gebrek aan planologie of productie-vermogen, maar onmacht tot realisatie, omdat de legale structuur, die realisatie mogelijk moet maken, een totaal verouderd instrument is. Dergelijke feitelijkheden hebben echter nog niet eens een plaats in de denk- en samenwerkingsstructuren van vandaag. Laat staan, dat deze structuren zich reeds wijzigen. Het resultaat is dus onvoldoende en onjuiste ordening van wat zal worden geproduceerd. Deze onvoldoende kan dan de vormgevers niet verweten worden. Uit onjuiste en onvoldoende ordening ontstaan behoeften.

Deze behoeften zijn des te gevaarlijker, omdat zij in tegenstelling met de andere hierboven genoemde behoeften, door de meeste mensen niet als zodanig worden herkend, maar wel ondergaan worden als een onverklaarde malaise.

Het gebrek aan middelen tot voldoende snelle informatie-verwerking en tijdige besluitvorming.
Echter om de materie te vormen, is niet alleen een goede organisatie-structuur nodig en een minimaal aanwezig potentieel aan vormgevend vermogen. Beiden kunnen in een expansieve, zich voortsnellende maatschappij, pas werken wanneer men de materie, die gevonden moet worden en die in voortdurende beweging is en in voortdurende groei, kan overzien en van dag tot dag dit overzicht in beslissingen kan doen uitlopen. Informatie-verwerking en besluitvorming zijn gebieden, die in de structuur van het huisvestingsproces de grootste aandacht verlangen.

Het gebrek aan inzicht omtrent de grenzen en mogelijkheden van het vormgevend vermogen.
Te zeer bestaat de neiging (vooral bij architecten) om bepaalde problemen op te lossen door een ontwerp, zonder dat de voorwaarden vervuld zijn, die kunnen leiden tot een succesvol ontwerp. Realisering van een materiële omgeving is altijd een kwestie van vormgeving, maar is nooit in de eerste plaats een kwestie van vormgeving. Vooraf zijn bepalend de hiervoor genoemde factoren: technisch vermogen en besluitvorming over de opgave, adequate juridische en organisatorische samenwerkingsstructuren voor alle partijen, die bij realisatie zijn betrokken.

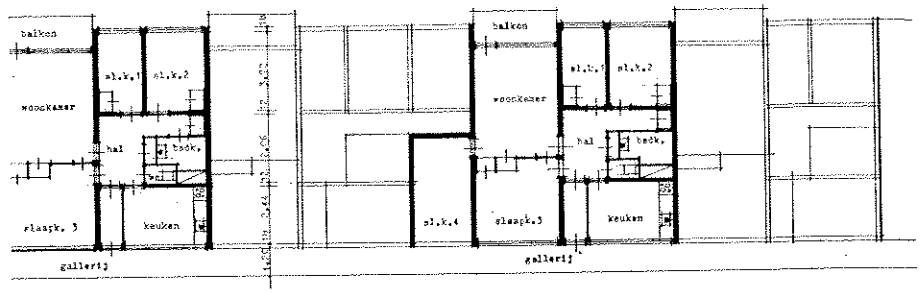
De neiging tot ontkenning, dat er sprake is van een structureel tekort in het huisvestingsproces en de neiging tot handelen alsof er geen sprake is van een structureel tekort.
De hiervoor genoemde factoren zijn onderling afhankelijk.
Het productie-apparaat kan zich niet werkelijk voegen naar de industriële mogelijkheden zolang omtrent deze mogelijkheden onvoldoende informatie bestaat en zolang over deze informatie geen besluiten worden genomen, omdat de bestaande denkstructuren geen ruimte laten om deze informatie naar waarde te schatten.

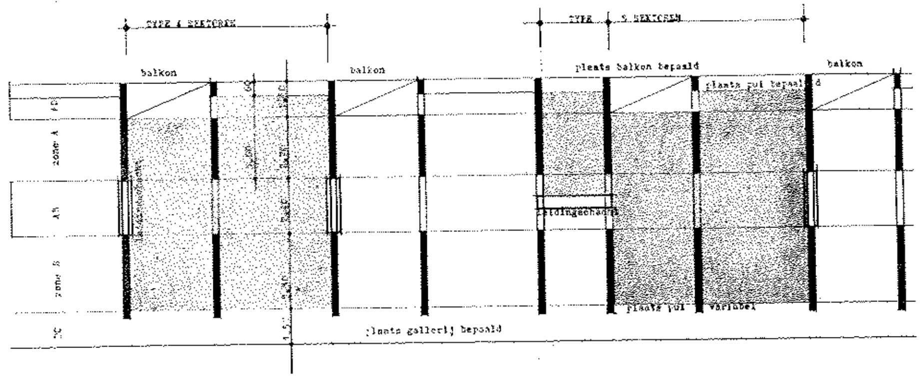
Deze onderlinge afhankelijkheid maakt het onmogelijk, dat men op eigen gebied het probleem oplost. Maar buiten het eigen gebied verlaat men de verhoudingen, waar binnen men met succes zijn brood verdient, en dus is er weinig reden om het bestaan van een structureel tekort aux serieux te nemen.

Dit verschijnsel is ook een gevolg van de expansie. Door de expansie van de maatschappij heeft iedereen genoeg werk. Voldoende werk doet de neiging afnemen tot structurele verbetering van de verhoudingen, waarin gewerkt wordt. Structurele tekorten, die de ontwikkeling remmen, worden zelden aangepakt, voordat zij de ontwikkeling geheel hebben afgeremd. Met andere woorden de mensen wachten liever tot dat bepaalde gebreken van structurele aard de schade hebben veroorzaakt van zodanige omvang, dat werken onmogelijk wordt.

*illustratie 6.3*
*Studie van 8 eerstejaars studenten op de Afd. Bouwkunde, T.H.E. Bestudeerd werd een bestaand flatgebouw te Eindhoven, waarvan werd nagegaan welke alternatieve indelingsmogelijkheden geboden zouden kunnen worden wanneer de flat een structuur zou zijn geweest. Alternatieve plattegrondmogelijkheden werden ontwikkeld in overleg met de bestaande bewoners nadat een analyse van de mogelijkheden door de studenten was verricht.*

*illustration 6.3*
*A study by eight first-year students of the department of architecture — Technical University at Eindhoven. An existing block of flats at Eindhoven was studied. An examination was made of all the various lay-outs, which would have been possible had the block of flats been a support structure. Alternative floorplans were developed in consultation with the present inhabitants after an analysis of the possibilities had been made by the students.*




AFSPRAKEN

ONTWORPEN ZONERING MET STRUKTUURWANDEN

marge AB : plaatsing balkons (plaats balkons gefixeerd)
zone A
marge AB : plaatsing natte cellen
zone B
marge BC : gemeenschappelijk (plaats gallerij)

werkgroep
jones van der heijden
floor mollen
edil poulina
biek van rooij
frank snep
wim teeuwisse
peter verberne
kees de vries

REDEN KEUZE FLAT:
1. 1 woonlaag (onze kennis reikt nog niet verder)
2. veel toegepast i.v.m. huisvesting van veel mensen op klein grondoppervlak.

EEN GALERIJFLAT OMDAT:
ons inziens die de meeste mogelijkheden zou bieden aangezien de entree is aan een zijde variabel ( dit in tegenstelling tot portaalflat).

Na een zeer willekeurige keuze van een galerijflat gemaakt te hebben, zijn de plattegronden en betontekeningen gehaald bij Bouw en Woningtoezicht.

21-11-69
Uitgaande van hetzelfde oppervlak is een nieuwe "struktuur" ontworpen, waarop een goede zonering mogelijk is.
Hierbij kon het bestaande systeem, waarbij alle muren dragend zijn, ook die welke evenwijdig aan de gevel staan, niet gehandhaafd blijven.
Het balkon is echter wel gefixeerd.
Het voordeel van de nieuwe struktuur boven de oude is, dat de eventuele indeling niet eenzijdig is.

[illegible]:
De diepte van het gebouw, 9,10 m., was niet geschikt om een zonering toe te passen van navolgend type:

α-zone
αβ
β-zone
αβ
α-zone

Hiervan uitgaande kwam de volgende zonering tot stand:

α-zone
marge
α-zone

VERSLAG: KONING ARTHURLAAN NO 74

EERSTE BEZOEK: het gezin bestaat uit ouders en twee kinderen, een jongen van 5 j. en een meisje van 3 j.
no 74 is een vijf sektoren type

| | 2.70 | 3.60 | 4.80 | |
|---|---|---|---|---|
| J. | E + B | W / $K_2$ | $S_2$ + $S_2$ / $S_3$ x W | TE KLEINE W IN 4.60 |
| K. | E + B | $S_3$ / $K_2$ | $S_2$ + $S_2$ / W | W TE KLEIN, S2 AAN GALERIJ |

WOON-EISEN:
- grote woonkamer met ligging aan zuidkant en verbinding met balkon
- twee ruime kinderslaapkamers; niet naast keuken, entree of galerij i.v.m. geluidshinder
- slaapkamers moeten bij elkaar liggen
- voorkeur voor relatie ouderslaapkamer-natte cel
- natte-cel: badkuip + wastafel + wasmachine
- eetkeuken; mag open zijn
- relatie keuken-entree niet noodzakelijk
- geen aanrecht onder raam

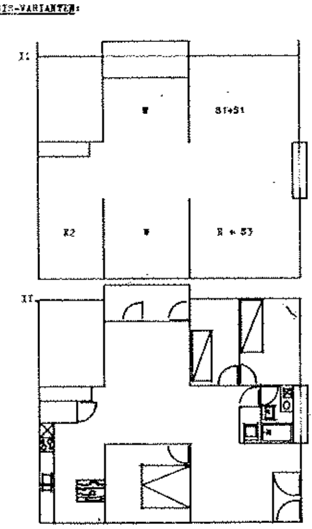
SEKTOR ANALYSE: ruime kinderslaapkamers, daarom geen $S_1$ + $S_1$ in 3,60 sektor geen $S_1$ + E en ook geen $S_1$ + $K_2$

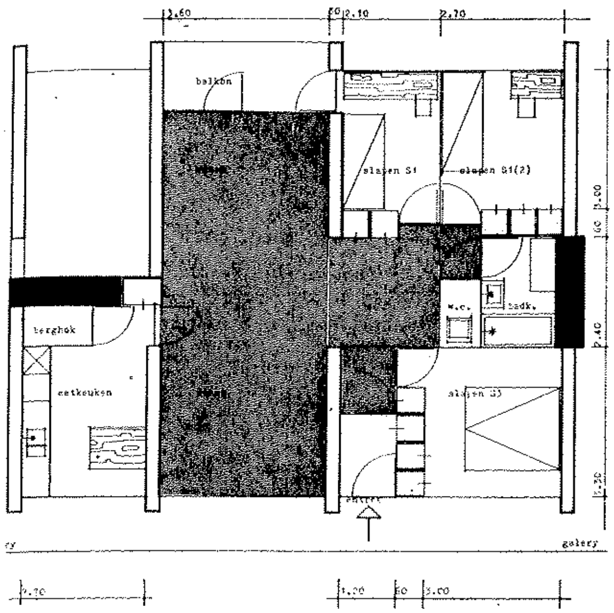
| 2.70 | 3.60 | 4.80 | |
|---|---|---|---|
| $K_2$ | $K_2$ + E | $S_3$ + $S_1$ | $K_2$ x W |
| $S_3$ | W | $K_2$ + E +(Kw) | $S_3$ x W |
| $S_2$ | $S_3$ | $S_3$ + E +(Ew) | |
| E + B | $K_2$ | $S_2$ + $S_2$ | |
| | | W | |
| | | W + B | |

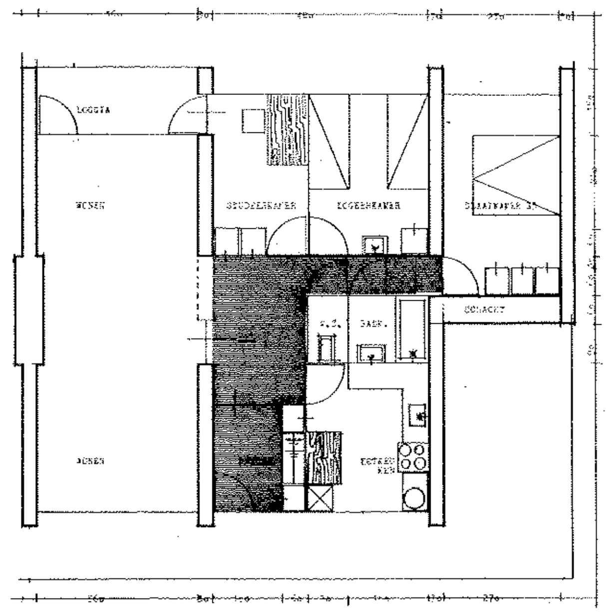
MOGELIJKHEDEN VAN SEKTOREN

| | 2.70 | 3.60 | 4.80 | | |
|---|---|---|---|---|---|
| A | $K_2$ | W / W | $S_1$ + $S_1$ / $S_3$ + E | VOLDOET | |
| B | $K_2$ | W / $S_3$ | $S_2$ + $S_2$ / W + E | " | |
| C | $S_3$ | $K_2$ + E / W | W / $S_2$ + $S_2$ | SLAAPKAMERS VERSPREID | |
| D | $S_3$ | W / W | $S_2$ + $S_2$ / $K_2$ + E | " | " |
| E | $S_3$ | W / $K_2$ | $S_2$ + $S_2$ / W + E | " | " |
| F | $S_2$ | $K_2$ + E / W | $S_3$ + $S_1$ / W | " | " |
| G | $S_2$ | W / $K_2$ | $S_3$ + $S_1$ / W + E | " | " |
| H | $S_2$ | W / W | $S_3$ + $S_1$ / $K_2$ + E | " | " |
| I | E + B | W / $S_3$ | $S_2$ + $S_2$ / $K_2$ x W | TE KLEINE W IN 4.80 | |

BASIS-VARIANTEN:






PROGRAMMA:
gezin bestaande uit ouders, meisje(3), jongen(5).
ieder een eigen slaapkamer met behoorlyke leefruimte.
grote woonkamer.
grote hal (als speelruimte voor de kinderen).
een eetkeuken.
badkamer (met badkuip, wastafel, wasmachine).

woonkamer aan balkon.
slaapkamers en W.C. by elkaar.

±10 kasten, en een berghok.

ZHALEK:

Ir van twee kinderen.
er kind een niet minimale slaapkamer i.v.m.
ctie.
te woonkamer.
l kasten, eventueel kastenwanden.
e vertrekken bereikbaar via de gang.

tafel op iedere slaapkamer.
de badkamer badkuip en douche.

e twee eisen zijn vervallen om technische
enen en in verband met indeling van ouder-
apkamer.

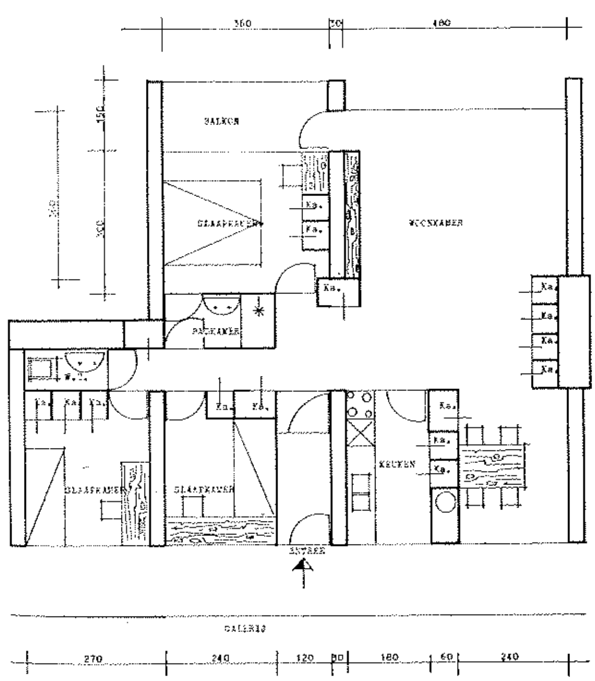
nkamer met avondzon en kinderslaapvertrekken met
tendzon.
n eetkeuken.
nij entree.

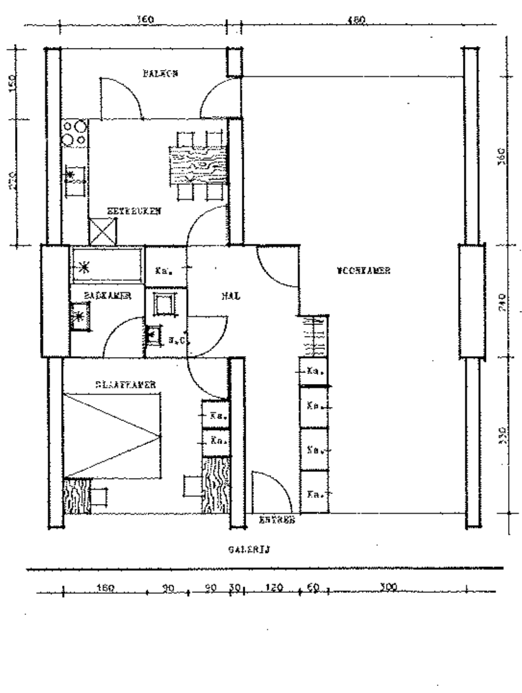
PROGRAMMA :
Gezin bestaande uit man en vrouw
Woonkamer aan Zuidzijde
Grote Ouders slaapkamer
Studeer kamer (minimaal)
Logeerkamer met vaste wastafel
Grote eetkeuken
Keuken gemakkelijk bereikbaar via entree
Wasmachine in keuken
Oudersslaapkamer liefst aan Zuidzijde
Woonkamer aan loggia
Grote woonkamer
Bad-douche combinatie
Alle kamers niet via gang bereikbaar
Keuken aan galerijzijde
Naderhand eis van grote berging

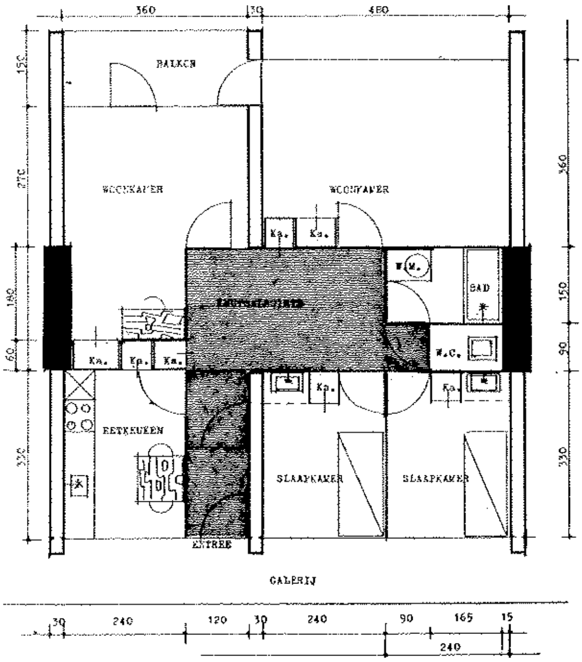
PROGRAMMA:

Bejaard echtpaar
geen kinderen meer in huis

EISEN:
grote woonkamer
grote slaapkamer
hal
alle vertrekken vanuit hal bereikbaar
eetkeuken
liever meer ruimte voor andere vertrekken
als een extra slaapkamer.






PROGRAMMA:

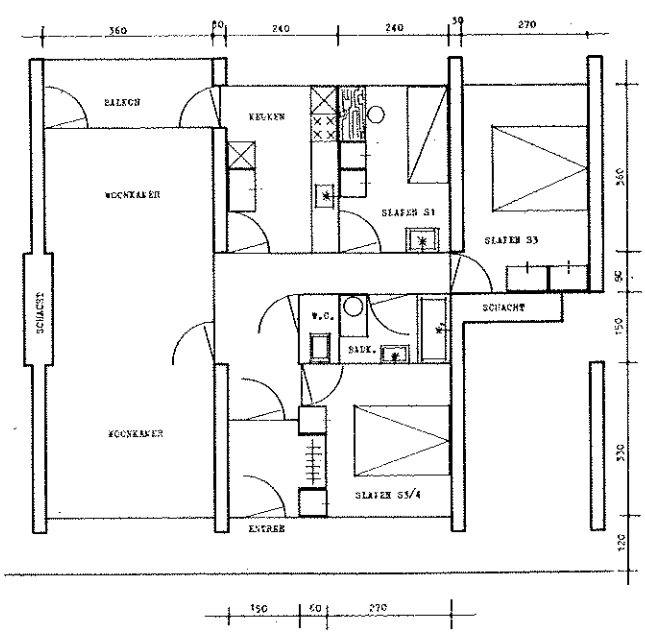
Bewoners: twee vrouwen (ongeveer 25)

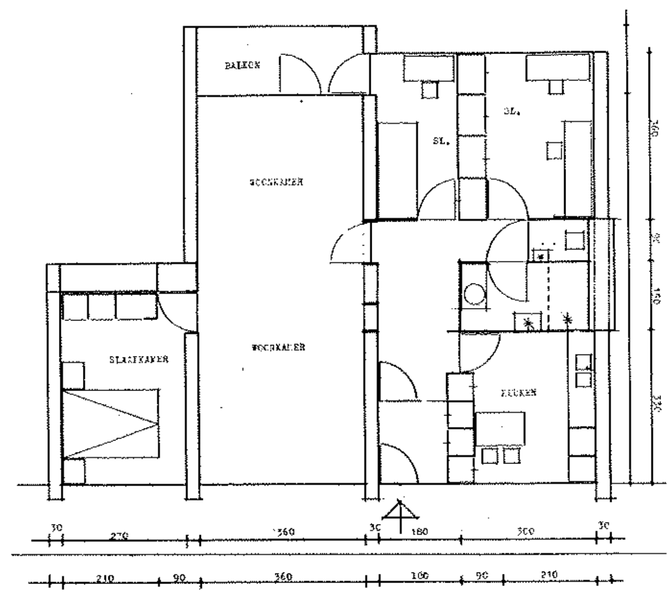
Twee aparte slaapkamers (zonder verblijfsruimte)
Slaapkamers hoeven niet aan het balkon.
Twee gescheiden woonkamers, allebei met studeerhoek.
Indien mogelijk eetkeuken.
Keuken niet in open verbinding met woonkamer.
Beiden woonkamers aan de zuidkant.
Alle kamers vanuit gang bereikbaar.
Grote hal, te gebruiken als knutselruimte.
Geen aparte bergruimte (kasten niet meegeteld).
Op iedere slaapkamer een wastafel.

PROGRAMMA

Bewoners: een echtpaar met één zoon (± 25)

Eisen :
- alle vertrekken vanuit gang bereikbaar
- rechte woonkamer
- brede entree
- ouderslaapkamer
- logeerkamer
- geen eetkeuken
- keuken aan het balkon
- wasmachine in badkamer




PROGRAMMA

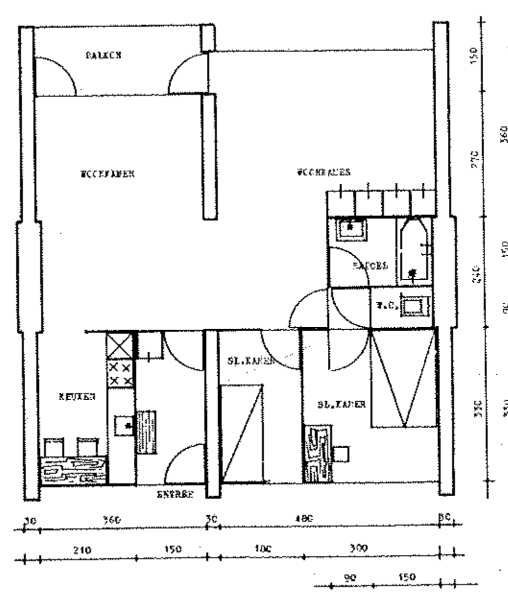
Bewoners: een echtpaar.

Eisen :
- een ouderslaapkamer
- een logeerkamer
- een werkkamer
- een eetkeuken
- keuken niet aan zuidkant dus niet aan het balkon.
- kastenwand. (geen losse kasten)
- lange woonkamer met zo weinig mogelijk hoeken.
- groot entree
- geen bad
- wasmachine in natte cel.

PROGRAMMA:

Bewoners: Een jong echtpaar

Eisen:
- brede entree
- woonkamer in twee sektoren aan zuidzijde
- kleine eetkeuken
- keuken in open verbinding met woonkamer
- zicht op aanrecht vanuit woonkamer niet gewenst
- slaapkamer met bed in de hoek
- eenpersoons-logeerkamer
- Geen ruimte voor wasmachine reserveren



## maatcoördinatie

Een ontwerpmethode heeft tot doel om op systematische wijze beslissingen te kunnen nemen, die uiteindelijk aanleiding geven voor het maken van een bouwwerk. In laatste instantie zullen daarom deze beslissingen betrekking hebben op de afmeting en de positie van materiaal. Het hanteren en coördineren van maten is daarom een onmisbaar onderdeel van een ontwerpmethodiek. Afmetingen en hun onderlinge relatie zijn een belangrijk onderdeel van de taal die de ontwerper gebruikt.
De afspraken over modulaire coördinatie zoals deze na de oorlog internationaal zijn geformuleerd zijn daarom een onmisbare en belangrijke bijdrage tot het voeren van een gemeenschappelijke taal in het ontwerpproces. Het is opvallend hoe vaak de modulaire coördinatie nog wordt gezien als een soort dwangmiddel ten behoeve van industrialisatie en hoe weinig nog wordt ingezien dat het daarbij in de allereerste plaats gaat om een hulpmiddel tot het nemen van beslissingen in teamverband.
Wanneer men werkt aan het ontwerpen van structuren en inbouwelementen moeten de beslissingen van de ene partij (degenen die de structuur ontwerpen) gecoördineerd worden met de beslissingen van de andere partij (degenen die inbouwelementen ontwerpen). Dit geldt vooral ook voor de beslissingen, die worden genomen op het gebied van de afmeting en de positie van materiaal. Beslissingen op het gebied van de afmeting en de positie van structuurmateriaal moeten zo genomen worden, dat zij niet de beslissingen doorkruisen die worden genomen op het gebied van de afmeting en de positie van inbouwmateriaal en vice versa. De positie van het materiaal is bij deze beslissingen nog belangrijker dan de afmeting. De afmeting moet zo vrij mogelijk gekozen kunnen worden mits de positie maar ondubbelzinnig is.
Om dit te bereiken zijn twee hulpmiddelen ingevoerd: het begrip pasmaat en het strokenraster.
Wanneer een ontwerper beslissingen moet nemen over de positie van materiaal moet hij dat vaak doen voordat hij de exacte afmeting van het materiaal kent. Heel vaak zal hij eerst globaal de positie van het materiaal ordenen en pas daarna beslissingen nemen over de laatste centimeters die de afmeting van het materiaal bepalen. Hierbij is een strokenraster een goed hulpmiddel. Het is een strokenraster gemakkelijk om afspraken te maken over de wijze waarop materiaal geplaatst wordt in het raster op een zodanige wijze dat men, zonder precies de afmetingen van het materiaal te kennen, toch al weet wat de minimum en maximum afmetingen van het materiaal in ieder geval zullen zijn. Door middel van een strokenraster kunnen dus de afmetingen van het materiaal binnen bepaalde grenzen worden bepaald wat globaal verder werken mogelijk maakt zonder dat men de laatste centimeter behoeft te weten. Dit kan gebeuren door bijvoorbeeld de afspraak te maken dat het materiaal eindigt in een bepaalde strook òf dat het materiaal ligt in een bepaalde strook. Als men zegt dat het materiaal eindigt in een bepaalde strook, bijvoorbeeld de 10-centimeterstrook in een 10/20-raster, is de positie van het materiaal gemakkelijk te bepalen, terwijl men tegelijkertijd weet wat de minimum en maximum afmetingen zullen zijn die het materiaal kan hebben.
Bij een 10/20-raster, waar het materiaal eindigt in een 10-centimeterstrook, is de minimum afmeting van het materiaal altijd n.x. 30-10 en de maximum afmeting van het materiaal altijd n.x. 30+10.

## dimensional co-ordination

The purpose of a designmethod lies in its systematic approach to decisionmaking leading finally to the construction of a building. Therefore in the later stages these decisions will be concerned with the dimensions and the positioning of the material. Consequently an essential part of a designmethod is the handling and co-ordination of measurement. They and their relationship with one another play an important part in the language of the architect. The conventions concerning the modular co-ordination as laid down internationally after the war are therefore an essential and important contribution to the use of a common language in the designprocess.
It is notable how often modular co-ordination is still considered to be a kind of a coercive measure favouring industrialisation. How little is it realized, that in the very first place this concerns an aid to the decisionmaking in teamwork.
When working on the designs of support structures and detachable units the decisions of the one party (those designing the support structures) must be co-ordinated with the decisions of the other party (those designing the detachable units). This is especially valid in the case of decisions being made about the dimensions and the positioning. Decisions concerning the dimensions and the positioning of structural material have to be made in such a way that they do not cross similar decisions about the detachable units and vice versa. The position of the material in these decisions is even more important than its size. As long as its position is clear one must have as free a choice as possible in the matter of its size.

In order to attain this end, two aids have been introduced: the 'fitting dimension' and the tartangrid.
When making decisions about the positioning of the material an architect frequently has to make them before knowing the precise in measurements of the material. Very often he will first roughly plan the positioning of the material and only afterwards decide upon the last centimetres determining its exact measurements. In such a case a grid can be a great help. For in using a tartangrid it is easy to decide upon conventions about the way material is placed in the grid so that without being exactly acquainted with the measurements of the material their minimum and maximum measurements will in any case be known. Thus by means of tartangrid the measurements of the material can within certain limits be decided upon. This permits a continuation of the designprocess without having to know the measurements down to the last centimetre. For example by agreeing on where material will end in a certain band or on material being situated in a certain band this can be brought about. If it is said, that material should begin and end in a certain band, for instance the 10-centimetre band in a 10/20 grid, then the position of the material is easily determined while at the same time the minimum and maximum dimensions of the material will be known. In a 10/20 grid when the materials begin and end in a 10-centimetre band the minimum dimension of the material will always be n. x 30 - 10 and the maximum n. x 30 + 10.
When the convention has been established that the material will be situated in a certain band then at the same time its maximum dimension

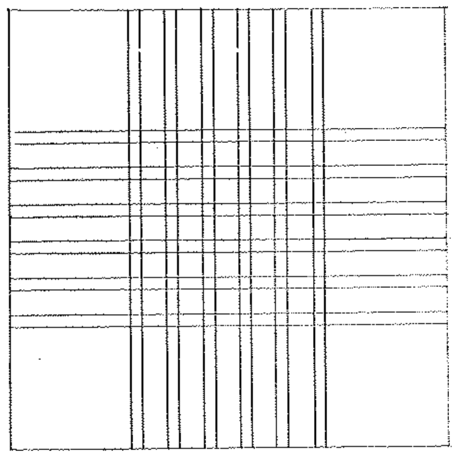
Wanneer men afspreekt dat materiaal ligt in een bepaalde strook is daarmee de maximum afmeting van het materiaal gegeven. Die maximum afmeting is òf 10 cm òf 20 cm in een 10/20-raster. Hierdoor biedt een strokenraster de gelegenheid tot een globale positiebepaling van materiaal waardoor gemakkelijk beslissingen over de positie genomen kunnen worden, terwijl men de zekerheid heeft dat men later bij meer exacte dimensionering binnen de gestelde marge nog allerlei beslissingen kan nemen.

De pasmaat is een hulpmiddel om de exacte afmeting van het materiaal weer te geven. De pasmaat geeft namelijk de afmeting van het materiaal tot de eerstvolgende rasterlijn. Met behulp van de pasmaat is in een gegeven raster het materiaal geheel ondubbelzinnig en exact in positie en afmeting bepaald. Wanneer men werkt in een strokenraster met behulp van de hierboven gegeven afspraken voor positiebepaling, is tegelijkertijd bekend wat de minimum en maximum afmetingen van een pasmaat kunnen zijn. Wanneer bij het ontwerp van een structuur de pasmaat gegeven is, weet de volgende partij (die de positie van het inbouwmateriaal moet bepalen) precies welke ruimte nog beschikbaar is. De pasmaat is dus een hulpmiddel om beslissingen van de ene partij ten aanzien van de maatvoering van materiaal door te geven aan de andere partij.

□

is made known. The maximum dimension in a 10/20 grid is either 10 centimetre or 20 centimetre. In this way a tartan grid makes it possible to arrive at a rough positioning of the material so that decisions about it can easily be made, while it is absolutely certain that in later stages during a more precise sizing within the given margin all kinds of decisions can still be settled.

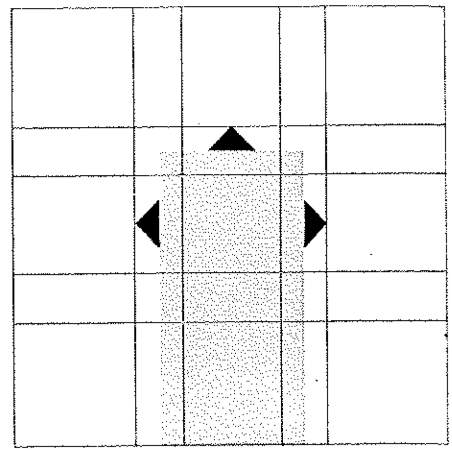
The fitting dimension is a tool in rendering the precise dimensions of the material. For the fitting dimension gives the measurements of the material to the next line in the grid. Thus by the aid of a fitting dimension the material in a given grid is defined absolutely and precisely as regards its positioning and its dimensions. At the same time the possible minimum and maximum measurements of the fitting dimension will be known when a grid is used with the help of the above mentioned conventions concerning its positioning. When in the design of a support structure the fitting dimension is indicated, then the next group (those having to decide upon the position of the detachable units' material) knows exactly whatever space is still available. Thus the fitting dimension is an aid in passing on decisions of the one group as regards the sizing of the material to the other group.



*illustratie 7.1*
*Het door de SAR voorgestelde maatraster is, horizontaal gemeten, een strokenraster met stroken van 10 en 20 cm om en om.*
*Door middel van dit strokenraster zijn afspraken te maken over plaatsbepaling en maatvoering van structuurmateriaal en inbouwmateriaal. Een strokenraster vergemakkelijkt dus het formuleren van afspraken over plaatsbepaling en maatbepaling.*
*Het maakt bovendien plaatsing en ordening van materiaal mogelijk voordat de afmetingen van het materiaal nauwkeurig bekend zpn. (globale benadering van het ontwerp).*

□

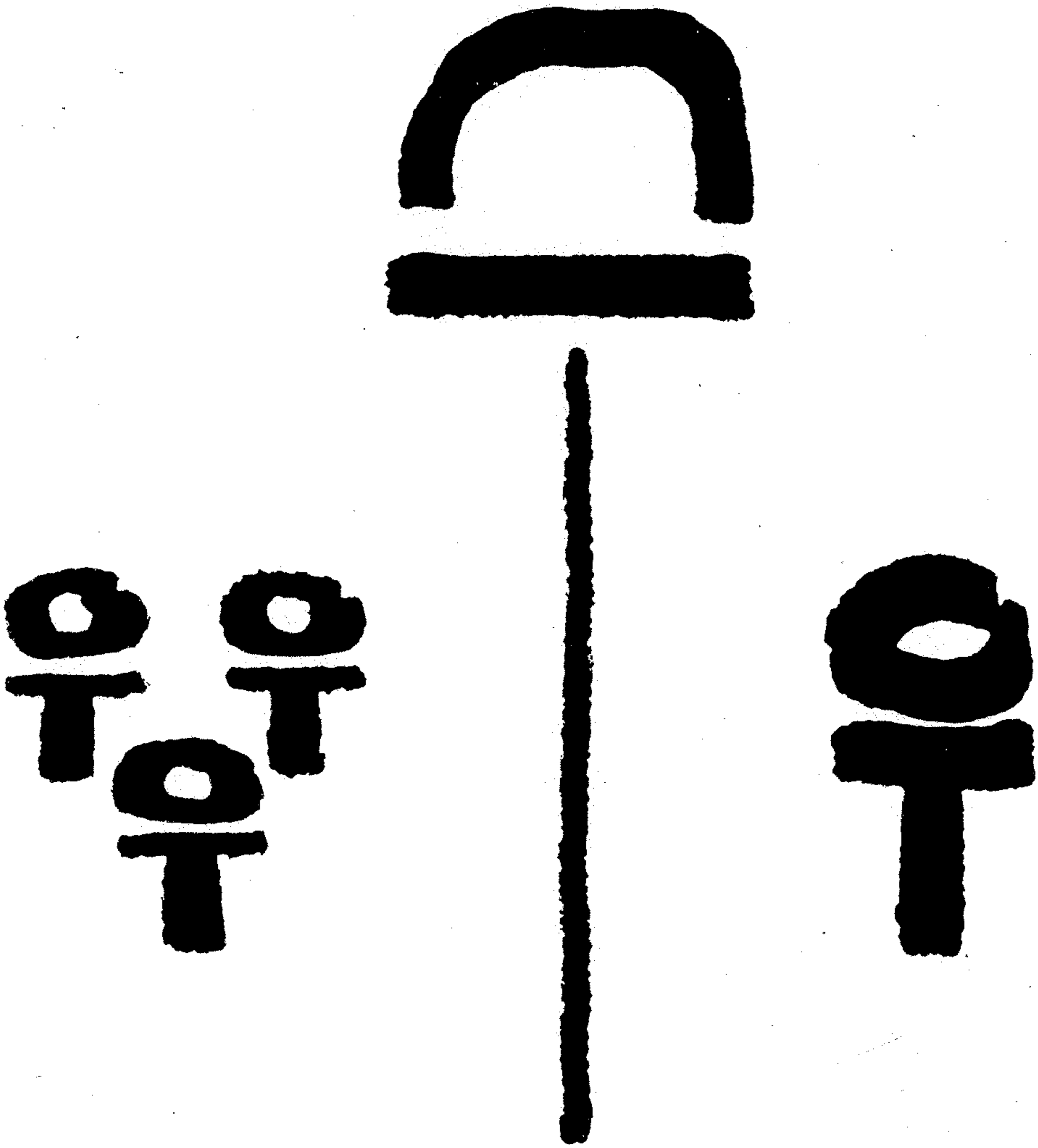
*Illustratie 7.1*
*The grid proposed by the SAR, measured horizontally, is a strip grid with alternate strips of 10 and 20 cm.*
*Using this grid, pre-arrangements can be made about positioning and dimensions of structural material and material to be built-in.*
*Thus a grid facilitates the formulation of agreements about positioning and dimensions.*
*It also makes it possible to determine position and arrangement of materials before their precise dimensions are known (broad approach to the design).*

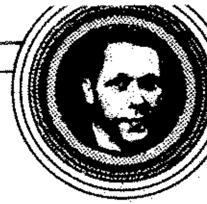


*illustratie 7.2*
*De pasmaat is de afstand tussen de grootste grensmaat van het structuurmateriaal en de eerstvolgende rasterlijn.*
*De pasmaat maakt het mogelijk de afmeting van het inbouwmateriaal altijd af te stemmen op een modulaire ruimte in een woonstructuur.*
*Het is mogelijk het inbouwpakket te stellen tot in de 10 cm-strook waarin ook het structuurmateriaal eindigt.*
*Het eventuele passtuk voor de aansluiting van het inbouwpakket op het structuurmateriaal is dan niet gelijk aan de pasmaat.*
*Omdat het structuurmateriaal eindigt in de 10 cm-strook varieert de pasmaat tussen 0 en 10 cm.*
*De pasmaat maakt het mogelijk om niet modulair structuurmateriaal in een modulair raster te plaatsen.*
*Inbouwelementen en structuur kunnen onafhankelijk van elkaar worden ontworpen en gedimensioneerd omdat het gebied bekend is waarin zij elkaar zullen ontmoeten en tevens de variatie in afmeting van dit gebied bekend is.*

□

*Illustratie 7.2*
*The insert measure is the distance between the maximum limit of the structural material and the next grid line. This insert measure makes it possible to always attune the dimensions of materials to be built-in to a modular space in a dwelling structure. The material to be built in can be extended into the 10 cm-strip in which the structural material also ends. Then any fitting-piece for fitting the built-in material to the structural material is not equal to the insert measure.*
*As the structural material ends in the 10 cm. strip, the insert measure varies between 0 and 10 cm.*
*The insert measure makes it possible to place non-modular structural material in a modular grid.*
*Built-in elements and structure can be designed and proportioned independently of each other, because the area in which they will meet is known, as well as the variations in the dimensions of this area.*





# Playing games

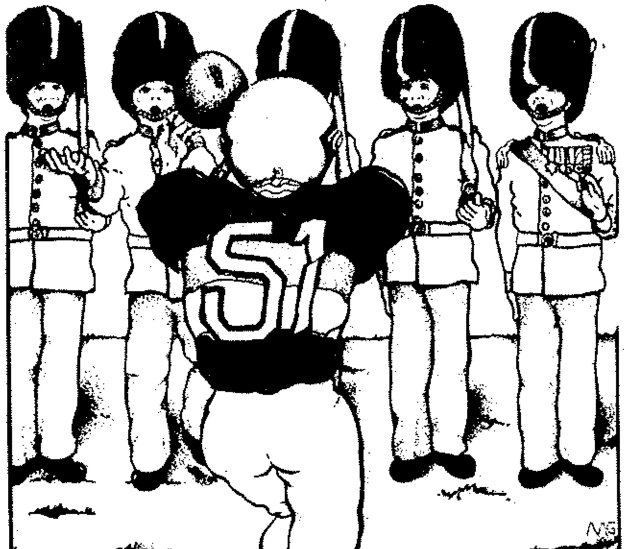
John Nikolaas Habraken

A book I wrote, *Supports and the people*[1], provoked interest; stirred by this interest a group of architects got together to do something about housing. We were fed up with the way things were going, we felt that the machinery of housing and technology did not produce the kind of hardware that people needed. We felt that architects had to play a role, and that they had no opportunity for doing so. So we created a small foundation, and pooled some money to do housing research. When we started, we had a very clear idea of what we wanted to do, based on the idea of support structures and detachable units. We wanted to prove that they could be made, we wanted to show that the individual could be a participant in the housing process.

Six years later we still continue; no one quite knows how, because there is no finance, but SAR (Stichting Architecten Research) goes on, and a lot of work remains to be done. We realised that if you want to involve the householder in the housing process, and you can do it by building support structure (some kind of building in which he can do something himself, in which he can be responsible for his own dwelling), you do not have to design. The problem is not one of design in the first place; it is a problem of changing the role of the people involved in the housing process. The dwelling is not the result of an architect making a design; it is the result of many, many specialists, and many other people acting and making decisions; out of that comes the dwelling. And if you want to do away with the dwelling and you want to make support structures and involve the householder himself, then you need some kind of common ground to act on, some kind of co-ordination. That is why we decided in the beginning to propose a set of rules that the architect should follow, to make it possible for the dweller to be a participant in the housing process.

These rules have been developed, and we have been working with them ourselves, and perhaps they have been developed into what you might call a methodology. This is a technique itself, and it is a tool. We need that tool if we want to change

**J. Nikolaas Habraken:** Born Indonesia 1929, studied at Delft Technical University, 1948-55, taught there 1958-60, worked for J. F. Berghoef and later Lucas and Niemeyer, now chairman of the Faculty of Architecture at Eindhoven Technical University and research director of the SAR (Stichting Architecten Research). See AD 1/70 p.32-38.



the process, but the danger is that people concentrate on the technique and the methodology, and become so involved with it that they sometimes forget what it was developed for in the first place. So before we talk about methodology we have to get back to the basic idea of why we want to use these tools, and what is it all for.

When we started we did not realise how difficult it is for people to change their roles, and the more we progress and the more pilot projects we embark on — builders are now interested in thinking in this way, investment people are starting to think in this way, industrialists are trying to work out proposals — the more we realise that people have to change their way of thinking. It is not a matter of technology. It is a matter of people knowing what they want to do and why. We did not realise in the beginning how much the whole process of co-ordination of all the parties involved would be affected. If we make proposals, plans and drawings, we say 'This is what it is going to look like' — and you need to do this to convince people, but what you actually do is something else.

Suppose you have a field, and in this field soldiers are on parade. There are people moving in the field. There is an organised structure of decision-making — the general at the top, and a chain of command going on down to the soldiers. Everything is organised. People know how to make decisions, what language to use, what they can do, and what they cannot do. Now throw in a ball and let the soldiers play soccer. Change the whole thing. Throw in a ball so that the people in the field will move differently. For the general on the sidelines it represents chaos; even for somebody who does not know soccer it is chaos, because he only sees people running around kicking a ball, and he sees no organisation or meaning in it.

But if you know the rules of the game you recognise the organisation and it has a meaning. To play the game you have to change the structure, you have to change everything from top to bottom. That is actually what we are going to do, which we cannot control from the evolve different kinds of movements which we cannot control faom the outside. I cannot control a soccer game from the outside. I can be a referee, or I can be a trainer; but once the ball is there and the people start playing, it goes on and one cannot predict in detail what will happen. That is what we want to do in housing.

How do you change the game. You can't just throw in a ball, because nobody knows the rules. You can talk about a different kind of game; you can talk to the people involved and say, "You should do it differently". They will ask "What do you mean?" They want us to show them what to do; but the demonstration can only be made by other people acting, not by making a drawing of a soccer game. I can choreograph a parade, but not a soccer game.

Now we need two things. We have to know and use the rules of the new game, and we have to be ready so that when people start asking questions we can answer them. This is very difficult, both for the people and for us, because we are conditioned by the decisions we make and the roles we play.

The basic dilemma of designers or architects, or whatever we call ourselves, is that we are frustrated because we discover that we don't want to operate in the game. Some of us would like to persuade people to play a new game: this means that we must go into the decision-making process, into politics. Others are more inclined to professionalism: how to design support structures; how to design in such a way that the individual can be involved; how to design in such a way that industry can make things in which the individual can be involved with the builders, and build things in which the individual can be involved. The danger is that these two aspects do not unite. What we need is people who can operate in both fields, people who know how to do it, and people who know why.

At the SAR we concentrated very much on the professional role; now we are concentrating hard on the other. We have made posters, and we are making more. We are approaching politicians. We are approaching all the decision-makers because now we are sure that we know what to do and how to do it. In Holland persuasion is difficult. Everything is organised. You have neat houses, whose tenants have each signed a contract undertaking that when the lease ends the house will be exactly as it was when he moved in. The organisation that leases the houses even provides nameplates, because all nameplates must be the same. They will even fix the colour of the blinds. I know of one area where people have to take all the plants out of their gardens when they move, because their gardens had no plants when they moved in. Try to tell people who organise like this that individuals should be involved; or talk to a builder, or the investment people. Their reaction is the same.

Other people in other countries have worked hard to involve the people. In 1945, in Egypt, Hassan Kahn found that houses could be built of clay baicks in a traditional way, and that the houses were cheaper and better than any others. They could be built by the people themselves. He managed to build a village, but he describes in a book the tremendous opposition it raised. He went no further, because the whole bureaucracy and the professionals were against him, not because he was building cheap houses, but because he was challenging their image of a new world. That is something you may not do, but you will have to do.

[1] *De Dragers en de Mensen.* Scheltema and Holkema N.V., Amsterdam 1961. (See *AD* 1/70)

*Supports.* Architectural Press, 1972. £ 2.25 or £ 1 (soft back).

# Involving people in the housing process

N. J. Habraken

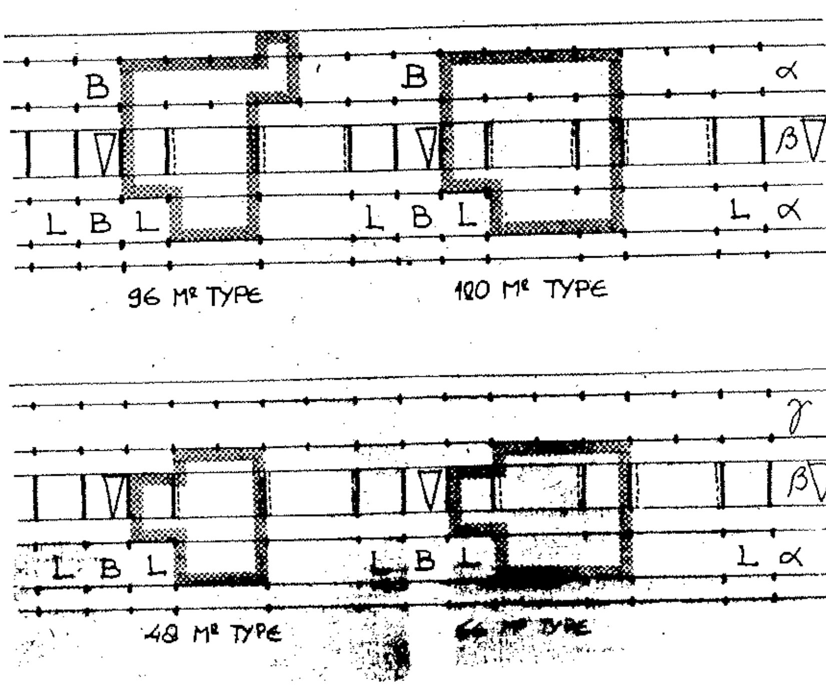
**The housing process simply doesn't work if the occupants are not involved, says N. J. Habraken, author of *Supports* (Architectural Press, available from the RIBA Bookshop price £1, p & p 10p). And the people who have specialist roles in the process – pre-eminently architects – cannot act properly if the dweller does not also play his role. This is an edited version of a talk given at the RIBA on 18 April**

At SAR for about six or seven years, we have been trying to make a philosophy work. This philosophy is based on the idea that the housing process can develop further and be a good process only if the occupants are personally involved in that process. I am not going to try to argue this philosophy, but I would like to say that this involvement is, in my opinion, necessary not only because the occupant ought to be able to make decisions about his dwelling, its equipment and interior spaces, and, if you like, be able to identify with his direct environment (all this, of course, is most important), but for many other reasons.

The main reason, perhaps, is that the process simply does not work if the occupants are not involved, and the people who have specialists' parts in the process cannot act properly if the dweller does not also play his role. One aspect of this philosophy is that we believe that the technical solution – production – is not possible if the user is not involved. This seems a paradox, because the whole housing process as it works now is based on the simple assumption that you can work if you leave the occupant out of decision making. If you accept this, the whole process as we see it today is logical and it hangs together, but if you want to introduce the occupant, the whole thing has to be rethought and each part of it has to be reconsidered.

But it is not a paradox that you can use industry or technology properly only if you start by thinking about involving people. One might argue that if that were not so, we would already have adequate industrial production of housing (which at this moment is a problem) and so would have enough houses, because wherever industrial production really works, we have too much and not too little.

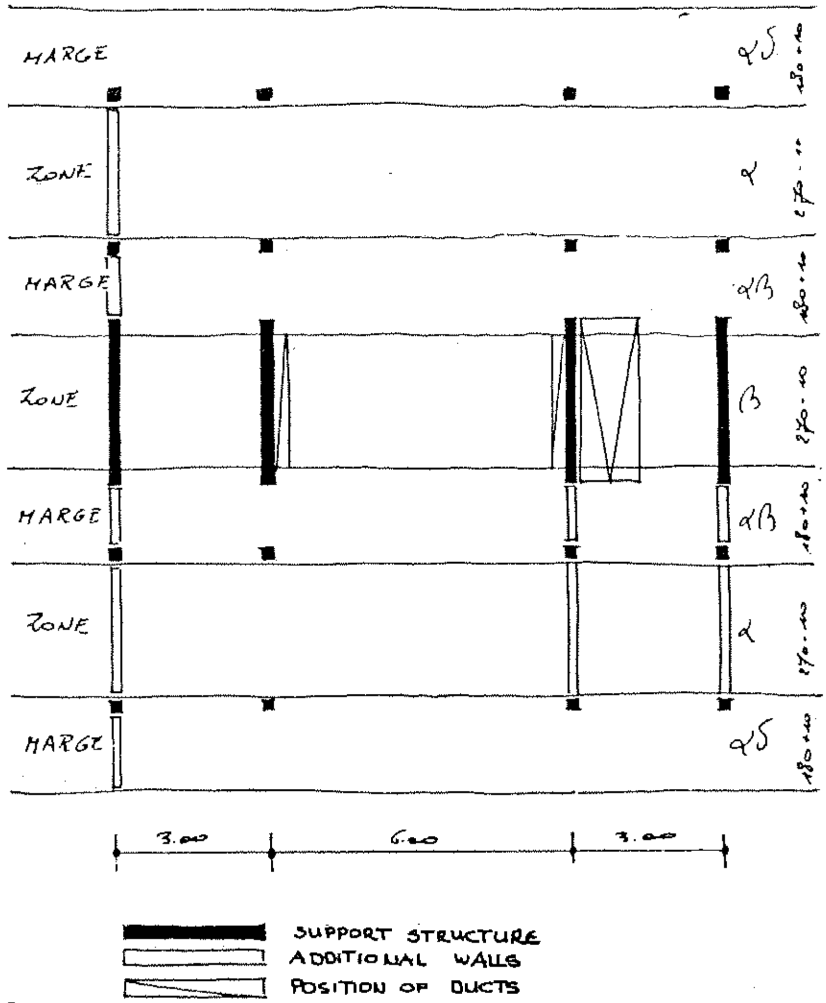
So one argument for trying to start from the other side by thinking about the occupant himself is that we might be able to solve our problems better. This also applies to the architect. In fact, we started SAR because we believed that the architect should take the initiative. Whatever you may say about him – and a lot of criticism, of course, is possible – he is still the one person who tries to bridge the gap between human needs and technical possibilities. He is trained to think in these two worlds, and he tries very hard to do so. So if we believe




1 Principle of Amsterdam project. Lower part gives ground floor with sheltered pedestrian circulation (γ) leading to stairs that give access to dwellings on second and third floor. Upper part gives second and third floor. Spans are 3m and 6m. Sectors marked B are for storage. Dotted lines in ß zone give place for vertical ducts. Different possible sizes of dwellings are indicated

2 Principle of loadbearing system and zoning of support. Ducts are near walls in ß zone. Support itself will have additional (party) walls and facade elements. Detachable units will be interior partitions, sanitary cells, and kitchen equipment

3 Three different floor plans in one of the possible areas in the support. Floor plans are part of a larger series worked out to test the support design to the criteria given by the client (eg municipality of Amsterdam) on room sizes, sanitary equipment, and space relations

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that by starting with the involvement of the occupant we can find better solutions, it is natural that we also believe that the architect has a role to play.

If you want to follow your own beliefs and you are an architect, you have to start by trying to find a way of starting in your own work and your own way of thinking. SAR was set up by ten architects' offices, and, as I remember very well, when they started putting together money to do research on housing and support structures, one of the main reasons was that they had a strong feeling of not being able to do what they should do, a feeling that housing was developing in such a direction that the architect really could not play his part in the two worlds of technology and use. It was felt that the architect was reduced to being someone who had to doll up something that had already been decided upon by industry or, even worse, bureaucracy. This feeling of not being able to act as an architect was, I think, the main reason why these ten architects' offices decided to set up a foundation to investigate the possibility of making an impact on the housing process, industrial production, and urban development by taking the individual into account.

Of course, the architect cannot act alone. If you want to change a process, all the parties involved have to participate, but you can start by defining the new role of the architect and try and follow it up. That is what we tried to do – to work out what you could do as a designer in this new role – and from that came what might be called a design methodology.

The problem was that you do not design the finished dwelling but things that will be put together by other people whom you do not know and who will come in later. A lot of decisions have to be made after the designer has finished his work, and he does not know who is going to make them. That means that you need some kind of design methodology which is based on design as a decision making process. This is a

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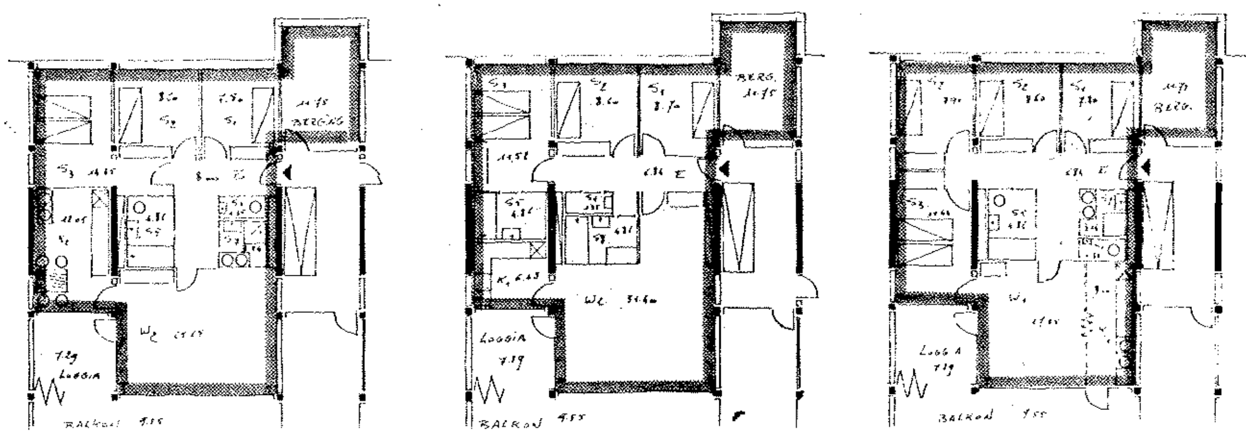

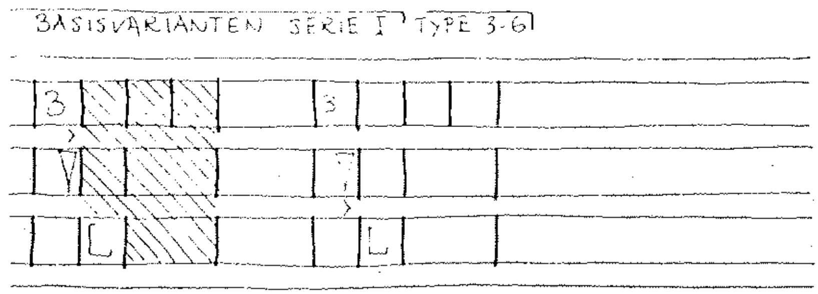


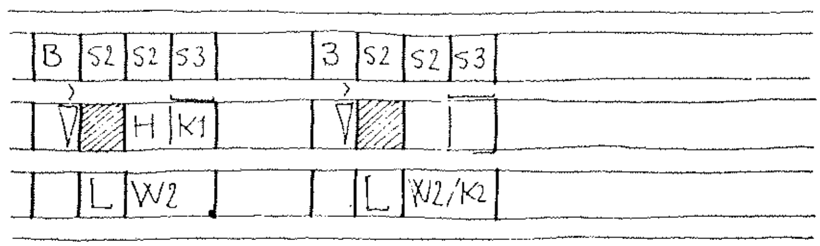


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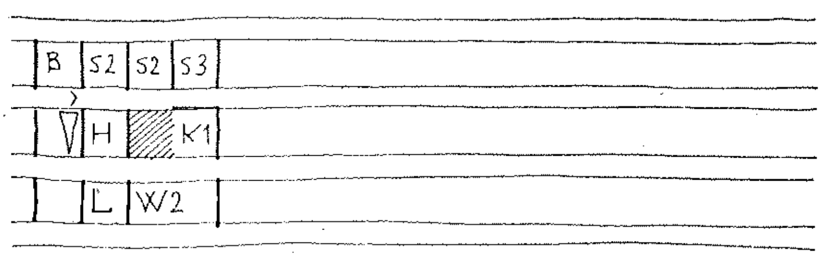


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continuous process in which the architect comes in at a certain point and makes decisions with other people, leaves the job again, and then other people come in and make decisions.

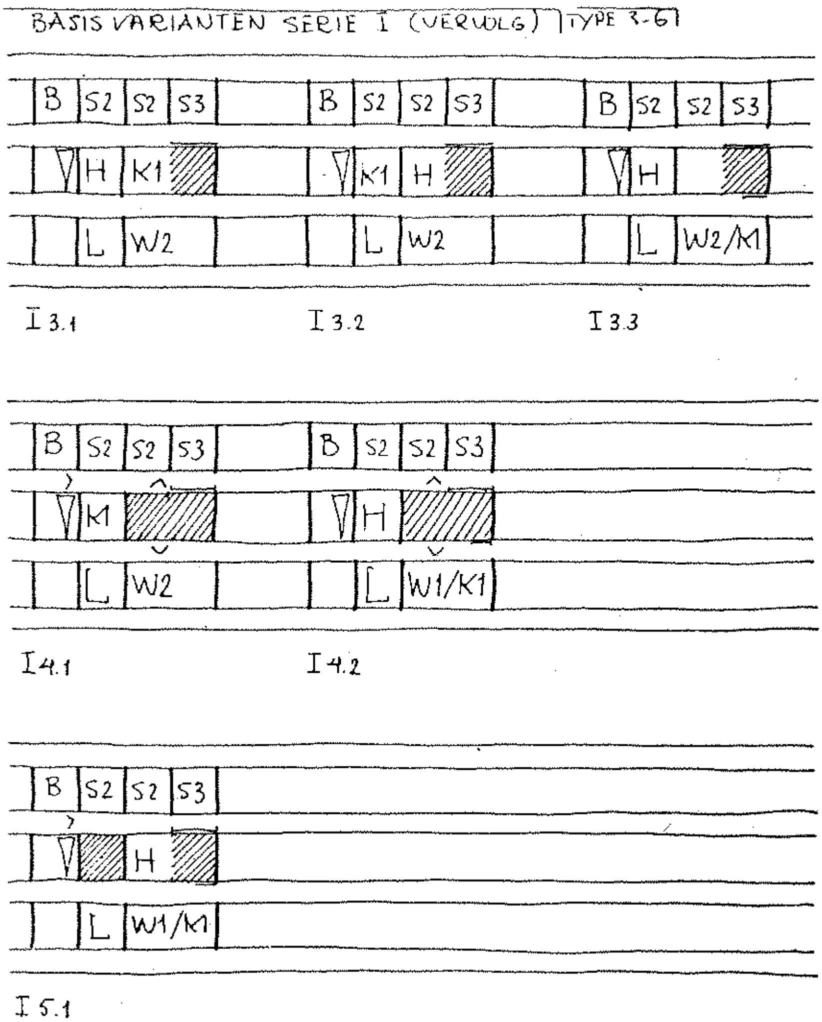
Out of this vision came a methodology based on communication, because if you do part of a job and someone else then takes over, and later still another person takes over, you can work together or hand it over only if you can communicate about the problems. This communication, of course, deals very much with values of use. If we say that the design process is a decision making process, then decisions are made on the basis of the kind of value you give to certain solutions in terms of use. We tried to make communication about values in the design process clearer so that we could be explicit about what our decisions meant and about what one could do with those decisions, and out of that develop some kind of tool. This tool, like all tools, can also be used by people who are not interested in support structures, but just in design. In fact, this tool is used in this way, and I do not think it is bad because we have found that architects who do so can do the job better and can have better communication with the client. They have a more explicit way of showing the client the different options he has. Moreover, structuring the decision making process in such a way ensures that the decisions are made at the right time. We found that several architects who used this tool found that clients gradually became interested, and once they saw the possibilities, they started thinking about other kinds of housing in which they really could also give choice to the user.

All this is what we call today 'software', and the hardware illustrated is the result of it. It can be judged only in the social and technical context of Holland at this moment. It is not an example of what support structures should be, but an example of how far we have progressed in trying to work together in a different way. I would like to stress this point. The illustrations are the results of a continuous dialogue. Of course, the dialogue itself is not only about projects and hardware: much of it is to do with ways of working and attitudes, arguing with people, and trying to convince people. Maybe this is the most important part, but I cannot show it to you. The simple fact is that now more than 30 architects' offices have joined SAR. People in other disciplines have also joined, and in different places

selves – and are working in the same direction. A continuous dialogue about possibilities is going on and growing, and this is the most important part of the work. Some things have been done not by us but by others with whom we have not been directly involved.

The first illustrations are of a pilot project carried out by the municipality of Amsterdam. It was the initiative of two architects called Rijnboutt and Frieling who work for the department of housing. They got the backing of their superiors, and the federation of Amsterdam housing societies was willing to be the client. A team was put together in which a builder and some manufacturers also took part. The idea was to build a support structure and produce detachable units and see whether it all would work. The design had already been done by Rijnboutt and we acted as consultants to the group. They are now concerned with the working details, cost problems, and so on. I think there is a reasonable chance that the project will be built.

It is a small project of about 100 dwellings on a not very interesting site which was available outside Amsterdam. The building will be three storeys high. There is a walkway round the ground

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4 Notation of basic variant for one possible floor area according to a given set of requirements. Codes designate specific functions and their position in the zoning system without actually giving specific dimension (maximum and minimum dimensions are given by the zoning). Each basic variant represents a set of possible floor plans having the same functional organisation

5 Study for high rise support based on loadbearing walls parallel to the facade with standardised openings

other levels (fig 1). This particular scheme is based on the idea of a column structure, with fixed stairs and fixed places for the ducts (fig 2). It was developed on the basis of a very specific set of requirements by the municipality, and any dwelling possible in the support structure had to meet these.

A report was made on an extensive study of the possibilities of this particular structure (fig 3). It gives an analysis of all the space required by the client for the different functions, the positions these spaces can have in the support, and the combinations of space that are possible within the spans of the structure. Finally, for each possible dwelling size, all combinations of functions and spaces that give floorplans which meet the client's requirements are written out in codes: these we call 'basic variants'. Basic variants give the relations of functions in a given area of space in the structure. Each represents a set of floorplans that all have the same functional organisation in common (fig 4). By giving all the basic variants that fit the requirements of the client in terms of space standards, space relations, and location of equipment, you can make explicit the possibilities which a particular support gives within a set of requirements. It is a way of testing out a scheme against given criteria, so the client knows exactly what he will get. Communication on the use value of the support is therefore possible, and decisions of a technical nature can be weighed in terms of use value and costs.

Once the support is built and the user can make decisions about positions of detachable units to organise the space available, there can be floorplans quite different from those given in the analysis. But this way of analysing a support design enables the parties responsible for the design to be very explicit about the many decisions that have to be made before the user comes in. You can compare different designs in terms of possible use and can discuss the patterns of use that you think have to be offered

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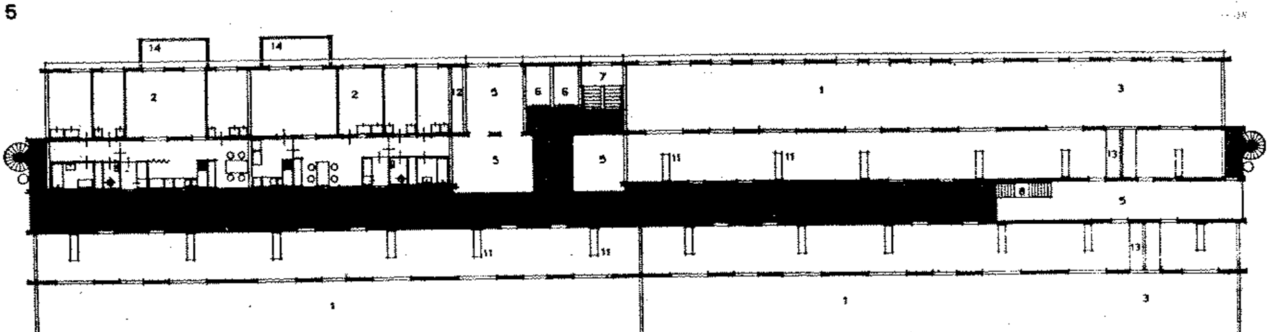

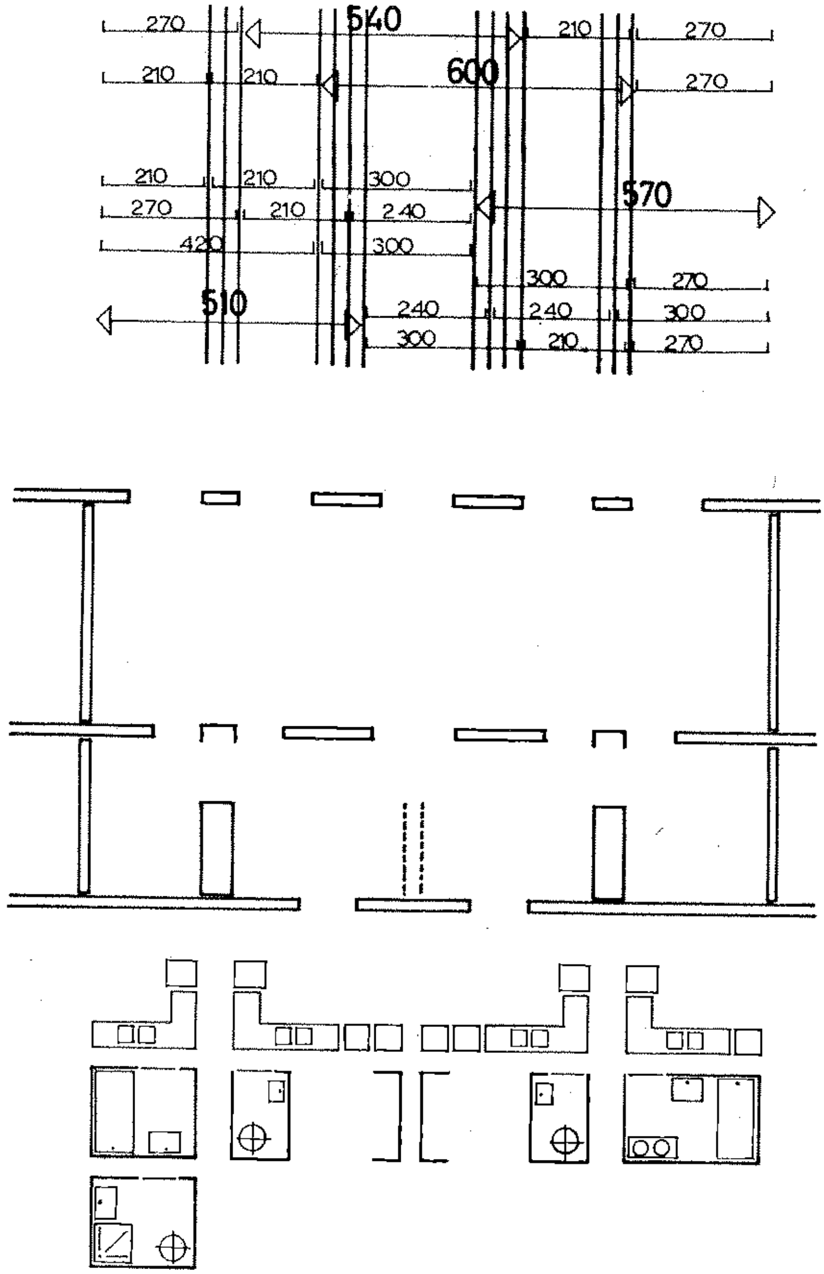


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6 Diagram showing principle of support. Gives area of approximately 100 sq m with possible positions for interior partition, sanitary cells, and kitchen units

to the user: ie, you can judge the constraints given by the support.

The illustrations show the result of about two years' work. It took that long simply because a whole team of people had to adjust to a new process. Because the parties involved had to learn a new way of dealing with problems – arguing about what should be changeable and what should not, what should be the values, what should be important, what

happen in the future, and so on – it was time well spent. They found new tools in the methodology proposed by SAR, and once they got through the initial difficulties, they became enthusiastic.

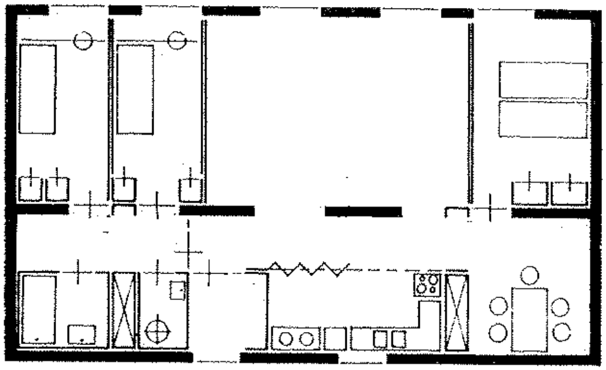
The next project illustrated is a completely different one which was developed about the same time. This came about when we were approached by a building company, who asked us to design a support structure system.

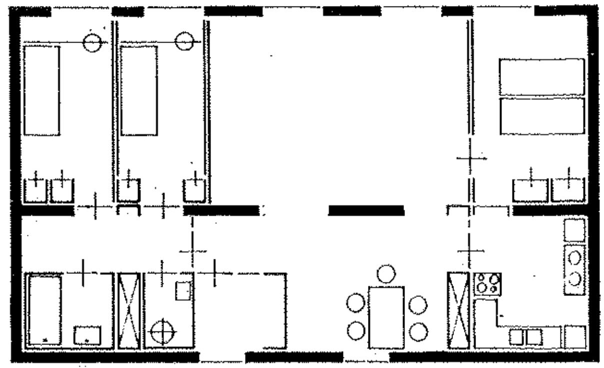
not that they were so much interested in the occupant being able to move around walls or sanitary cells, but that they wanted to give a choice to their clients. Each time they were approached by a client, he handed them a design and they had to change and retool their production system. What they wanted was to continuously develop their production by means of a support structure which they could improve in course of time, giving more possibilities and options to the client, so that he could have designs of different kinds of dwellings with different kinds of floor-plans very quickly, and know exactly what he was getting.

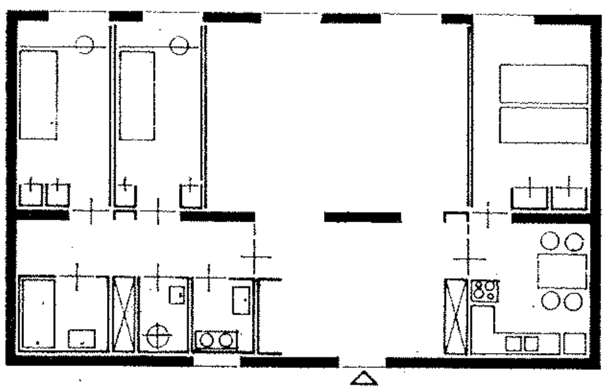
At the same time, we were approached by the municipality of Rotterdam which, for its own reasons, proposed that we set up a pilot project to show what it would be like to have 'flexible housing'. We brought the municipality and the building company together, because we wanted to develop something in 'real time'. The two parties found a third one, an investor, who was interested, and the group asked us to develop a support structure principle which could lead to low and high rise dwellings of different types: they would then build a pilot project in Rotterdam. The first one was to be a high rise scheme, about eight storeys high, and what is illustrated is a result of the research for the support system. It is not the high rise building that is going to be built but one of our sketches of a possibility. We put in an interior street because for this particular project it was considered a good experiment in a high rise building as an alternative to outside galleries.

This high rise scheme is one particular interpretation of the support system principle which is completely different from the Amsterdam system. It is based on loadbearing walls parallel to the facade. The idea is very simple: the only restriction is that you can make openings in the walls only in standardised sizes. We worked out three different sizes for the outside walls and three for the inside walls. The spans between the walls can be chosen freely as long as they are on a module of 30cm and do not exceed 4.8m. One reason for this principle was that it gives great freedom in sizes of dwellings, which can be decided on independently of the loadbearing structure. The party walls are non loadbearing. We wanted small openings in the facade, and, for reasons to be explained later, we thought that this would also be a very efficient way of building in concrete.

The principle of this particular interpretation of the system is explained in fig 5. This is the size of dwelling, about 100 sq m, which can accommodate about three bedrooms and a living room according to the standards for subsidised housing in Holland (fig 6). What seems to be a random pattern of openings has certain regularities: those in the exterior wall have a relation to those in the interior wall. Each pair of openings in







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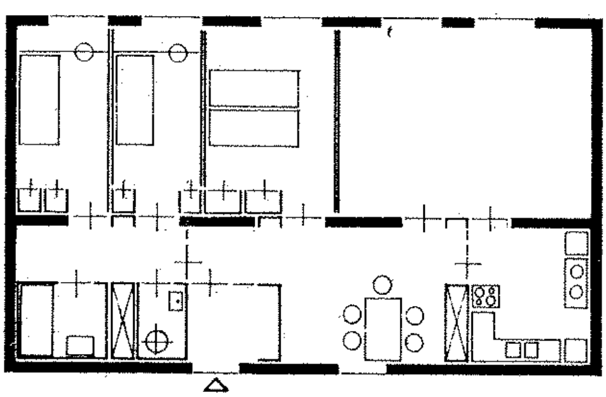
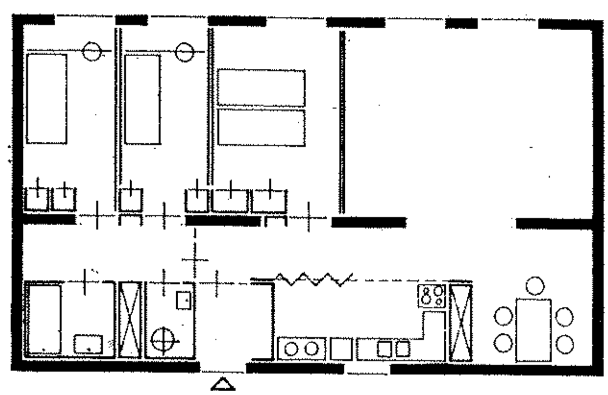
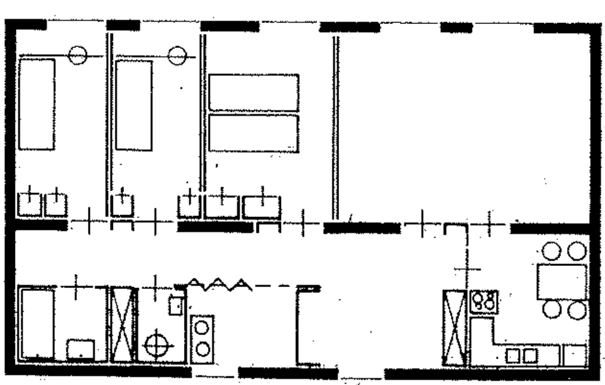
**7** (above and below) Pages from report in which possible floor plans are studied within requirements for subsidised housing. Codes of basic variants of which the floor plans are interpretations are added







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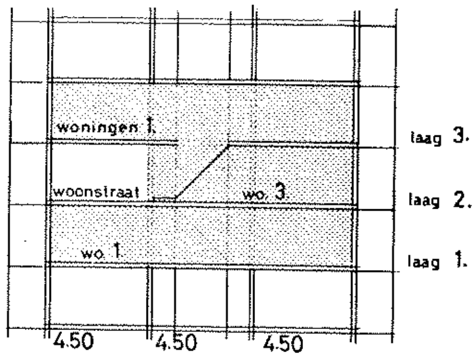


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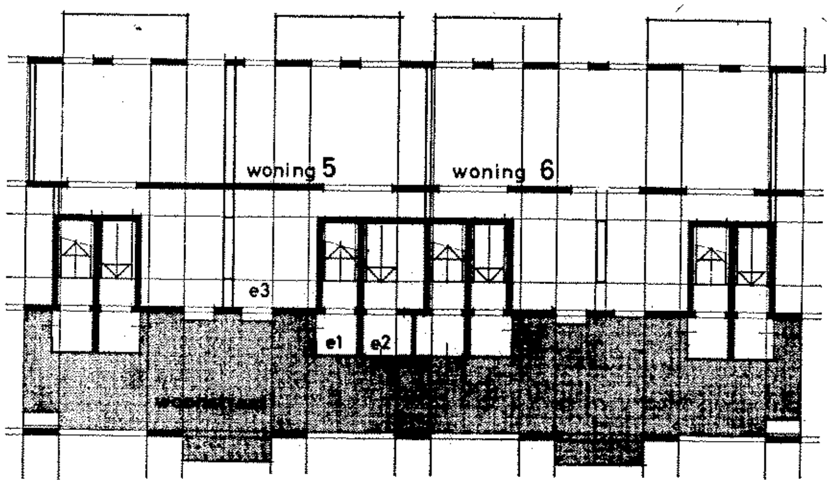
**8** Cross section of high rise support based on same system as in figs 5–7. A circulation area gives access to dwellings on three levels

**9** Floor of support of fig 8 on level of circulation area. Stairs lead to floors on upper and lower floors

**10** Floor of support of fig 8: stairs and shafts are fixed but party walls are non loadbearing

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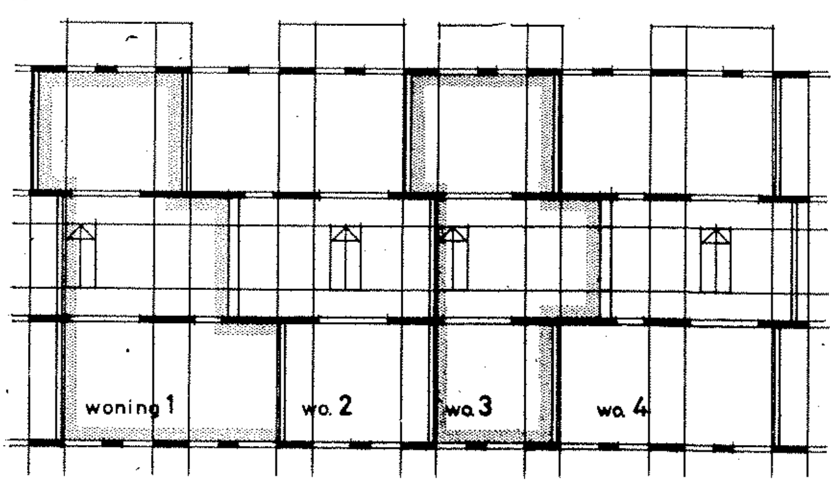



in the inside wall next to it, and in the centre line of this opening is positioned the vertical shaft for ducts. Thus two exterior openings, one interior opening, and a shaft form one group. The illustration shows two of these groups and the single openings in between. You will see that non loadbearing walls run perpendicular to the facade and always span two parts of the support structure. That is one reason for this scheme: detachable parts meet only the support structures, not each other, which makes installation fairly easy. The main reason for making it like this is that we tried to get the maximum possibilities of use with the minimum of detachable units and energy in placing them. There are four places where you can have either sanitary cells or kitchen elements (fig 7).

The floorplans explain the possibilities of the scheme. Dwellings of different sizes can be made in a range from one room studios to dwellings with three or four bedrooms. For each possible dwelling size, an analysis can be made of the basic variants possible in it that are according to the requirements for subsidised housing in Holland and, as I have explained, the basic variants show the range of use patterns. They do not give all possibilities the user has, but they do allow the validity of the support to be judged.

We made models to explain in another way what it is all about. The empty model gives the support structure as it will be when it is finished. At this stage, the first occupants can come into play and decide where they want to live and what size of dwelling they want. In fact, when we started, the client, an investment company, said that he wanted that because he knew that their investment would be obsolete in 15 years and that it took them 50 years to get out money, so if they invested in support structures and detachable units, it would be possible to reactivate their property in 15 years. So again the client's motive was not to give possibilities to the occupant but just to keep his property up to date. But when we had worked out this scheme, he said, 'Well, I didn't expect it to be that simple, but if it is really going to be like this, we could try to give a choice to the first occupants about what they really want to have'.

We at SAR did not design the actual pilot project. The design of the support that will be built in Rotterdam will be by the office of Maaskant Van Dommelen. This again is part of the role game: we have designed the system for the builder, then the client and his architect take over. The architect accepts the principle of the support structure, but he gives it his own interpretation. For example, he has designed a larger continuous outside space, and also what he calls an 'outside detachable unit', a wood and glass box that spans one or two openings and can be put in front of the support structure on the outside balcony where the occupant wants it, so that the occupant can decide or wants to add something to the inside space. This is one illustration of how someone else can take the principle and play around with it.

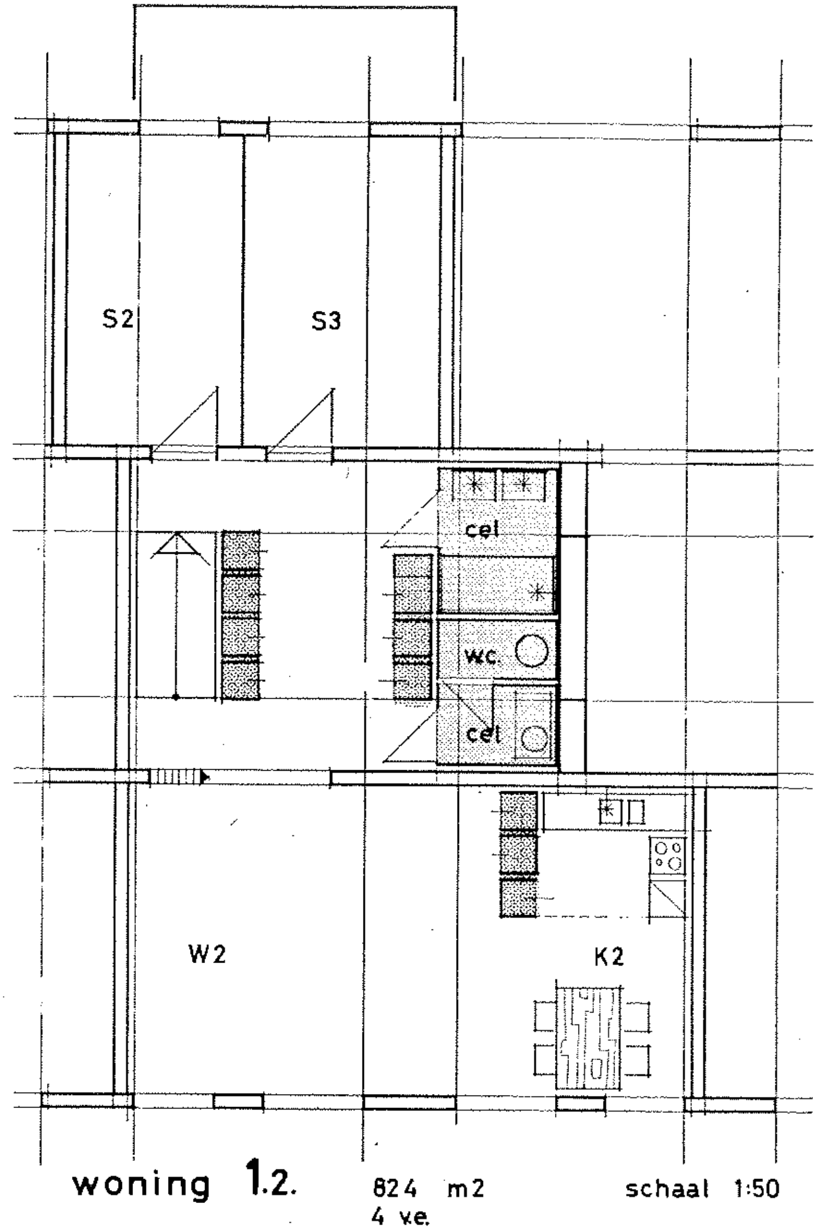
We found it necessary to make a full scale model of part of this support structure because many professional people did not really recognise the possibilities of the space in the support structure as we thought it would be. At our school, we can hang wall elements on a grid ceiling so that you can change floorplans very quickly. It is possible to make a new floorplan in 20 or 25 minutes, and we used this to show how it worked in terms of space. We found, a bit to our surprise, that in Holland architects did not like our proposal: they like large glass facades. We argued that these smaller openings could work very well, and we found that this argument would be settled with a full scale model: they said, 'It really looks nice. It works.' We also found that people who were not professionals immediately reacted very strongly to the model, saying, 'I could do this' and 'I could do that', or 'I would do it this way' and 'I would make the dwelling like this'. Their suggestions are always different from the kind of floorplans that we as architects make.

Also illustrated is another interpretation of the same support principle. We had to design it for this particular builder so that he could make high and low rise projects, and also different kinds of dwellings. Figs 8, 9, and 10 show the type of gallery street, from which you can reach three different levels, with dwellings on each level. Again, the positions of the stairs and the ducts are fixed. You see a different pattern of openings, but the internal relation of the detachable units to the support structure is the same. The rather odd shape for the size of the dwellings comes naturally: that is the easiest way to do it (fig 11).

Figs 12 and 13 show a low rise interpretation of the same support principle. It can be seen that on each side of an interior street, which is at ground level, are the different types of dwellings in the high rise. They are combined in one structure. We did this exercise as part of some research into what we call the organisation of urban tissues, the integration of the support system with outside space, pedestrian streets, and so on. These three projects are based on one principle. Again, the important thing is that other parties have been working now for two years in this direction. They all know about it, and by experience have now become convinced that new perspectives can be found for realistic development.

The next illustrations deal with a particular way of using the idea of design rules to facilitate decision making, the design stage, and communication among the parties involved.

Architects De Jong Van Olphen & Bax are working on a scheme for about 900 dwellings in the city of Gouda. They tried to structure their work in such a way that other parties could be involved

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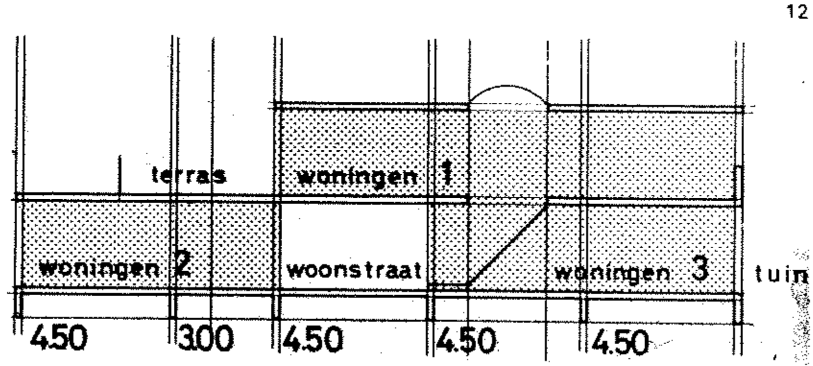


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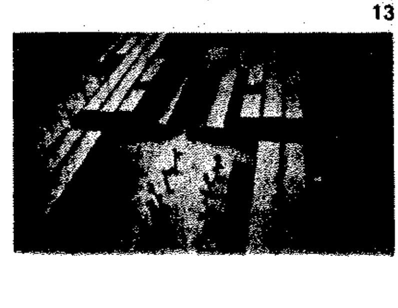
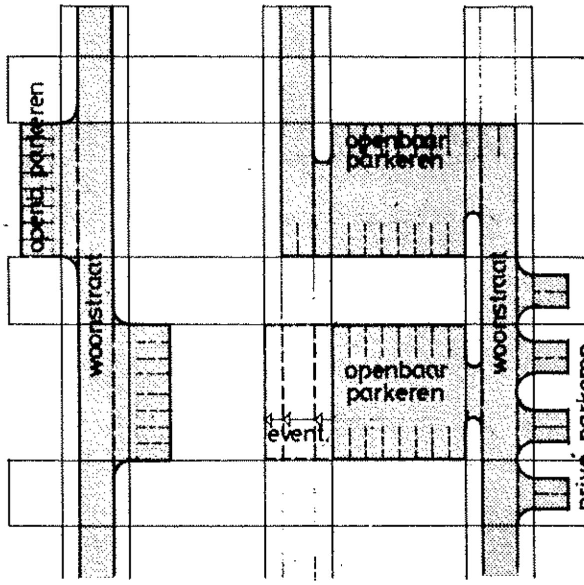


**11** Example of floor plan shows how detachable units can fit in to make dwelling in given area of support

**12** Cross section over low rise support based on principle of loadbearing wall parallel to facade

**13** Model of low rise support based on

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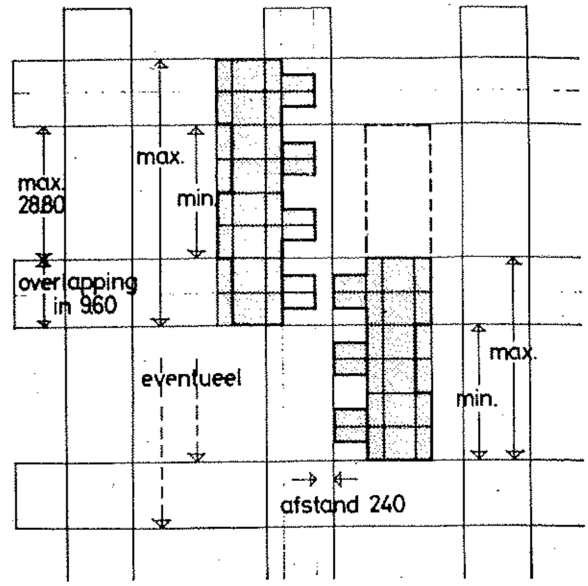



15

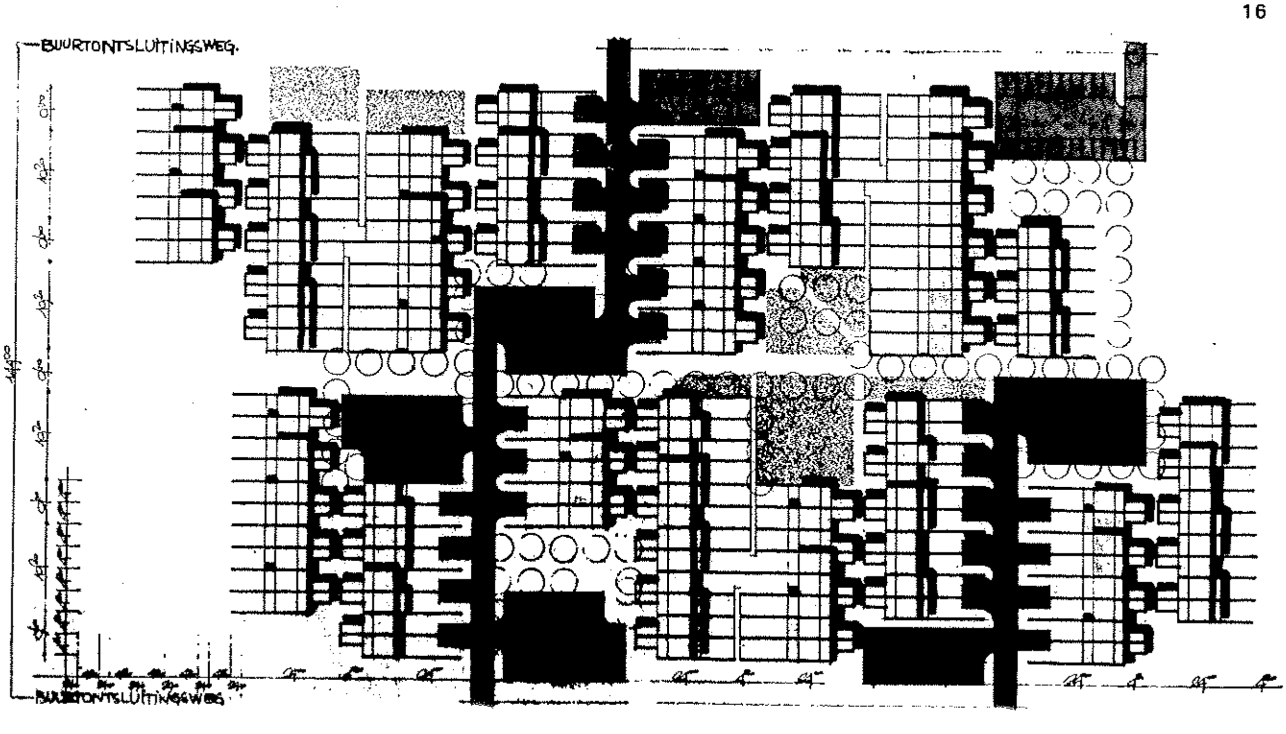
in the design process in a better way. The parties in this case are the clients (a developer and a building corporation) and various representatives of the municipality, of user groups, and of higher authorities to which the municipality has to submit new urban planning proposals. They decided not to start with a sketch plan or global scheme, but they submitted a booklet containing proposals for elements out of which different plans could be composed, as well as rules for positioning these elements in a grid system in such a way that they could not conflict with each other. The elements were roads, pedestrian circulation, parking spaces, open spaces for communal use, lots, and finally six different dwelling types, each being representative of a set of variations (figs 14, 15). The booklet enabled them to discuss possible design solutions. Because the elements and rules formed a coherent whole and were understood by all involved in decision making, different approaches with their variations could be worked out very quickly and the different options could be studied and discussed freely (figs 16, 17, 18). Costs of the elements were also known, so that cost estimates of the options could also be calculated without too much effort. The discussion involved, among others, such issues as orientation of dwellings, patterns of circulation, principles of parking, use of communal spaces, relationships between private and public spaces, degrees of density, and mixtures of dwelling types.

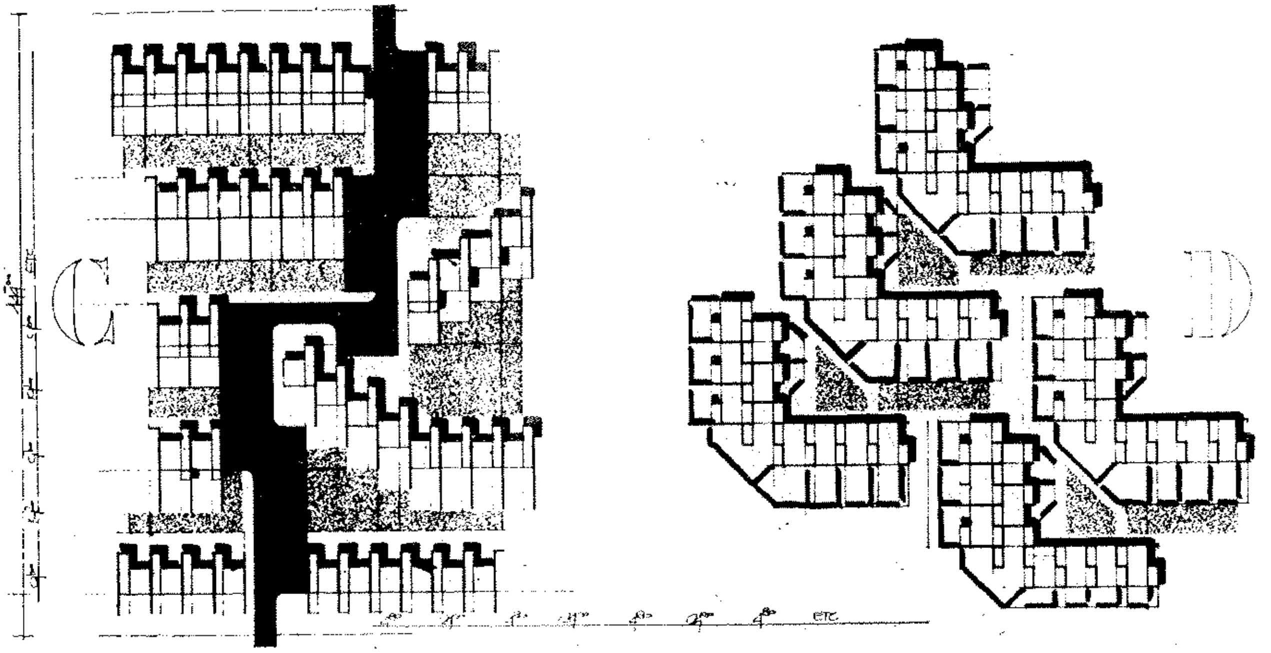
A project that we are still working on

**14–15** Two pages from the booklet with rules for positioning elements used by De Jong van Olphen Bax in the design process for a housing scheme in Gouda

**16–17–18** Examples of variations generated in the design process for the Gouda project

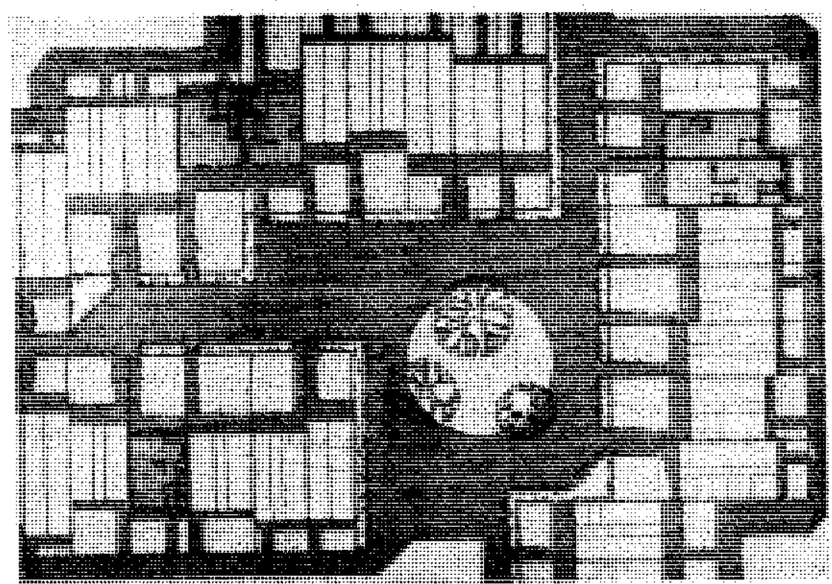
16





17–18

19



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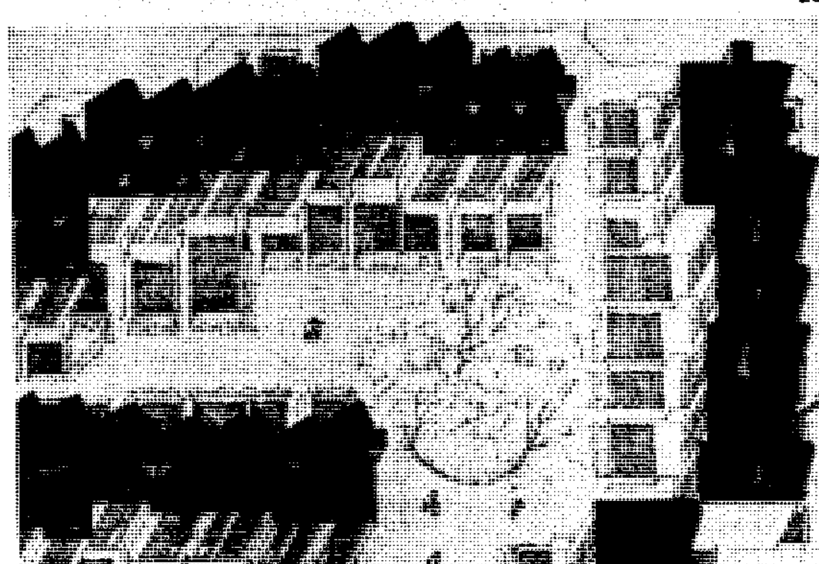


**19** Row house system. Study of combination of different sizes in width and depth in one scheme from a limited number of components and elements

**20** Bird's eye view of elevation of fig 19

is another example of how some people become interested in what we do and start working in the same direction. We were approached by a developer who also has a plant for prefabricated concrete elements. He pointed out that most systems that we have in Holland are for high rise and big projects in big cities. But 40 or 50 per cent, or even more, of what is built each year are small projects of 10, 20, or 50 houses in different areas of the country, and this has not been put into a system at all. It is still done traditionally, which becomes more and more difficult because labour costs go up and the whole process involved becomes so cumbersome. So he asked us, 'Can you design a system for terrace houses in which you can have different sizes of dwellings and, in each size of dwelling, different kinds of interior possibilities? And can you do it in such a way that 10 or 15 houses in a row can all be different and still make it

Is it possible to make one house in one week?' We said we would try.

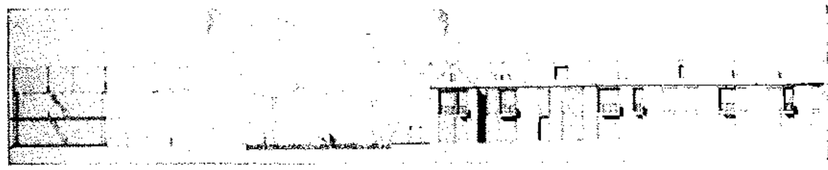
In discussion we came upon a few strategies. One was that it would not be possible, we thought, to launch the whole system at once. So we tried to cut it up into subsystems that could be developed independently, so that we could start, for example, with the system for the loadbearing element, and then add a system for the roofs, and then a system for the infill, and so on. Second, we tried to do it in such a way that all the piping and wiring could be reached after the dwelling was finished.

If you want a dwelling in which people can later change things, the piping is most important, and we wanted it to be as it is in an old fashioned house, in which you can tear away parts and find your piping and wiring and change or add something. Another problem was that if you want a lot of possibilities, you need small elements, but if you want to work very quickly on site in one or two weeks, you need large elements. So how do you get a really flexible system in which you can still work with large elements in the field?

The solution, we think, can be found by making a distinction between what happens in the factory and what happens on site. In the factory, small standardised components are assembled into large elements. This makes for a great variety of possible large elements, which are then transported to the site and put together to make the building as specified. The detachable units are then put in to finish the dwelling. A final solution on these principles has not been reached, but a preliminary catalogue has been put together and the general principles have been accepted so far (figs 19, 20, 21).

Finally, something of the set of detachable units that has been developed by Bruynzeel Ltd is illustrated. They have been working for about three years on them: the first year was a failure because they tried to make a set of detachable units out of components they already produced – kitchens, doors, wall elements, and cupboards – and then fit them into a whole. After a year they decided that this would not work and that they had to start all over again. The decision was made to set up a research group that was given freedom to develop a whole set of detachable units independent of what the firm already made.

The principle is that first you have element groups that you can recognise by their function: walls, sanitary cells, kitchens, and cupboard walls. Then you have the elements that are transported to the site and put together to make an element group. Then there are the components out of which the elements are made in the assembly plant. Different elements are made out of a limited number of components, and out of the different elements the larger groups are made according to the specification of the user (fig 22). The development team element because everybody knows that it is not difficult to make a detachable wall element but it is difficult to make one very cheaply, and they had to compete with traditional materials. They came up with a scheme which is interesting because there is a lot of choice in the finish. It has two panels attached to a core, so you can choose different thicknesses, different acoustical properties, and different finishes. A full scale dwelling space based on the Amsterdam project has been built to try



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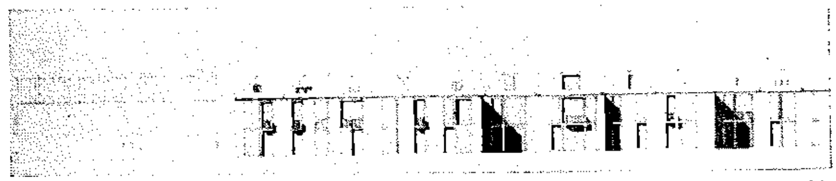

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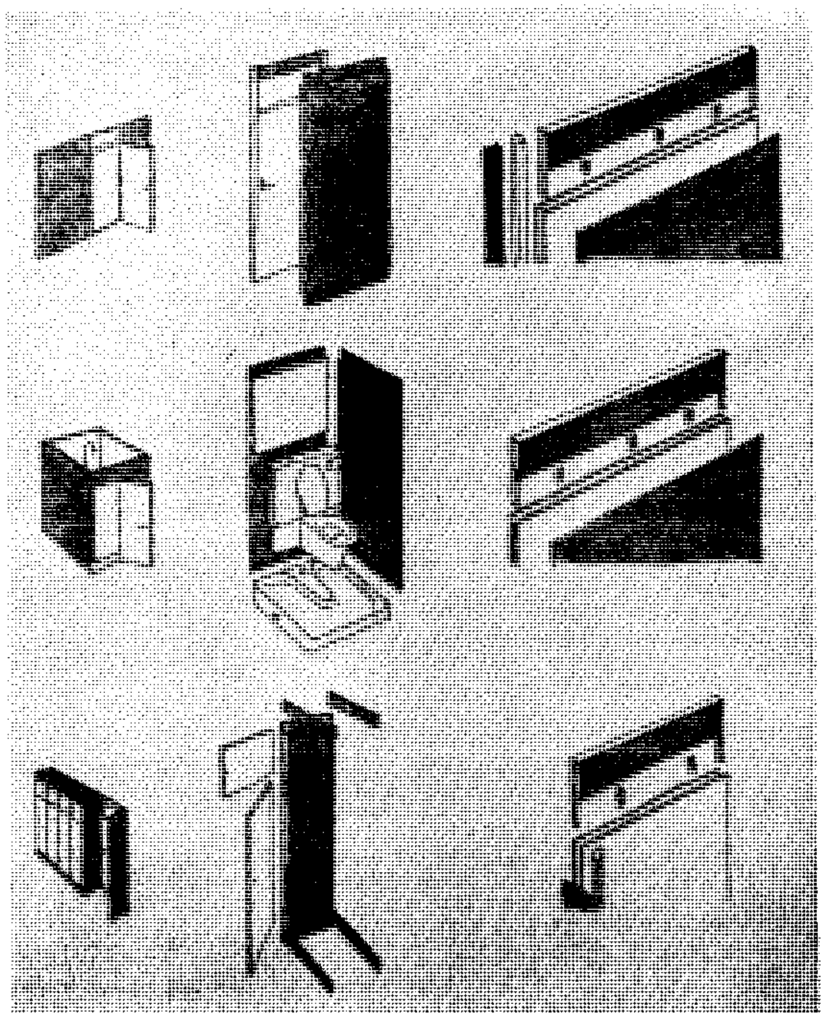


22

**21** Row house system: facade study

**22** Principle of Bruynzeel set of detachable units. Components (right) are combined into elements in the factory. Elements are combined in the dwelling space into functional group

# DIMENSION AND POSITION OF MATERIAL

MODULAR COORDINATION

This audio visual course deals with methodology for dimensioning and positioning of material in a 10/20 cm. band grid. An introduction to modular coordination according to S.A.R.

Slide 1. SAR considers that rules for modular coordination are useful as a means of communication. Modular coordination has often been seen as a means of standardization of elements. However, standardization cannot be the goal of design process.

Slide 2. What is proposed in these series of slides is a strategy for modular coordination. A strategy which takes into account non-modular elements. This strategy is a tool to notate design decisions and make conventions about the position and dimensions of materials in a clear and precise way.

SIZE AND POSITION OF MATERIAL

# AGREEMENTS ABOUT DIMENSIONING AND POSITIONING OF MATERIAL

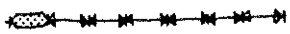
Slide 3. SAR modular coordination is based on an internationally accepted basic module. According to ISO (International Standards Organisation), a basic module is defined as a fundamental module used in modular coordination, the size of which is selected for general application for buildings and components. The value of the basic module has been chosen as 10 cm for maximum flexibility and convenience. The symbol for the Basic Module is capital M. Principles of modular coordination are not dealt with separately here, but certain aspects are considered, so far as it is necessary to understand the system of agreements regarding size and position of materials in a design process.

Slide 4. The two most important concepts proposed by SAR for modular coordination are:

1. Tartan grid or band grid
2. The concept of fitting dimension.

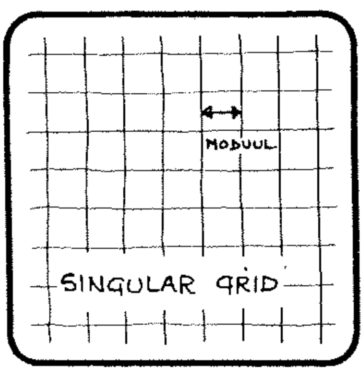
Slide 5. First we should consider modular grids in general. A modular grid is defined as a rectangular coordinate reference system in which the distance between each consecutive line gives the module or a multimodule. The multimodule may differ for each of the two dimensions of the grid. Multimodule is a module, the size of which is a selected multiple of the basic module. The illustration shows a simple modular grid, known as singular grid. It consists of a system of lines at regular intervals, the distance between which gives the module.

MODULE



MODULAR
COORDINATION

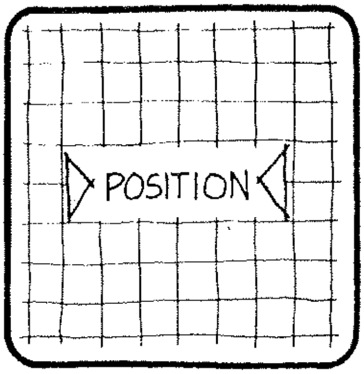
BANDGRID
AND
FITTING-
DIMENSION

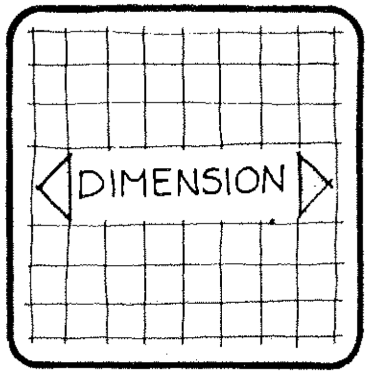


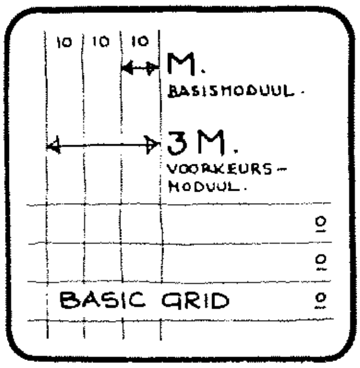
Slide 6. A modular grid, primarily is an aid to fix the position of material in a given area. In this respect a modular grid is used as any other system of coordination. Moreover, with modular grid, one can establish a relation between the material and the module of the grid in which the material is placed. This helps in deciding about the position and dimension of material.

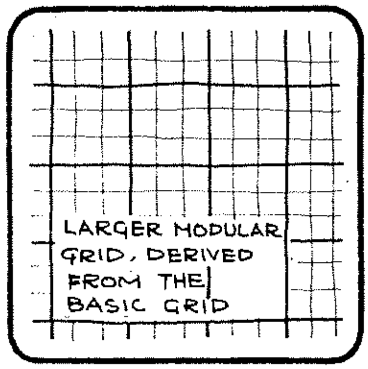
Slide 7. In addition to the internationally accepted basic module of 10 cms, there is also a general agreement about what is called "Preferential Module". The value of preferential module is 3M or 30 cms. This value also relates the metric system to the inch-foot system where the preferential module of 3M or 30 cms is approx. equal to 12 inches or a foot. This value is related to the measurements of the human body and therefore is quite useful in the design of buildings.

The 10 cm module grid is considered as a basic grid, from whcih other larger grids can be derived. The illustration shows 30 cm module grid, superimposed on the 10 cm basic grid


POSITION

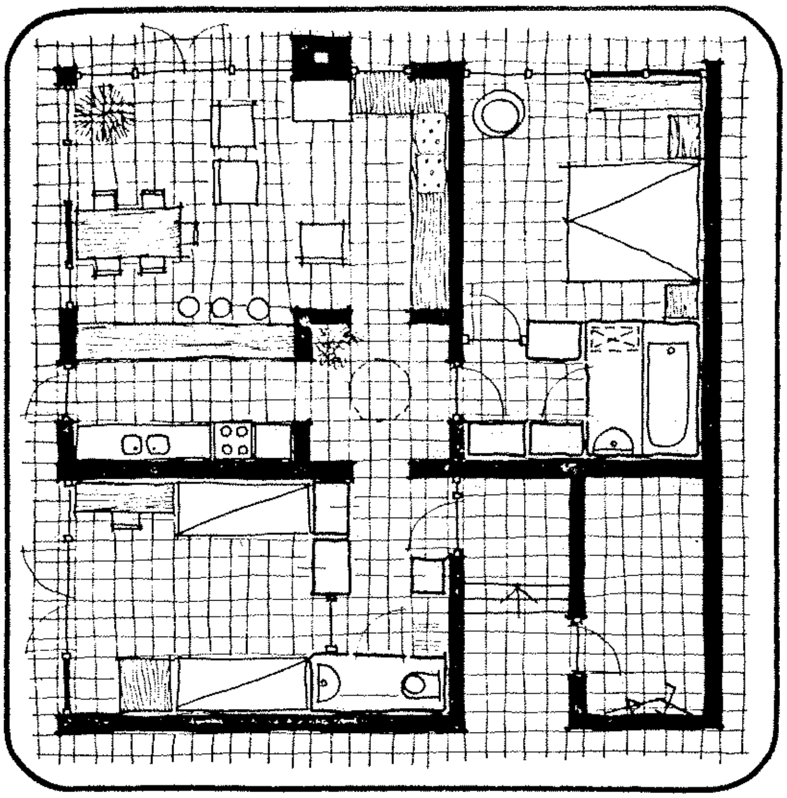

DIMENSION

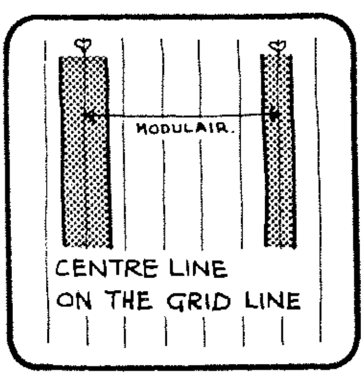

10 10 10
M.
BASISMODUUL.
3 M.
VOORKEURS-
MODUUL.
10
10
10
BASIC GRID

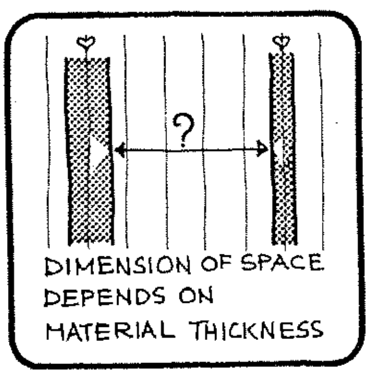

LARGER MODULAR
GRID, DERIVED
FROM THE
BASIC GRID

Slide 8. Now we shall consider the positioning of materials in a modular grid.
This slide is an illustration of a floor plan, designed and drawn with the aid of a modular grid.

Slide 9. A common way of positioning material in a grid is by placing the center line of the material on the line of the grid. This center line method is often used, because in this way, the position of material can be stated very precisely. However, this method is not suitable for estimating exact space dimensions. This is because the materials have different thicknesses which often are non-modular in dimensions.

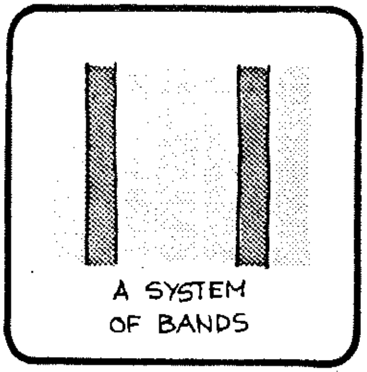



MODULAIR.
CENTRE LINE
ON THE GRID LINE

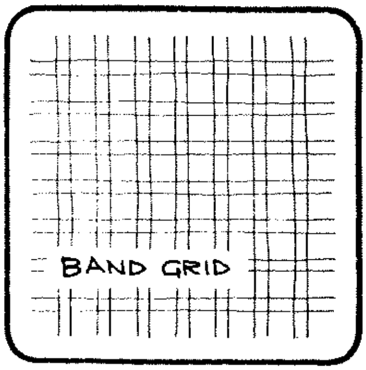

?
DIMENSION OF SPACE
DEPENDS ON
MATERIAL THICKNESS

Slide 10. For the purpose of solving structural problems, where precise positioning of material is essential, the centre line method is good and therefore structural engineers prefer to use this method. On the other hand, architects, with their main interest in spaces and their combinations, tend to use a method where the boundary of the material and the space lie on a grid line. In this way space dimensions can be precisely defined.

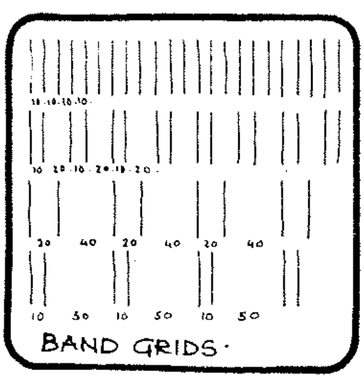
Slide 11. Another way of obtaining modular dimension, is by placing a material between two grid lines, as shown in the illustration. However, in this case we must accept a limitation that the thickness of the material shall never be more than the size of the module, although it can be as thin as possible. If we accept this limitation, this method makes it much easier to estimate dimension of spaces, because the minimum size of the space shall always be a multiple of the selected module.



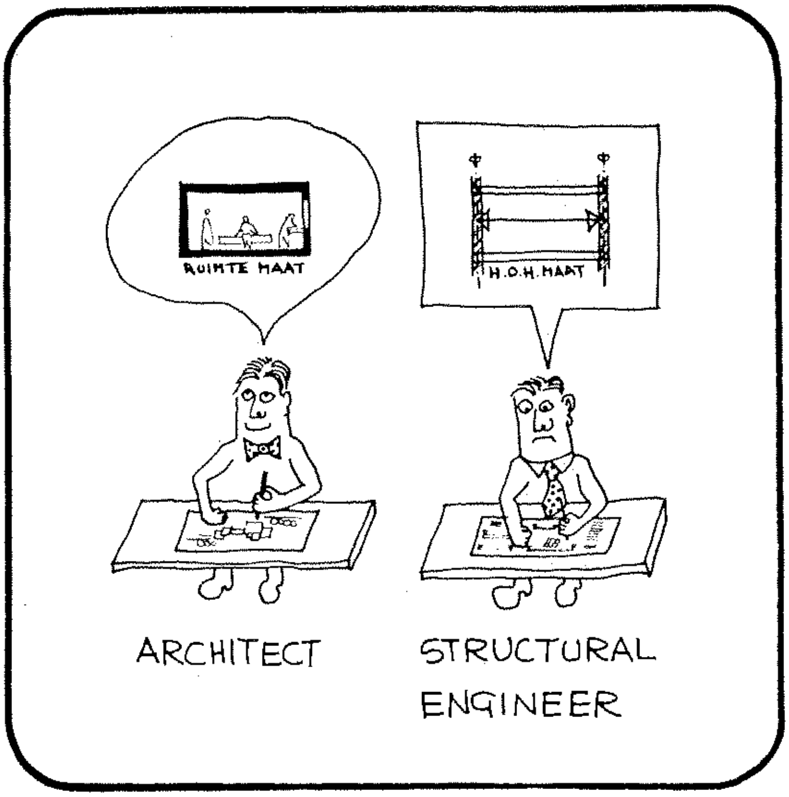
A SYSTEM OF BANDS

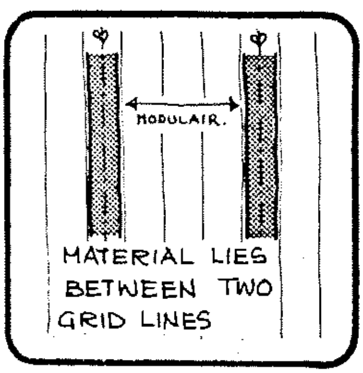


BAND GRID




BAND GRIDS.


RUIMTE MAAT
H.O.H. MAAT
ARCHITECT
STRUCTURAL
ENGINEER


MODULAIR.
MATERIAL LIES
BETWEEN TWO
GRID LINES

Slide 12 Instead of saying that the material lies between the two grid lines, we can also say that material is placed in a band. The difference between the two methods is, that in the first case we see the grid as a system of lines, whereas in the second case we see the grid as a system of bands. If we treat the grid as a system of bands, we can still place the centre line of a material according to modular rules and also obtain relation between dimension of the material and the dimension of the band.

Slide 13 We can select a grid with bands of different dimensions having certain regularity. Such a band grid is also known as a tartan grid. The advantage of the tartan grid is that it offers the possibility to make rules about the position of material in a general way.
The illustration shows a grid with bands of two different dimensions.

Slide 14 In principle the designer is free to choose the module he prefers to work with, both in tartan as well as singular grids. However, the selected module and the grid derived from it, must be based on the basic module and the basic modular grid.

Slide 15. The minimum size of module that can be chose for a modular grid is 10 cm. In order to introduce the 30 cm preferential module to this grid, we place the 10 cm bands at 30 cm, centre to centre.
As a result we get alternating bands of 10 and 20 cm which are related to both 10 cm Basic Module and 30 cm preferential module.

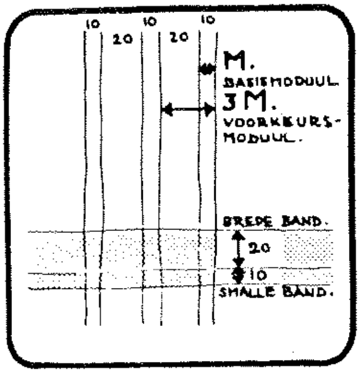
Slide 16. Between any two line of the 10/20 cm band grid, various dimensions are found which are related to the 30 cm preferential module. These dimensions fall into three catagories.

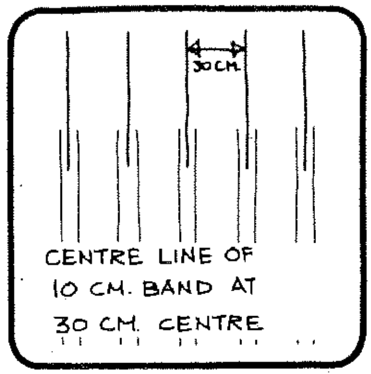
(1) The dimension between the broad and the narrow band i.e. between 10 cm and 20 cm band is n.30.

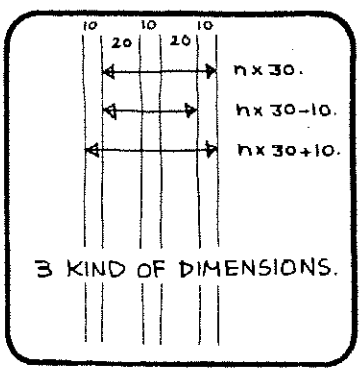
(2) The dimension between two narrow or, in other words two 10 cm bands is n.30-10.

(3) The dimension between two broad bands or, in other words, two 20 cm bands, is n.30+10.

Note: the bands of the same width are always placed at n.30 cm, centre to centre.


10
20
10
20
10
M.
BASISMODUUL.
3 M.
VOORKEURS-
MODUUL.
BREDE BAND.
20
10
SMALLE BAND.


30 CM.
CENTRE LINE OF
10 CM. BAND AT
30 CM. CENTRE


10
20
10
20
10
n x 30.
n x 30-10.
n x 30+10.
3 KIND OF DIMENSIONS.

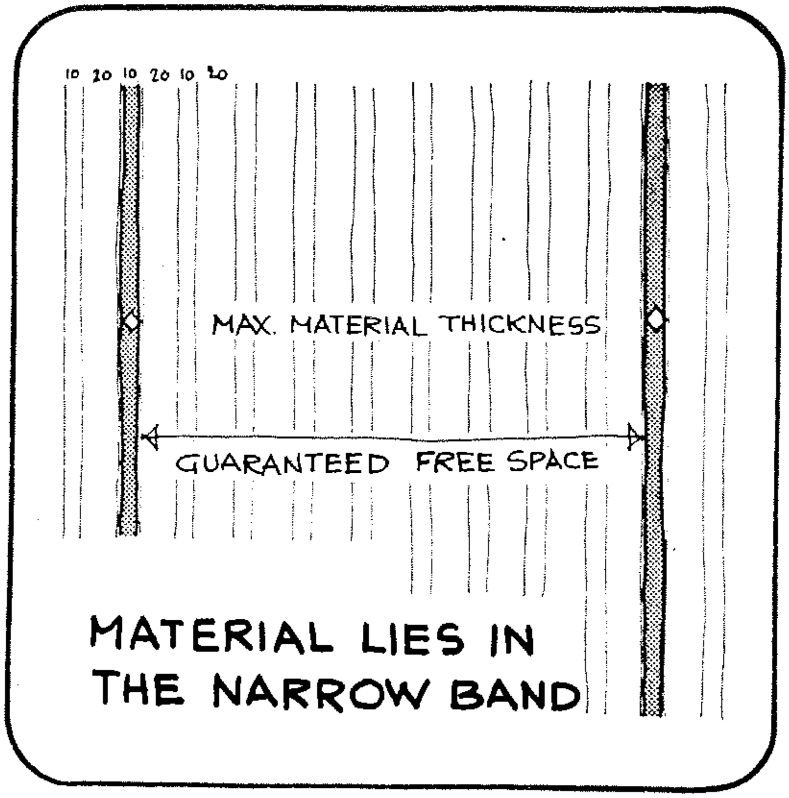
Slide 17

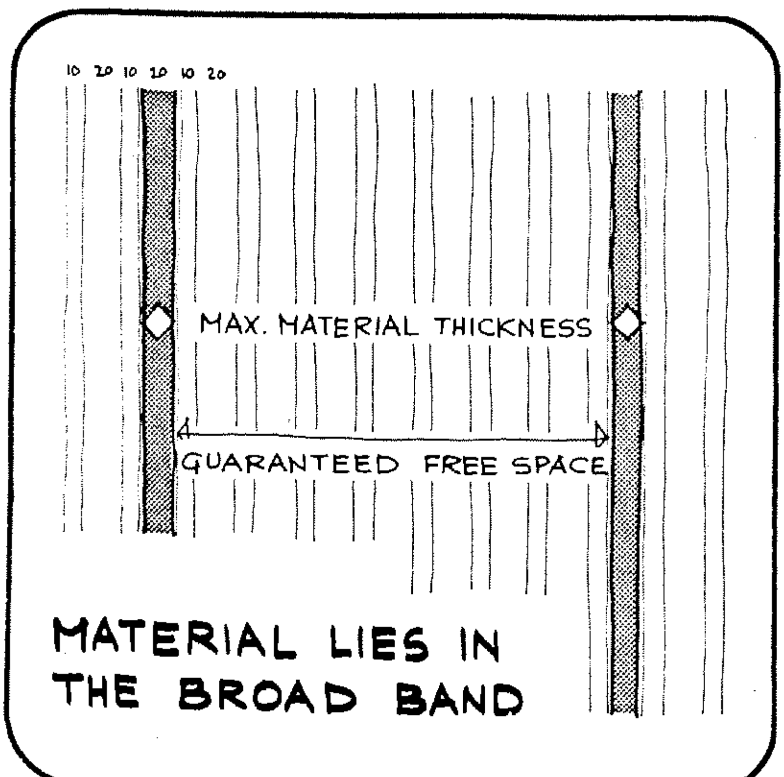
Now let us consider some rules for positioning of material in the 10/20cm band grid and their implications. We have already seen that a material can be placed in a given band. Since we have bands of two dimensions, we can make two different rules.

The first rule that can be stated is: The material lies in the 10cm band. From this it can be derived that the maximum dimension of the material will be 10 cms. In this case, the minimum dimension of the space shall be n.30 - 10 and therefore the minimum guaranteed free space shall also be n.30 - 10.

Slide 18

The other rule applies to the 20cm band. In that case we shall have maximum dimension of the material as 20cms and the guaranteed free space of n.30 + 10.


10 20 10 20 10 20
MAX. MATERIAL THICKNESS
GUARANTEED FREE SPACE
MATERIAL LIES IN
THE NARROW BAND

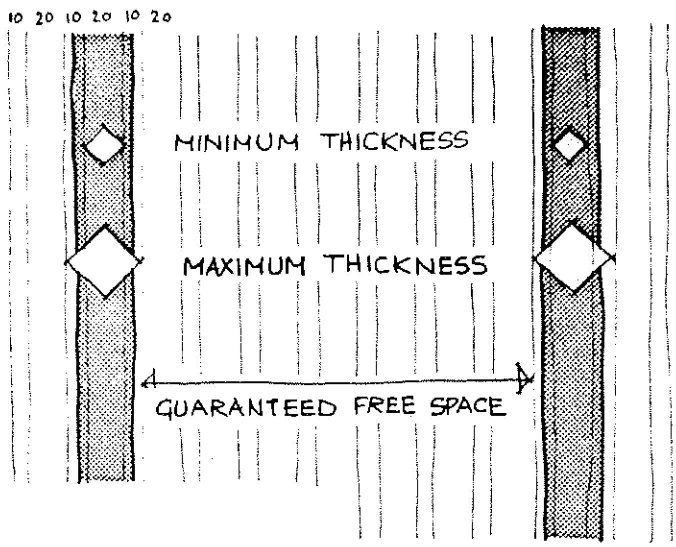

10 20 10 20 10 20
MAX. MATERIAL THICKNESS
GUARANTEED FREE SPACE
MATERIAL LIES IN
THE BROAD BAND

Slide 19

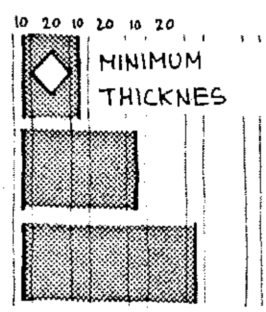
There is another possibility which gives a greater range of dimensions of material. This rule states that the material ends in the 10cm band. In this way minimum and maximum dimensions of a material can be determined. Minimum dimensions being n.30 - 10 and maximum n.30 + 10. This rule also gives guaranteed free space of n.30 - 10.

Slide 20

This shows that only the minimum size of the material is fixed, i.e. the size of the broad band. The possible dimensions can be between 20 and 40, 50 and 70, 80 and 100 cm and so on.




MATERIAL ENDS IN
THE NARROW BAND



Slide 21

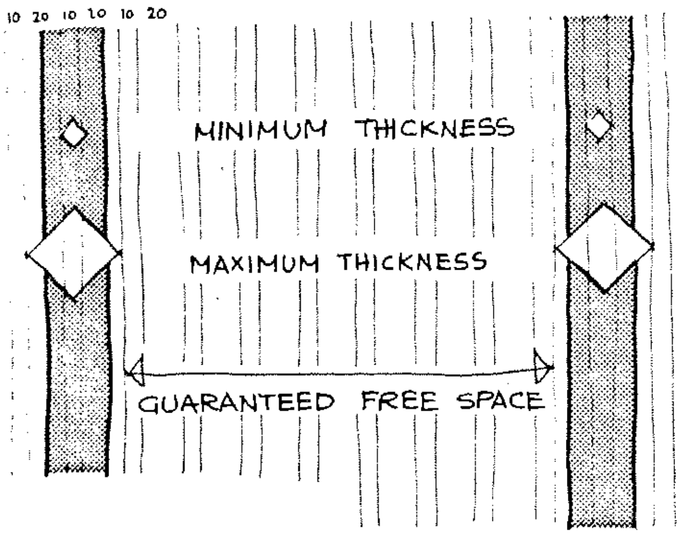
The 10cm band rule can be applied to a 20cm band. We shall then have guaranteed free space of n.30 +10. Application of the 20cm band rule gives much wider margin of dimensions between material and the space, such as between 10 and 50 cms. In this case the minimum size of the material is e ual to the size of the small band.

Slide 22

So basically there are four ways in which we can position material in the 10/20cm band grid.

1. Material lies in 10cm band
2. Material lies in 20cm band
3. Material ends in 10cm band
4. Material ends in 20cm band

For the dimensional system, the designer is free to choose any of the given rules which suits his purpose. However, he should remain consistent in his application.



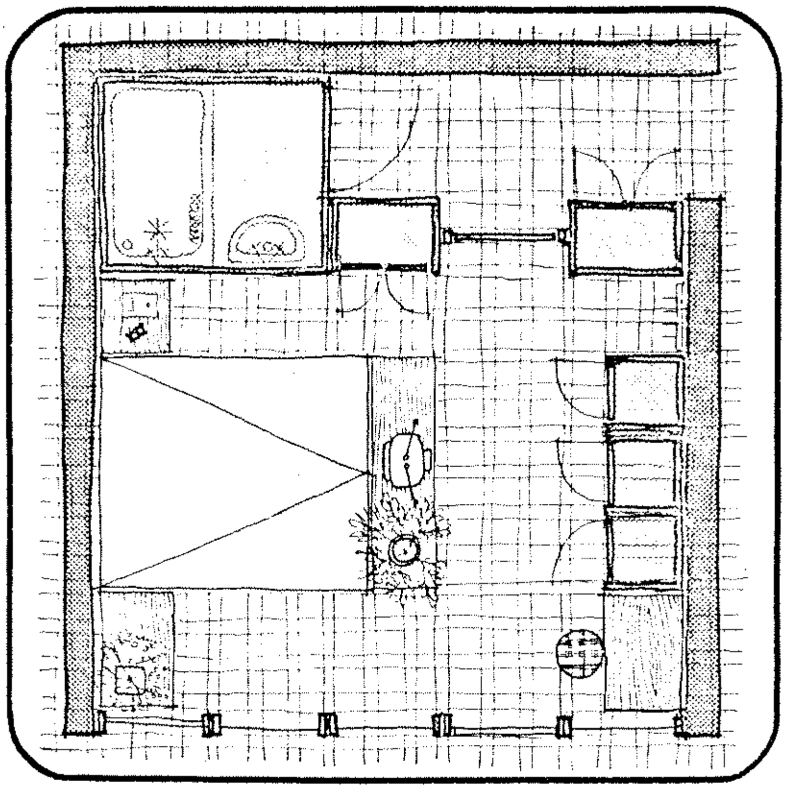

MATERIAL ENDS IN THE BROAD BAND

1. MATERIAL LIES IN THE NARROW BAND
2. MATERIAL LIES IN THE BROAD BAND
3. MATERIAL ENDS IN THE NARROW BAND
4. MATERIAL ENDS IN THE BROAD BAND

Slide 23. From the stated four rules, rule no. 3 which states that the material shall end in the 10 cm band, has been chosen by SAR as the basic rule. This rule has proven to be very useful in the design of housing structures. For the design of supports and detachable units, this rule is preferred over other rules, because application of this rule gives smaller increments in the measurements of the material and the difference between the guaranteed free space and the resulting space is very small. However, for different design problems, other rules may prove to be more useful.

Slide 24. The floorplan shown here, is drawn according to the rule which states that material shall end in 10 cm band. One can see that the structural walls as well as the detachable units end in 10 cm bands.

MATERIAL
SHALL
END IN
10 CM. BAND



Slide 25. We have seen that the thickness of the material according to the 10 cm band rule, varies between n.30-10 and n.30+10. For instance, if a wall ends in two consecutive 10 cm bands, the dimension shall vary between 20 and 40 cm. To state this more comprehensively, we say that the nominal dimension of the wall is 30 cm. The nominal dimension is always multiple of the module of the given grid.
This implies that the wall with nominal dimension of 30 cm ends in two consecutive 10 cm bands.

Slide 26. The same can be said for the dimensions of the spaces. Therefore the minimum guaranteed free space will be n.30-10 and the maximum n.30+10.
The nominal space dimension therefore is n.30, so when we say that the nominal space is 2.70 cm, then we know that the minimum dimension will be 2.60 and maximum 2.80.

Slide 27. The rule that the material ends in the 10 cm band also implies the possibility that the material lies in the 10 cm band. If the material does lie in the 10 cm band, then the dimension of the material will be n.30+10 where n = 0. The minimum size of the material therefore, will be equal to 0.
From this it follows that the guaranteed free space is n.30-10.

Slide 28. We have already seen the possible series of dimensions which can be used by application of the stated rule . They vary between 0 and 10, 20 and 40, 50 and 70, 80 and 100 etc. This is a wide range, although certain dimensions cannot be used, such as between 10 and 20 cm, between 40 and 50 cm. etc.

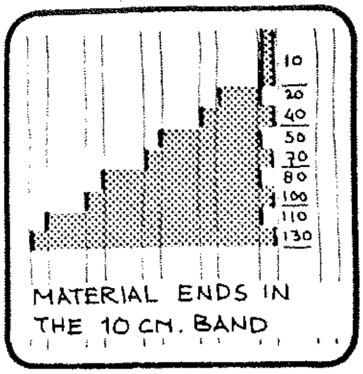
One can observe that the centreline of the material alternates between 10 cm band and 20 cm band. Between the range of 20 and 40 cm, 60 and 80 cm, the centreline of the material lies in the 20 cm band and between the range of 30 and 50 cm, 70 and 90 cm, the centreline lies in the 10 cm band.

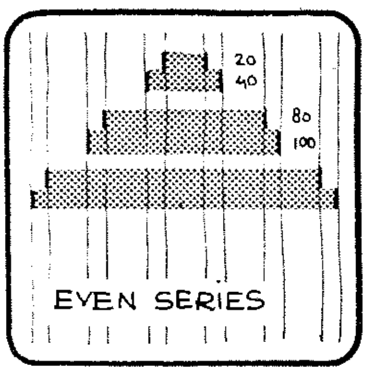
Slide 29. The range of dimensions thus derived fall into two series.

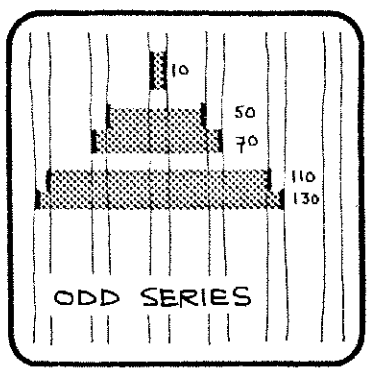
1. The series of dimensions obtained by placing the centreline of the material in a 20 cm band, such as between 20 and 40, 80 and 100 etc. is an even series.

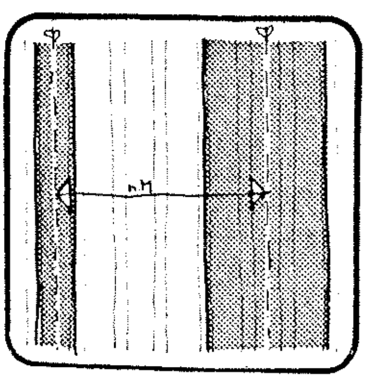
2. The series of dimensions obtained by placing the centreline of the material in a 10 cm band such as between 0 and 10, 50 and 70 etc. is an odd series.

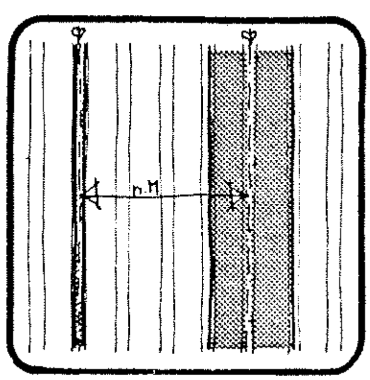
Slide 30. To obtain centre to centre dimension of n.30 one of the two series of dimensions must be applied. In each case guaranteed free space shall be n.30-10.

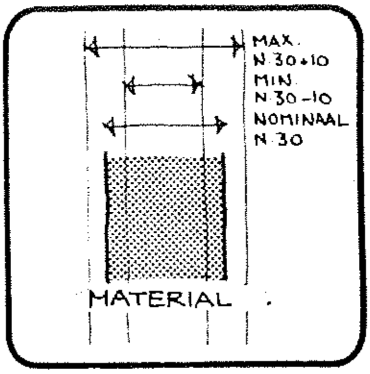

10
20
40
50
70
80
100
110
130
MATERIAL ENDS IN
THE 10 CM. BAND

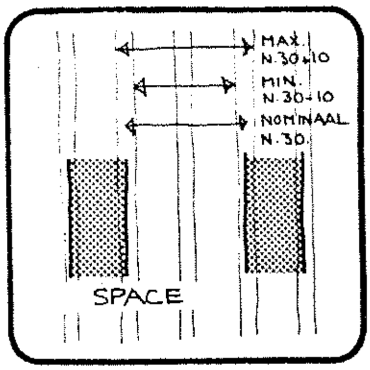

20
40
80
100
EVEN SERIES

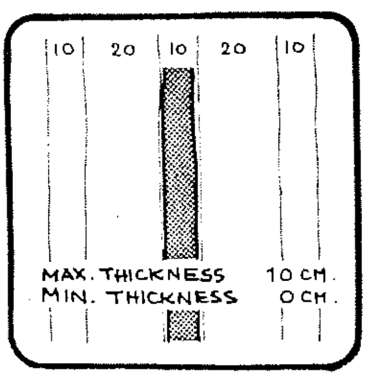

10
50
70
110
130
ODD SERIES

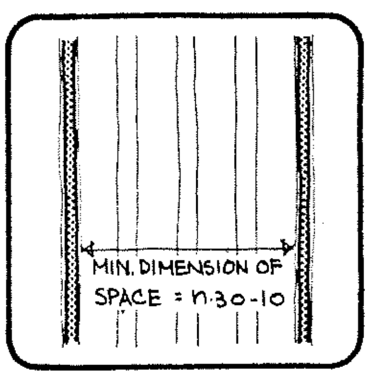

n.M


n.M


MAX.
N.30+10
MIN.
N.30-10
NOMINAAL
N.30
MATERIAL


MAX.
N.30+10
MIN.
N.30-10
NOMINAAL
N.30
SPACE

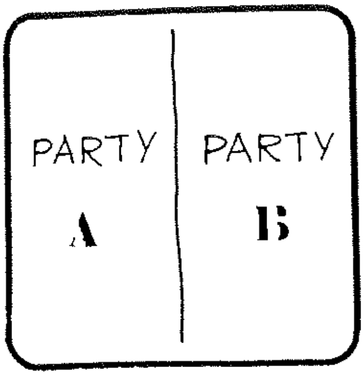

10
20
10
20
10
MAX. THICKNESS 10 CM.
MIN. THICKNESS 0 CM.


MIN. DIMENSION OF
SPACE = n.30-10

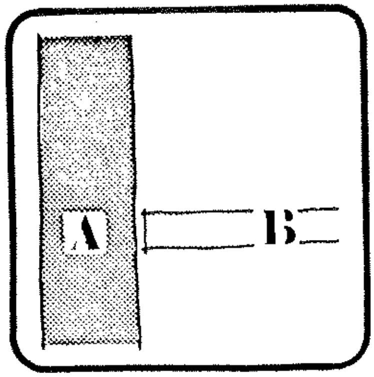
Slide 31. Now that we know how to position material in a 10/20 cm band grid, we can see how the decisions made by party A can allow for decisions made by party B.

Slide 32. In designing supports and detachable units, there will be more than one party involved, for according to SAR, supports belong to the communal or public sphere and detachable units belong to individual or private sphere. This means that there will be designers and builders of support structures, industries producing detachable units and dwellers combining both to complete the housing process. To ensure that their efforts and products can be coordinated, we need to state precisely how materials will meet.

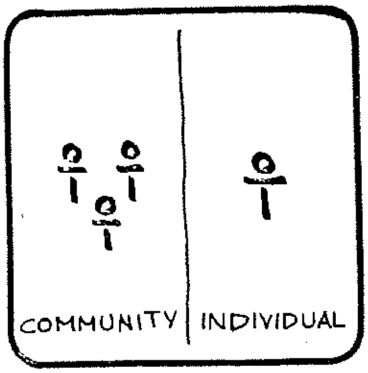
Slide 33. By stating that material shall end in the 10 cm band, it follows that the material shall meet in the 10 cm band. Where this connection between support and detachable units takes place, must be stated very precisely and clearly.



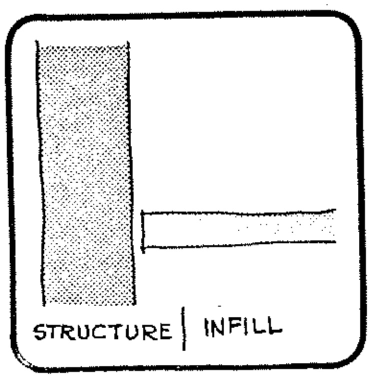






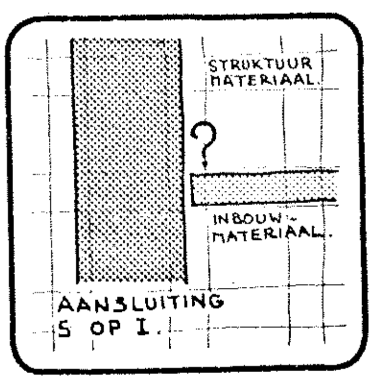








MATERIAL
ENDS IN THE
10 CM. BAND



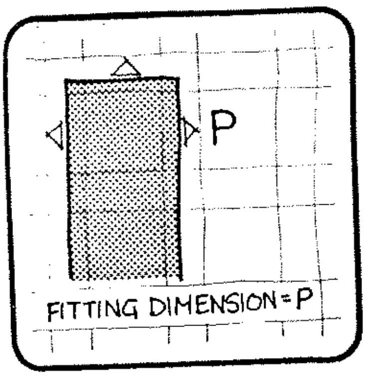
Slide 34

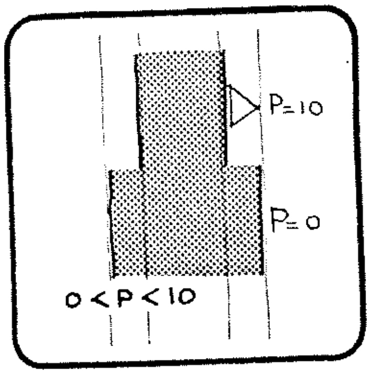
For this purpose we have developed the concept of 'Fitting Dimension'.
By definition, fitting dimension is the distance between the material and the next grid line.

Slide 35

The concept of fitting dimension can be used in any kind of grid and for any kind of material. Also the material need not be modular, for according to the basic rule that material ends in 10cm band, the fitting dimension shall always be between 0 and 10cms.

FITTING-DIMENSION = DIMENSION BETWEEN THE MATERIAL AND THE NEXT GRID LINE



Slide 36

From the previous statements we can conclude that the eventual space in a structure shall always be the result of the three dimensions.

1. Fitting dimension P
2. Dimension of n.30 - 10
3. Second fitting dimension P

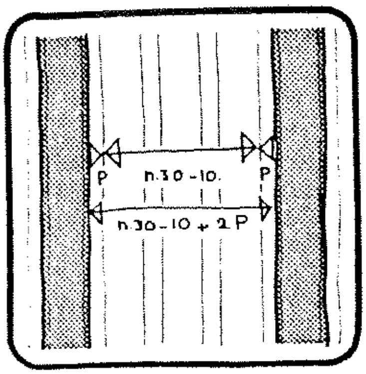
which can be simply stated as n.30 - 10 + 2P.

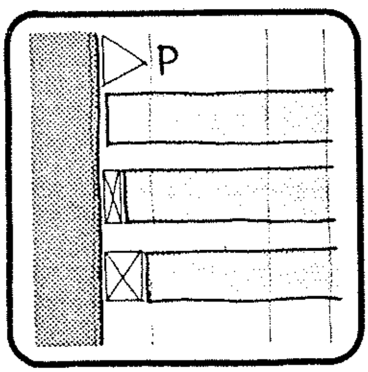
Slide 37

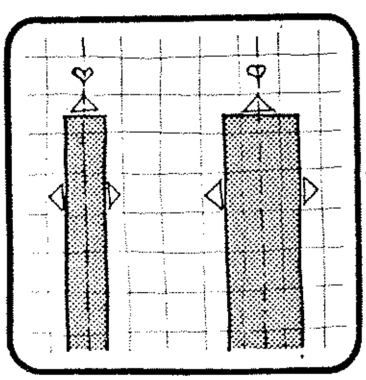
The fitting dimension need not be the dimension of connecting elements. The detachable units can directly fit on to the support structure or with the help of a connecting element. For the fitting dimension is quite different from the connecting element. In fact Fitting Dimension is no more than a free space.

Slide 38

This slide illustrates that the concept of fitting dimension can be used in different kinds of modular grids. The maximum fitting dimension that can occur, always equals the width of the band in which the material ends. Fitting dimension can be used as a means of communication for the position of material in any kind of design process.


P
n.30-10.
P
n.30-10 + 2P

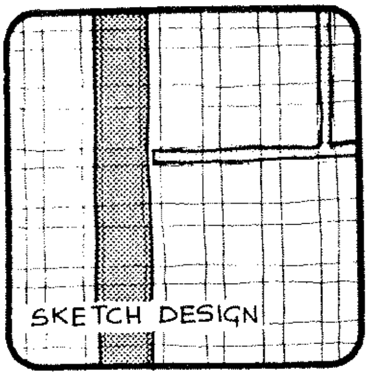

P

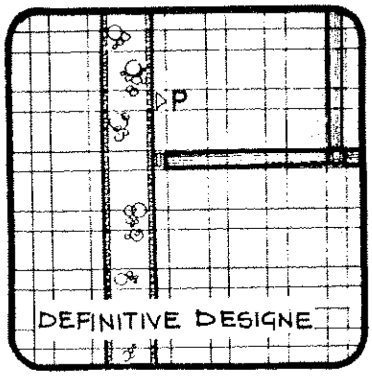


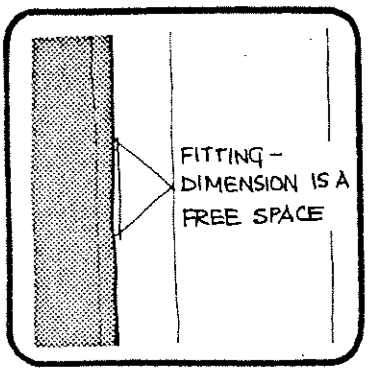
Slide 39. This slide illustrates a rough sketch where the position of the material has been drawn on the grid. Such a sketch can be initially used and at a later stage the fitting dimension introduced for precise calculations.

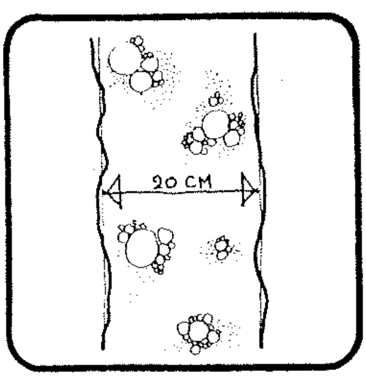
Slide 40. From the definition it follows that the fitting dimension is a dimension of a space which always indicates free space between the material and the grid line.

Slide 41. The concept of fitting dimension will be adequate if we assume that materials we use are always perfectly smooth and remain in a constant state. Since this is not the reality, we shall have to take into account tolerances of materials we choose to use.


SKETCH DESIGN

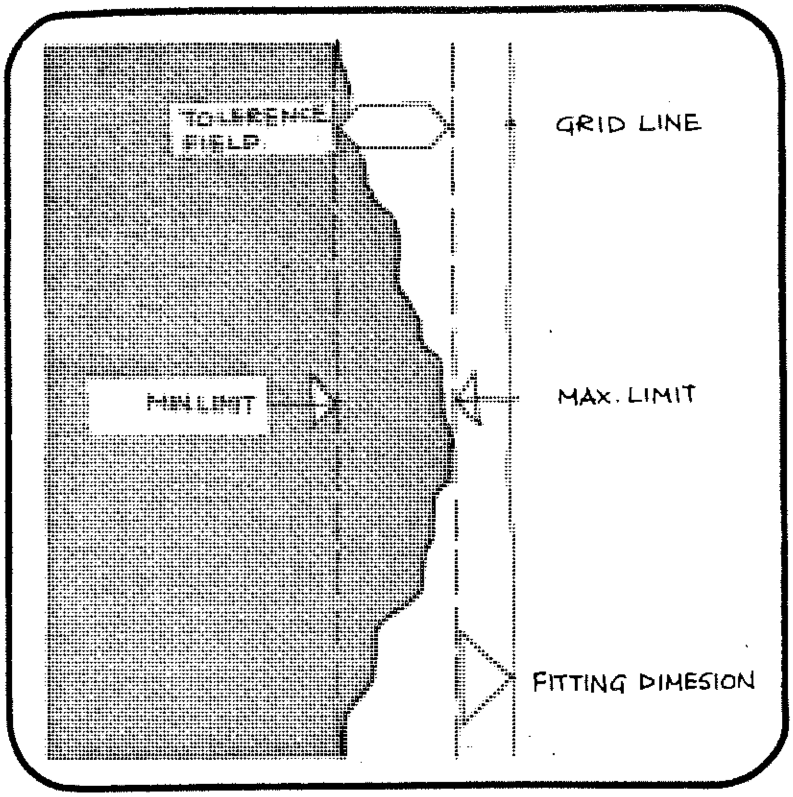

P
DEFINITIVE DESIGNE

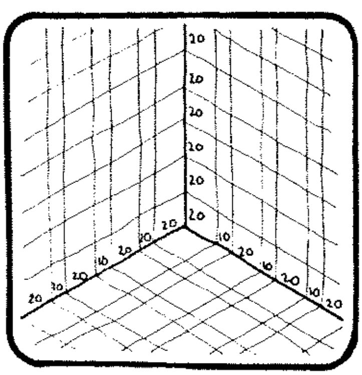

FITTING -
DIMENSION IS A
FREE SPACE

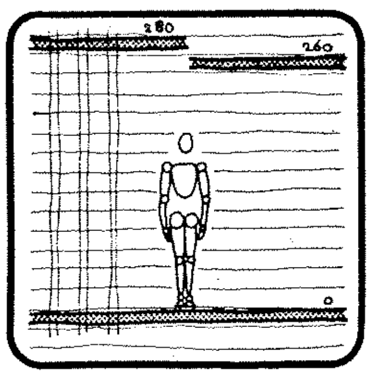

20 CM

Slide 42. Here we see the fitting dimension in relation to the tolerance field of the material. It is clear from the diagram that the fitting dimension is a clear distance between the material and the gridline. In other words, fitting dimension is always outside the tolerance field.

Slide 43. Sofar we have seen that the 10/20 cm band grid with the preferential module of 30 cm works very satisfactorily for designing of floor plans. However, for the vertical sections, we shall have to slightly modify the grid in view of the preferential agreement of the internaitonal modular coordination, which states that the floor dimension shall always be multiple of 20 cm or 30 cm. For our purpose we have selected the 20 cm module. Therefore the modified grid will have 10/20 cm band horizontally and 20 cm band vertically.

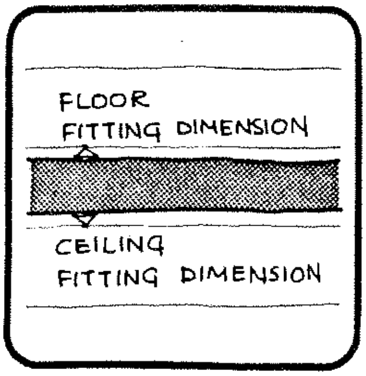

TOLERENCE FIELD
GRID LINE
MIN LIMIT
MAX. LIMIT
FITTING DIMESION

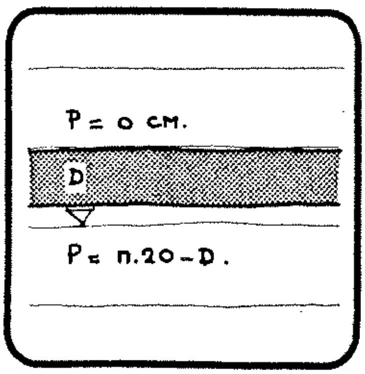



280
260
0

Slide 44. There are two rules for placing material in a 20 cm grid. The first rule says that material ends in a 20 cm band. Here the fitting dimension can vary between 0 and 20 cm. In this case we can say that there are two fitting dimensions.
Say a floor fitting dimension and a ceiling fitting dimension.

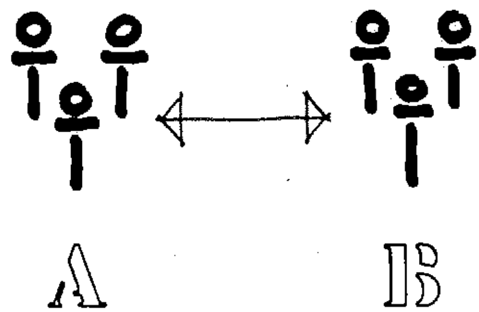
Slide 45. The second rule states that the floor fitting dimension is 0 cm. This means that the finished floor coincides with a grid line.
The ceiling fitting dimension will depend on the thickness of the floor construction. If we say that the thickness is equal to D, then the fitting dimension will be n.20-D cm.


FLOOR
FITTING DIMENSION
CEILING
FITTING DIMENSION

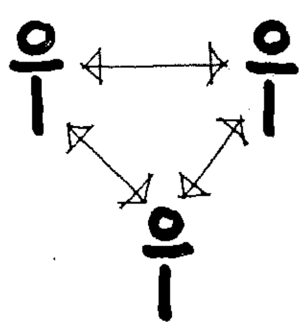

P = 0 CM.
D
P = n.20 - D.

Slide 46. All rules given sofar, are necessary because we make distinction between support sturcture and detachable units. They are also necessary for better communication and coordination between various parties involved in the design, production and construction process. In principle these rules are valid for any kind of design process where communication and coordination are necessary.

Slide 47. The most important advantage of this method is that the parties working independantly, can proceed with their work and still be reasonably sure that they will be able to coordinate their work.
The industries producing detachable units can be guaranteed that supports designed by architects shall accomodate their units and vice-versa.



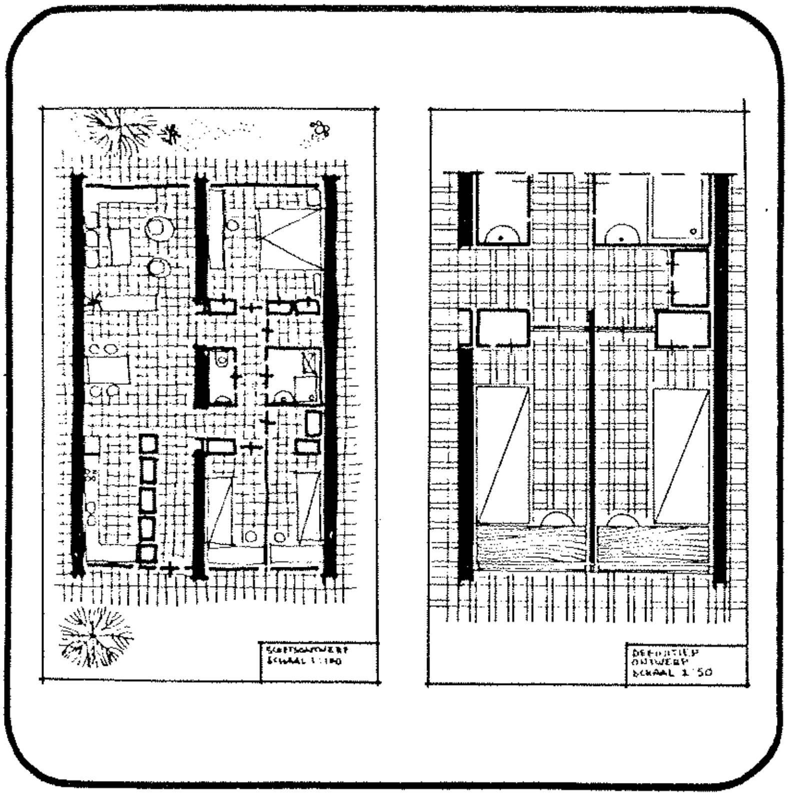

DECISIONS ABOUT
DIMENSION AND POSITION
OF MATERIAL

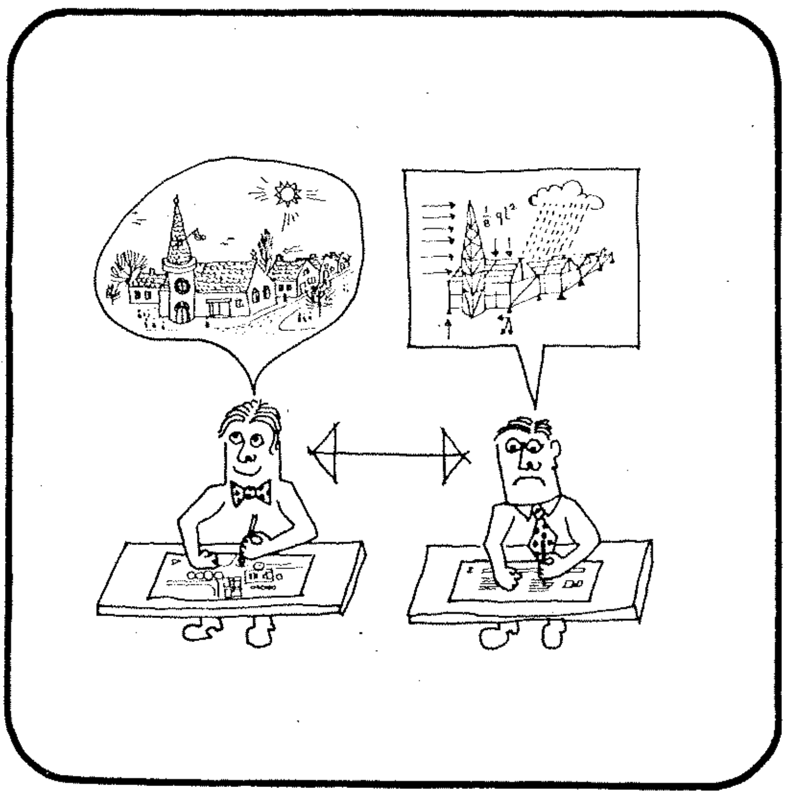


A SYSTEM OF AGREEMENTS
IS AN AID IN COMMUNICATION

Slide 48. This slide shows an example of how a design sketch on the left hand side can be carried from general to specific plan on the right hand side with the aid of rules of modular coordination. In this case modular coordination becomes a means of communication between the designer and the technician.

Slide 49. Another example of communication through modular coordination. This time between architect and structural engineer, where positioning and dimensioning of material is the common language between two specialised disciplines.


SCHETSONTWERP
SCHAAL 1:100
DEFINITIEF
ONTWERP
SCHAAL 1:50



Slide 50. To end these series of slides we have to remind the listener that, although the system of modular coordination is universally applicable in the building process, the rules presented here are not. The modular coordination rules formulated by SAR are particularly suited to design of supports and detachable units.
However, for other design problems, different rules can be formulated to suit their particular needs.
Once again, to sum up the rules by SAR for supports and detachable units:

1. Basic Module is 10 cm in accordance with international agreements.
2. Pref. Module is 30 cm in accordance with international agreements.
3. 10/20 cm band grid with material ending in the 10 cm band
4. Concept of fitting dimension to get exact position of material according to these rules.

Slide 50. To end these series of slides we have to remind the listener that, although the system of modular coordination is universally applicable in the building process, the rules presented here are not. The modular coordination rules formulated by SAR are particularly suited to design of supports and detachable units.
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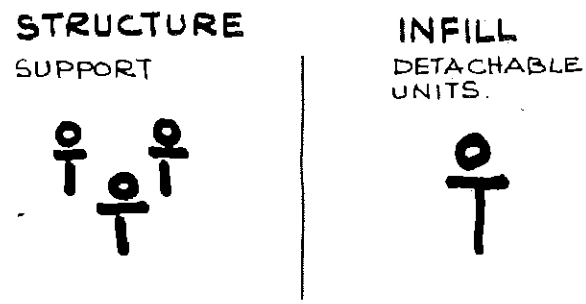



BASIC MODULE = 10 CM.

PREFERENTIAL MODULE = 30 CM.

GRID = 10/20 BAND GRID

MATERIAL ENDS IN 10 CM. BAND

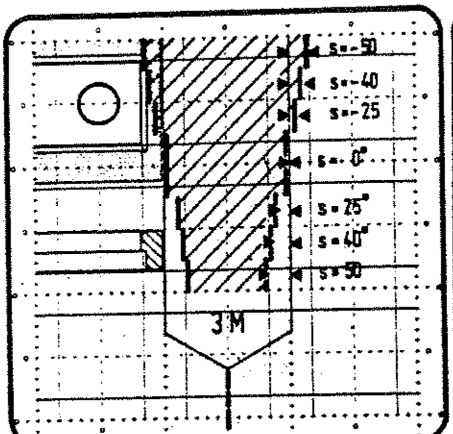

# Modular co-ordination for housing based on NEN 2880:

## Modular Co-ordination in building.

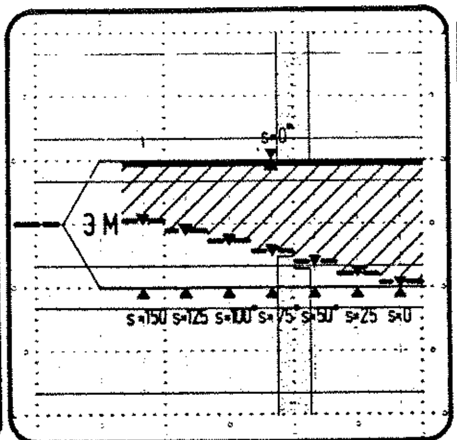
Netherlands Normalisation Institute (NNI). Polakweg 5, Postbus 5810,
2280 HV RIJSWIJK (Z.H.)

D. Smets Staff member Prof. van Randen, Dept. of Architecture
Delft University, Berlageweg 1, Delft.

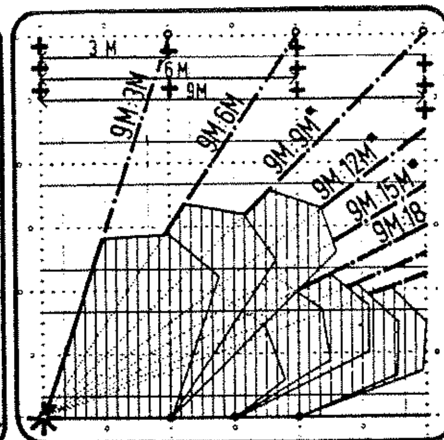
# the nine rules of NEN 2883



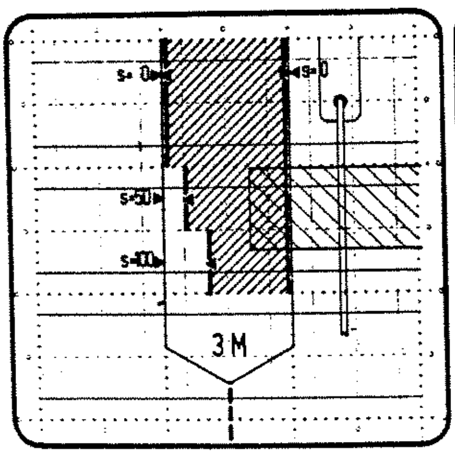

RULE 1 THE BAND FOR LOAD-BEARING WALLS IS 3M AND IS CENTERED ON THE 3M⁻ LINE GRID (---)



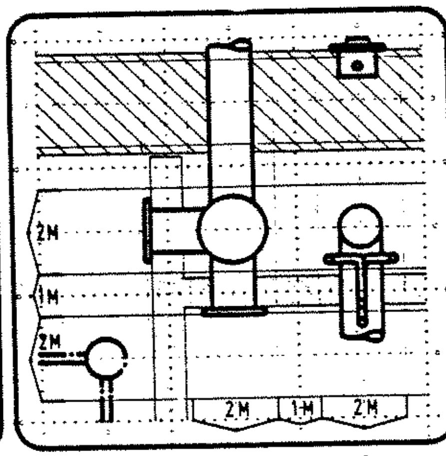

RULE 2 THE BAND FOR LOAD-BEARING FLOORS IS 3M AND IS CENTERED ON THE 3M⁻ LINE GRID (---)



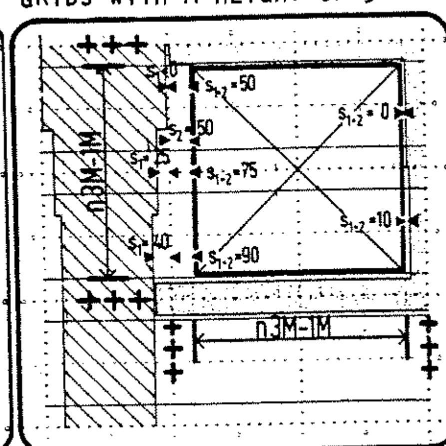

RULE 3 THE ROOF CONSTRUCTION IS SITUATED IN A ZONE THAT HAS A HYPOTHENUSE AS ITS UPPER REFERENCE LINE AND AS ITS BASE THE UPPER SIDE OF THE FLOOR BAND BETWEEN TWO VERTICAL 3M+ LINE GRIDS WITH A HEIGHT OF 9M.



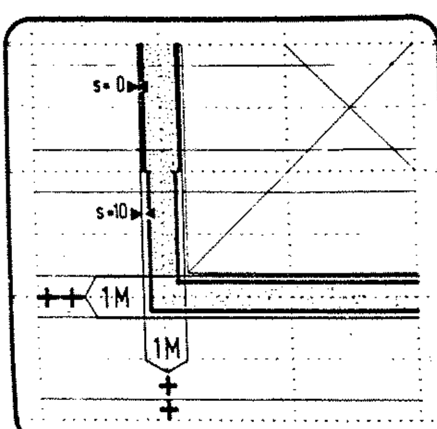

RULE 4 THE BAND FOR THE FACADE IS 3M AND IS CENTERED ON THE 3M⁻ LINE GRID.



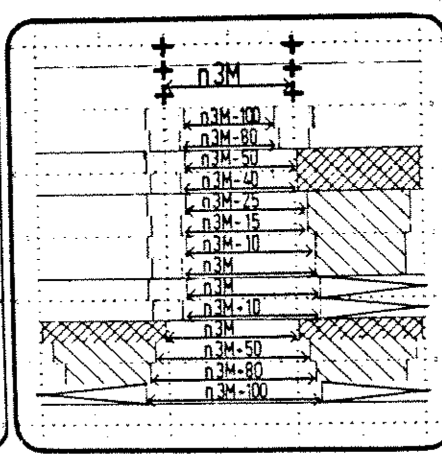

RULE 5 IN THE HORIZONTAL PROJECTION SERVICES PENETRATE WALLS AND FLOORS IN THE 2M STRIPS.



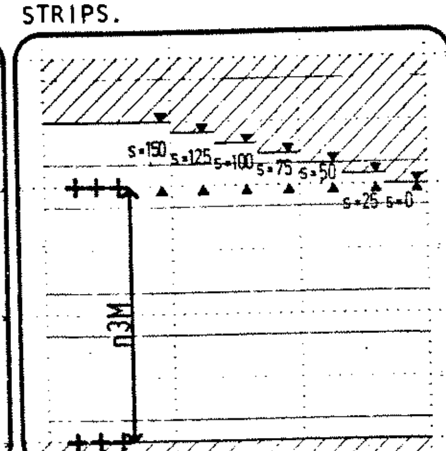

RULE 6 IN THE HORIZONTAL PROJECTION EQUIPMENT FACILITIES MEASURE n.3M - 1M AND ARE SITUATED BETWEEN 1M STRIPS.




RULE 7 THE BAND FOR PARTITION WALLS IS 1M AND IS CENTERED ON THE 3M+ LINE GRID.




RULE 8 SPACES ARE NOTED ON A 3M PLANNING GRID WHICH COINCIDES WITH THE 3M+ LINE GRID (+++)




RULE 9 THE ROOM HEIGHT BETWEEN TWO LOADBEARING FLOORS IS n.3M AND IS SITUATED BETWEEN TWO 3M+ OR TWO 3M⁻ GRID LINES.

DETAILIN
SMALL TR
OBVIOUS).
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DETAILING OR: HOW TO AVOID TRIPPING OVER SMALL TREACHEROUS ROCKS (THE BIG ONES ARE OBVIOUS).

Why do "good" details not blossom and mix like flowers in a meadow?
Why is it that time and again they have to be invented as if nothing has happened before?
Some of the reasons for this phenomenon are:

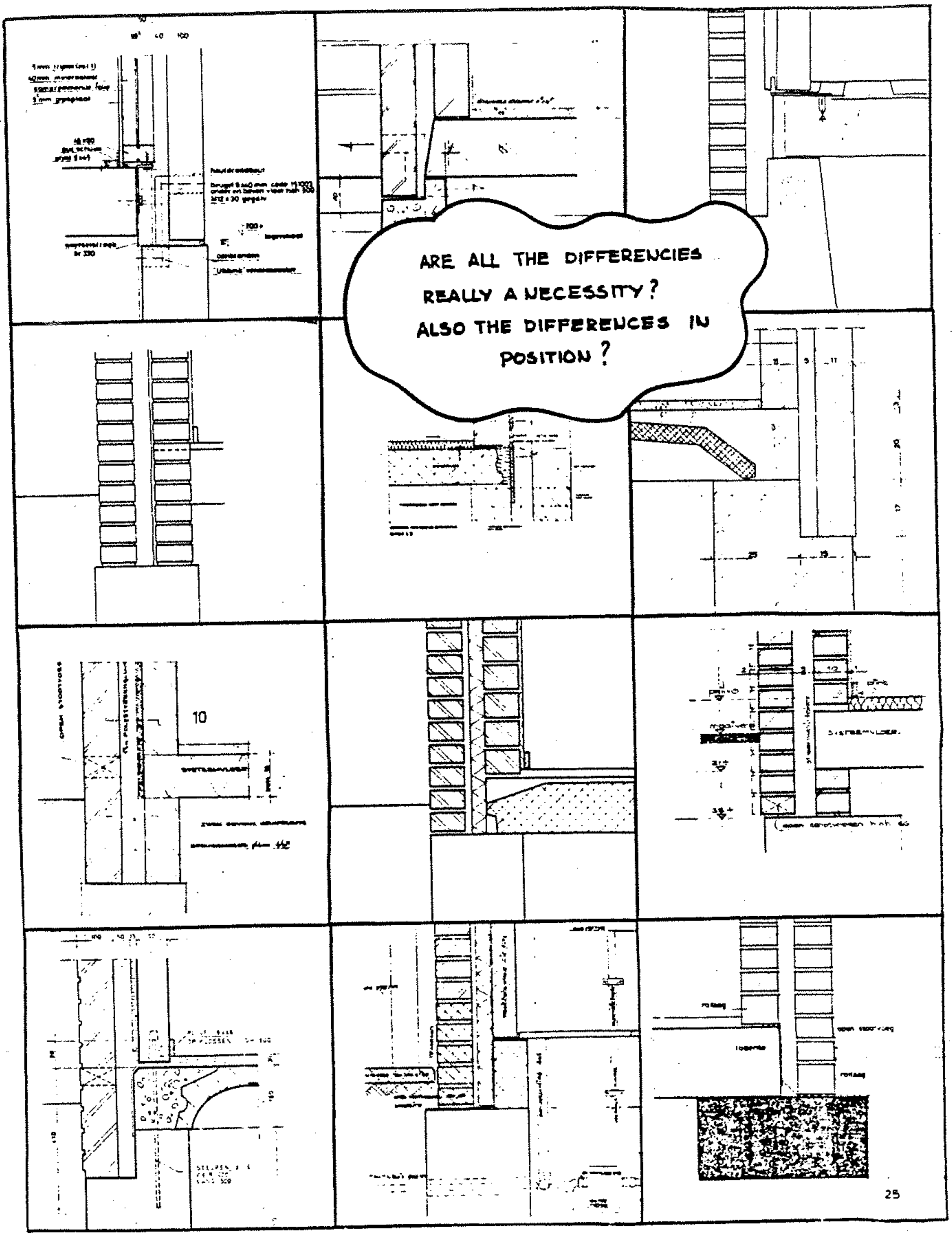
*There is no such thing as two completely identical projects:*

1. Experience induces changes. Regulations in one county are different from those in another. Each project has typical considerations.
2. If *users-participation* becomes a reality no two houses will be exactly identical. And this will have its effects on detailing: more user-participation will lead to a different kind of detailing.
3. The great variety in *building material, products, components, systems, building machinery and equipments* leads to a great variety of details.
4. The *commercial monopoly:* in ancient times a craftsman became a master if he knew how to imitate very well, now you are called a thief if you use somebody else's idea.
5. The *originality-principle:* a designer who respects himself should have new ideas.
6. Details are less and less embedded in a tradition, a convention. They originate no longer from a direct confrontation with the user, but are much more based on the *subjective taste* of designers. For them purity, honesty, finishing, very often is much more interesting than convention.
7. *Economy:* real or assumed changes in economic circumstances very often have a profound influence on the detail level. Even between two contractors these assumptions can differ widely. Yet all these factors do not really explain the "time and again". There have still to be other factors.
8. Though there is available an enormous arsenal of building-products, systems techniques, methods, schemes, etc., each designer will try to limit his choice. The more different materials, etc. the more different details. But not only that: each detail through its ripple-effect has its influence on other details: *the existing materials and products and also the many space-regulations - cause by their intolerance a constant expansion or shrinking* of the detail and through that of the design as a whole (shoving things around until they fit...).
9. Even if a limited choice has been made it turns out to be impossible to keep the details unchanged during the design-process: it is impossible for an architect to foresee everything. He has to change details and very often not one time but again and again.
   *A detail is very sensitive for decisions of other participants in the process:* a local official who does not approve a roof-tile construction, bricks that have to be replaced by imported bricks with different sizes, etc.
   All these reasons cause a change in details which does not stem from the character of the design. And what is even more one change causes through the ripple effect other changes.

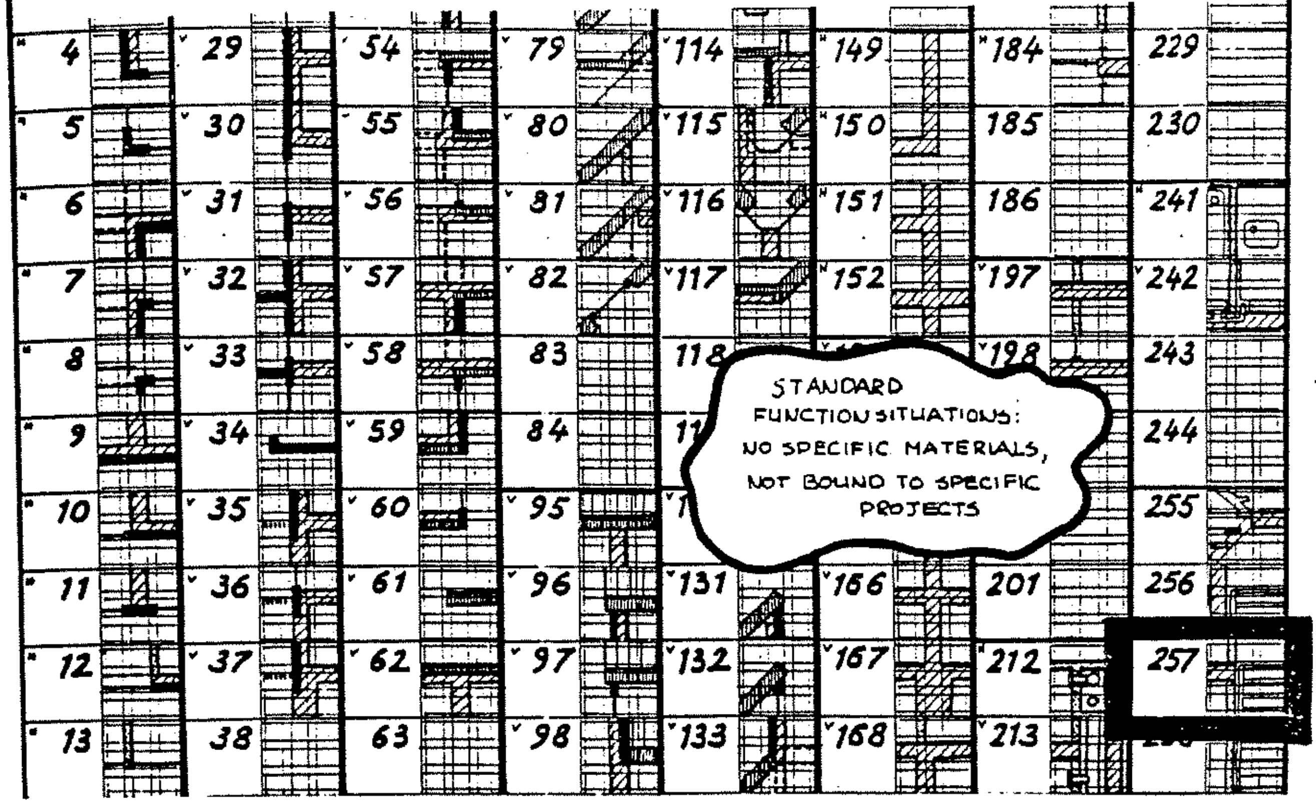
Even if a designer leers clear of the rocks mentioned under 1 - 6, the points mentioned under 7 and 8 *will make it very difficult to use only a useful variety. Very often they will saddle him with a useless variety* (see picture 1).

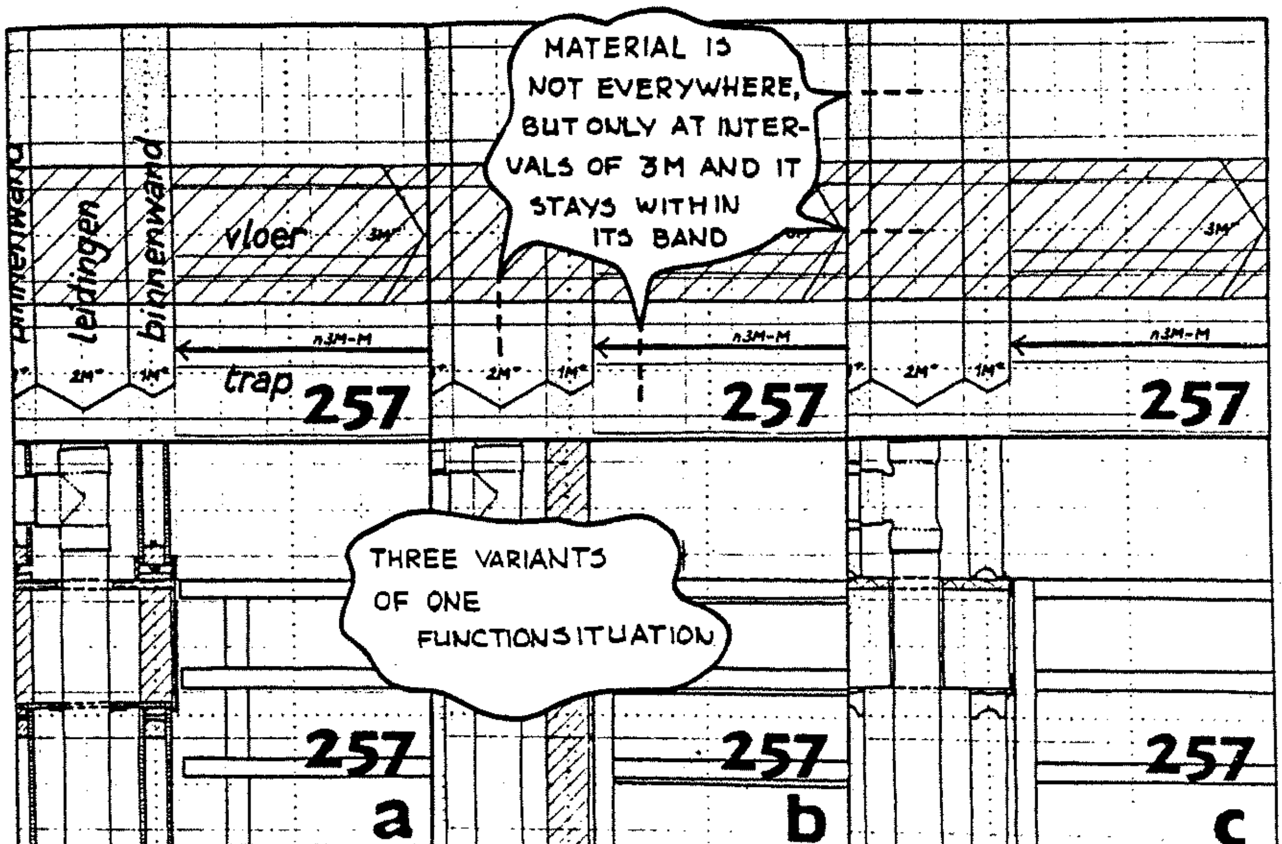
The new Dutch standards NEN 2880 "modular co-ordination in building" and NEN 2883 "modular co-ordination in housing specially deals with the last two points. They give both material and space a co-ordinated position.
This means: decisions about space and material will be co-ordinated if you stick to the rules.
In this way different participants can work *side by side* and *in harmony* instead of work *at cross-purposes* and *in conflict*. This remedy of course is not spectecular at all: neither is the ailment: "shoving things around until they fit". Very often this causes only a very minor change. But a small change can have big effects: almost the same very often is totally different.

Now of what importance is NEN 2883 for the architect?

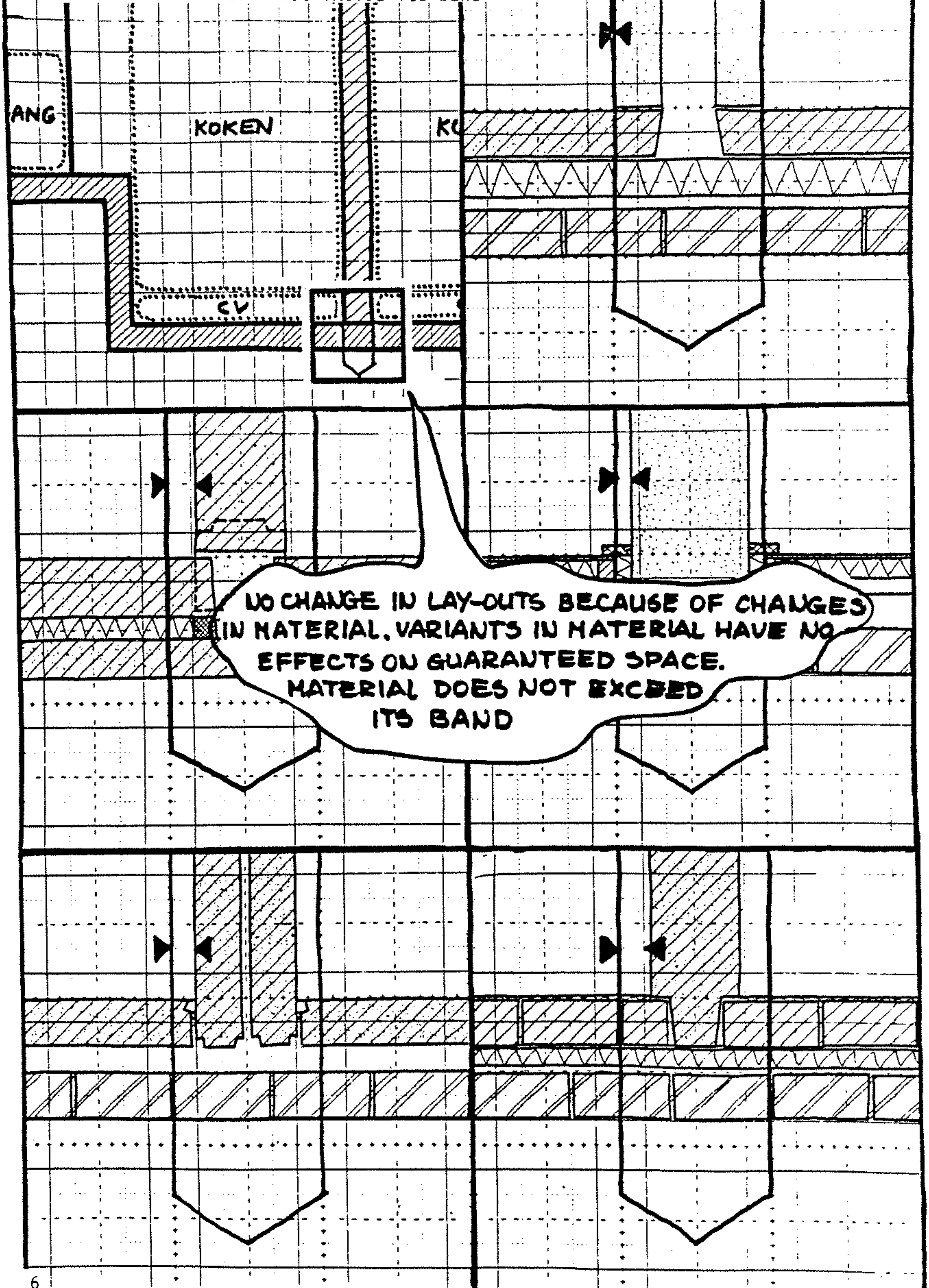

ARE ALL THE DIFFERENCIES
REALLY A NECESSITY?
ALSO THE DIFFERENCES IN
POSITION?
10

Material no longer has to be expected everywhere, but only at intervals of 3M (300mm) and only within the limits of its band. This means that it is possible to make standard junction-situations not bound to specific projects and materials. Per project these standard junction-situations can be filled in

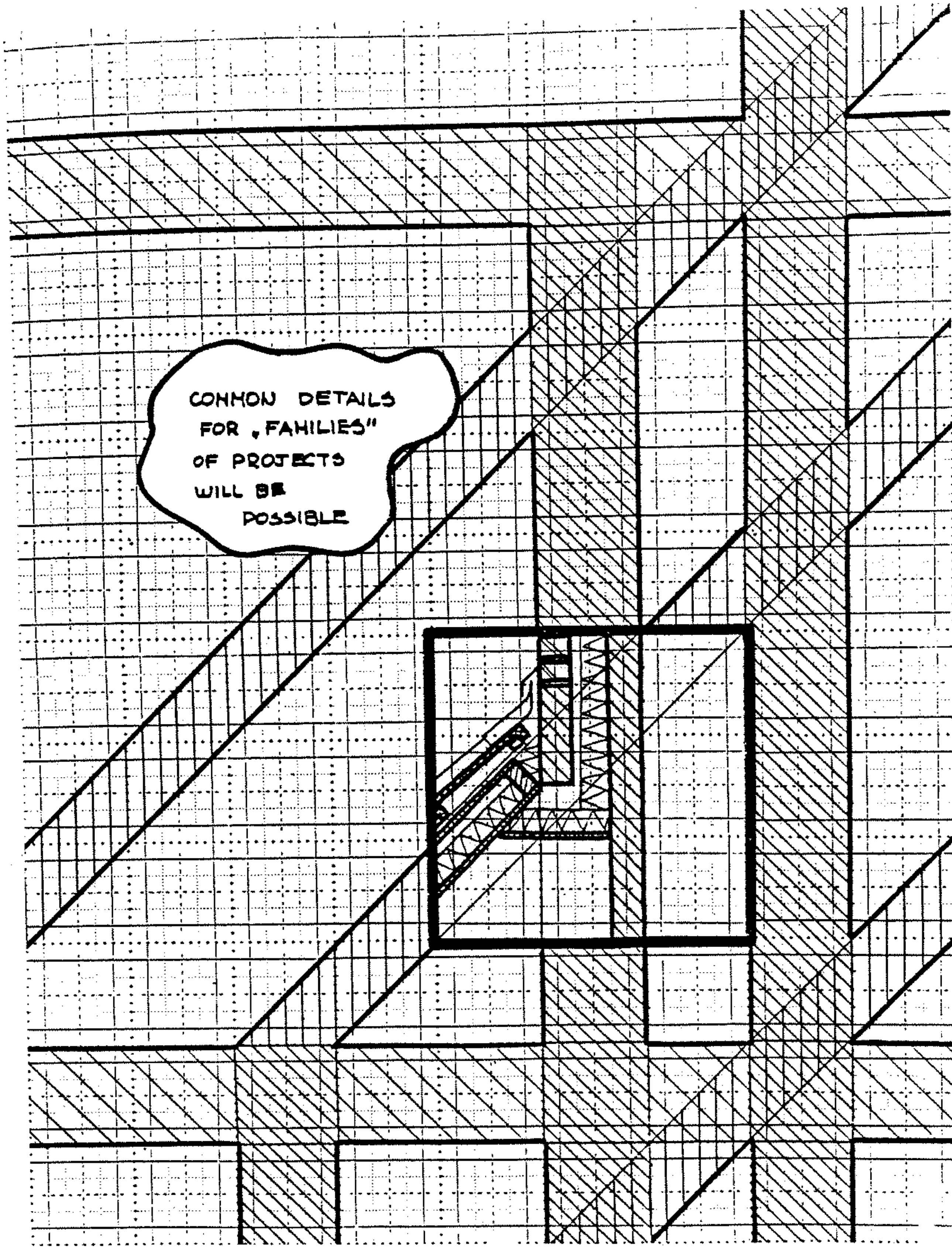


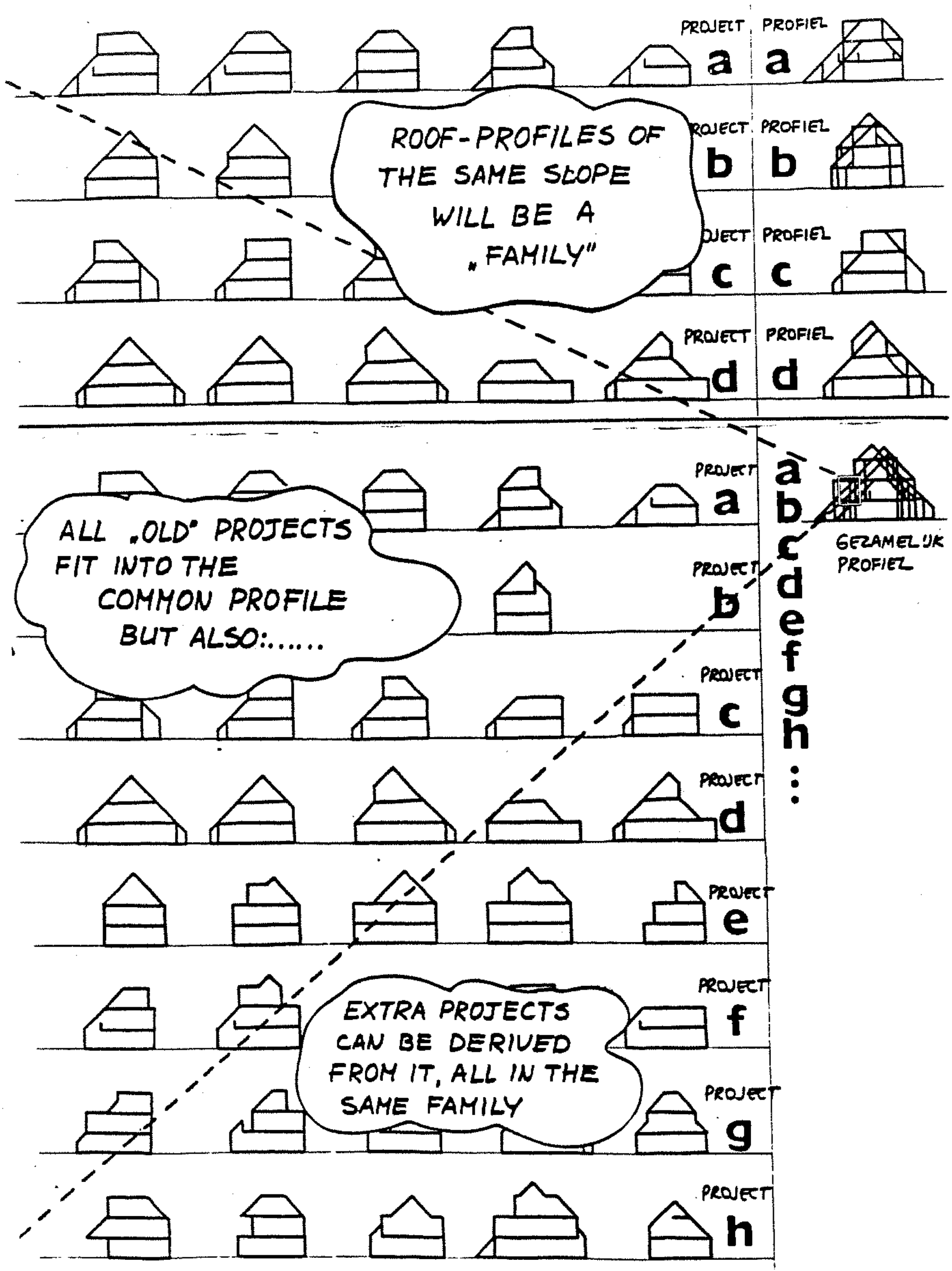



A global lay-out of spaces will not be influenced when in a later phase material is chosen and details are worked out. Variants in material will cause slight changes in space-dimensions. But the guaranteed space is always there because material does not exceed its band

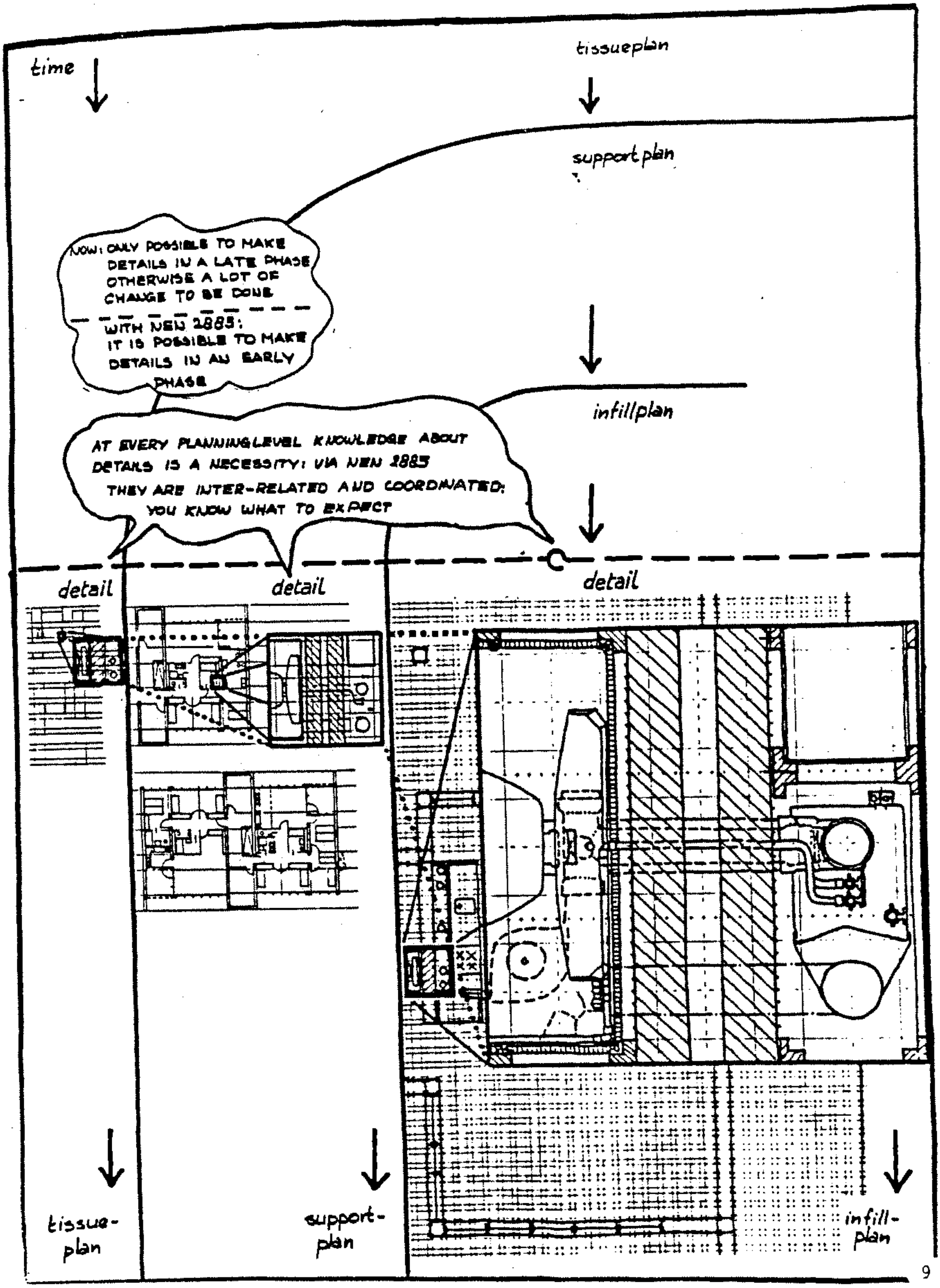


Everything has its own position at intervals of 3M. In between "nothing can happen". One effect is for instance that all housing-profiles with the same roof-slope will be "a family". Profiles of different projects will turn out to overlap each other. Details can be swapped, between projects, new profiles can be extracted from the common profile and so on (see picture 4 and 5).

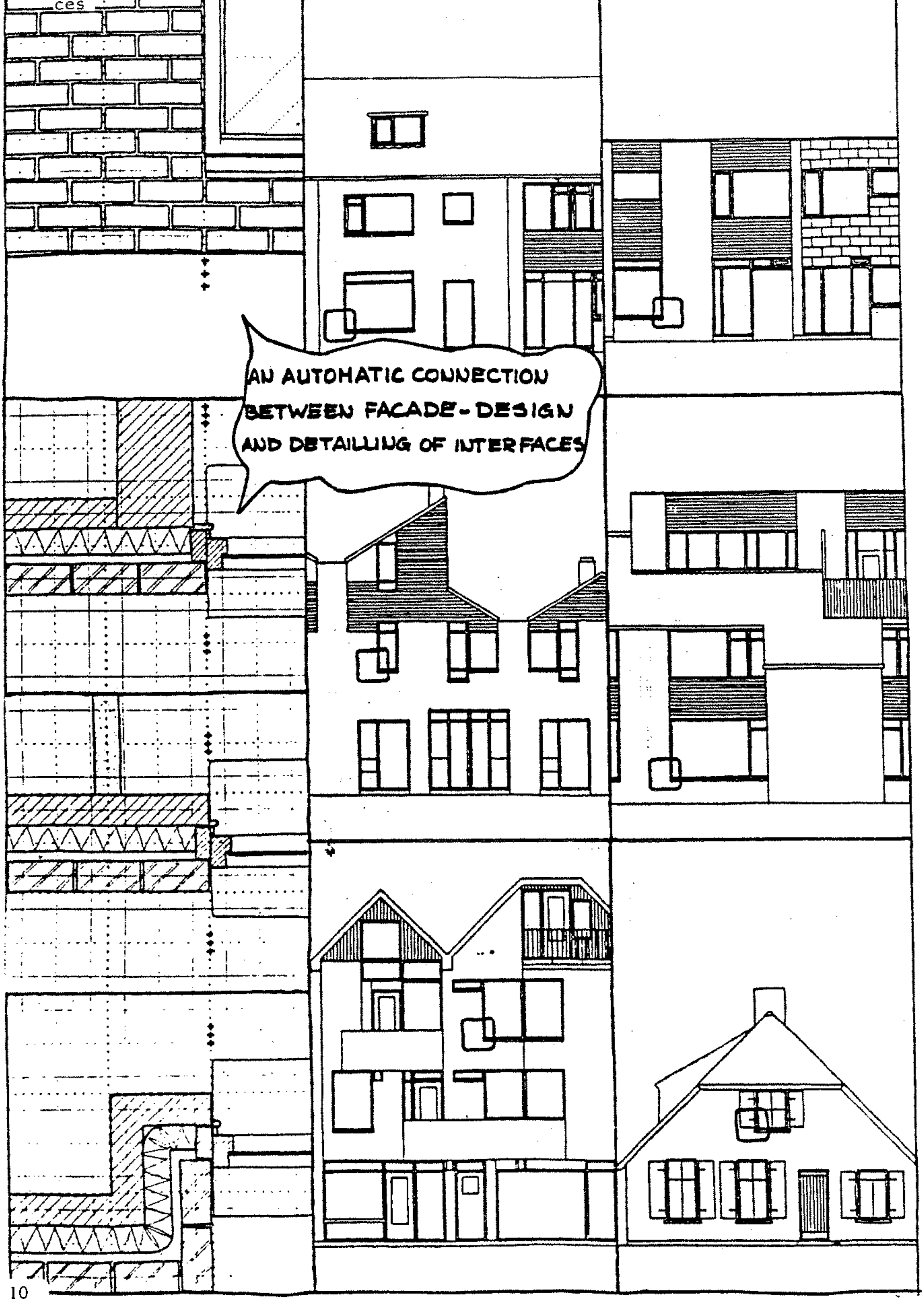



PROJECT a
PROFIEL a
PROJECT b
PROFIEL b
PROJECT c
PROFIEL c
PROJECT d
PROFIEL d
ROOF-PROFILES OF THE SAME SLOPE WILL BE A „FAMILY"
PROJECT a
PROJECT b
PROJECT c
PROJECT d
PROJECT e
PROJECT f
PROJECT g
PROJECT h
a b c d e f g h ...
GEZAMELIJK PROFIEL
ALL „OLD" PROJECTS FIT INTO THE COMMON PROFILE BUT ALSO:......
EXTRA PROJECTS CAN BE DERIVED FROM IT, ALL IN THE SAME FAMILY

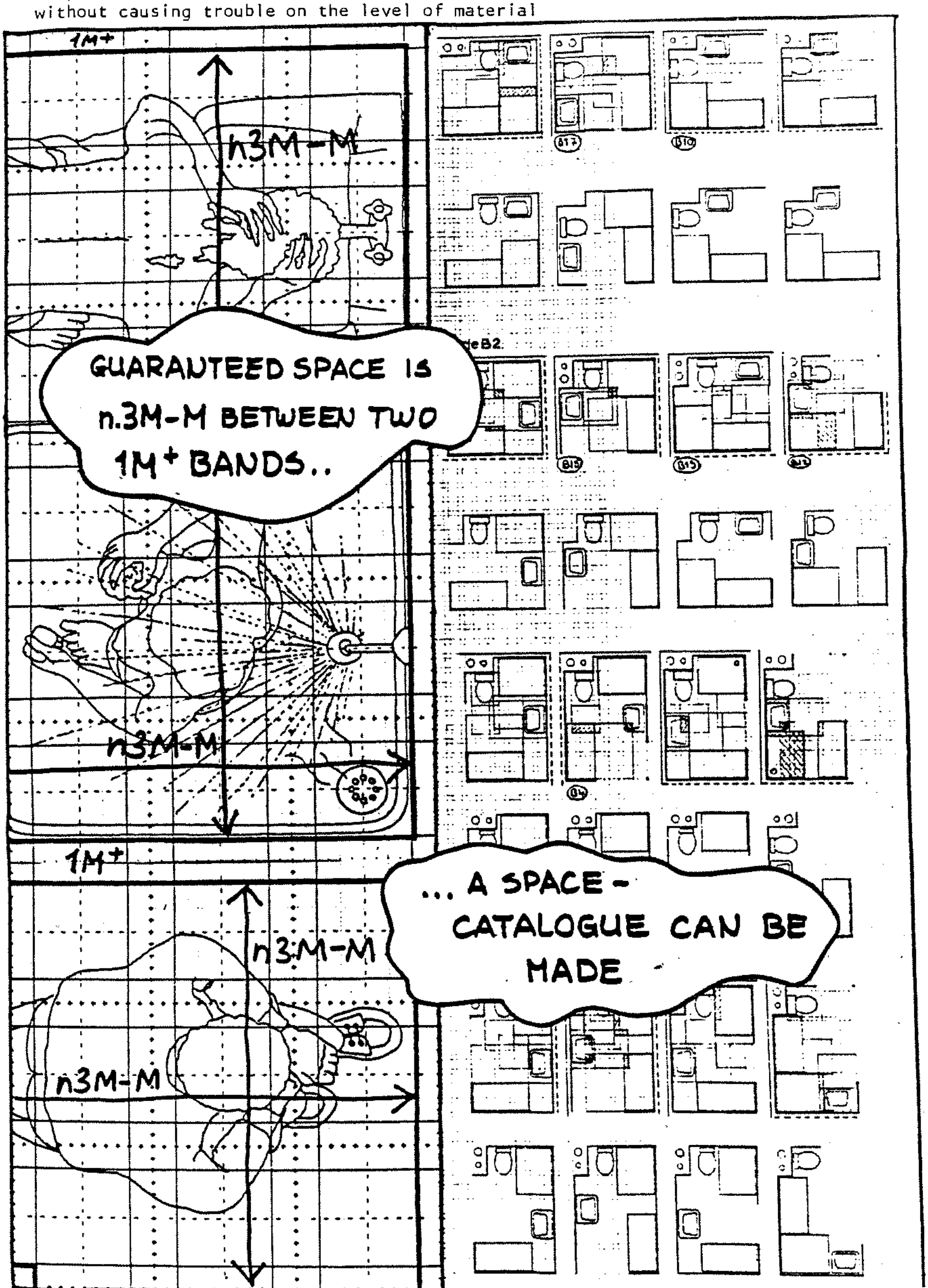
A global design determines a specific design: one comes after the other. The standard gives the possibility to move certain decisions ahead: it is no longer a necessity to wait for one another. Each can work on his own pace. Even in the global design phase it is possible to make details



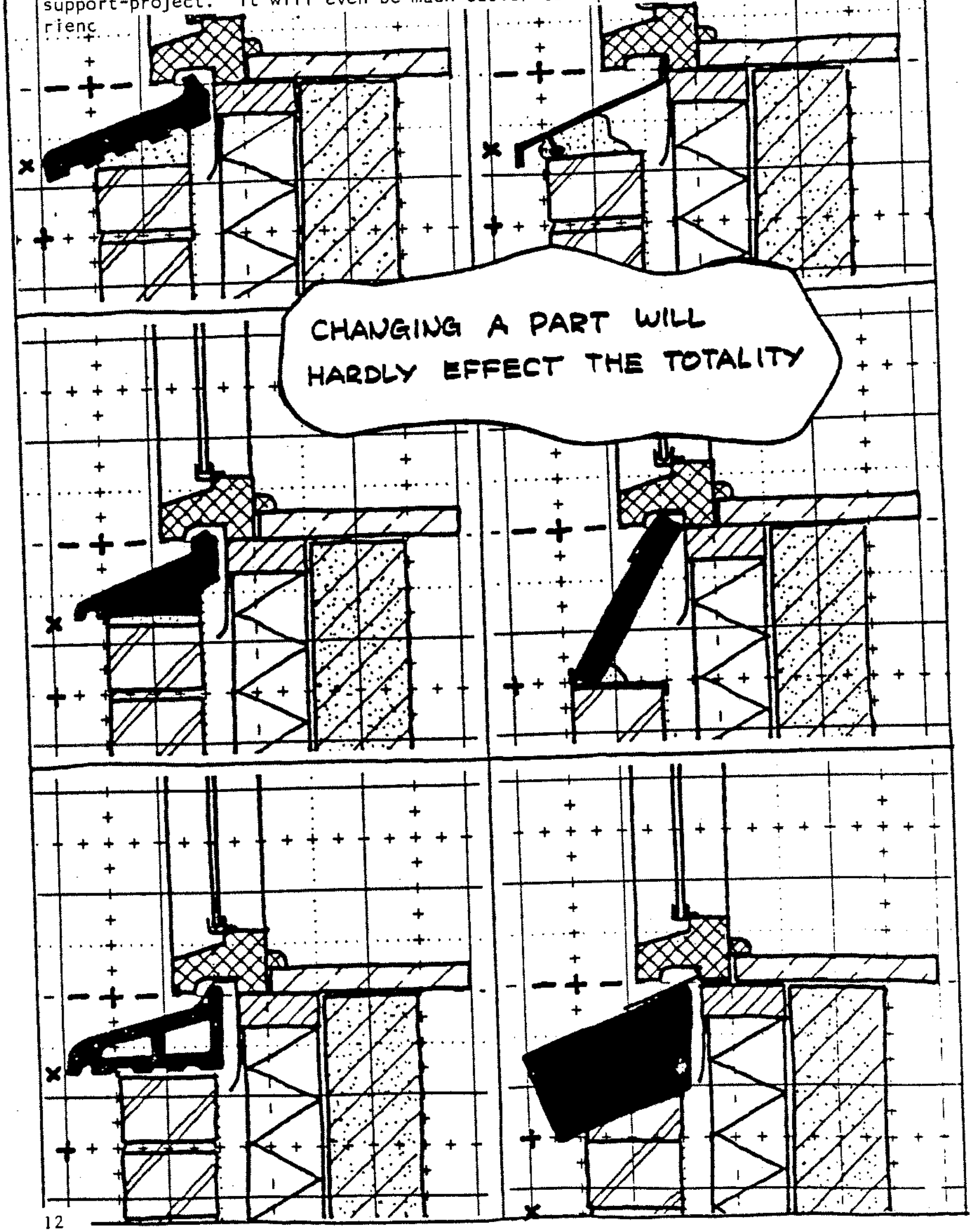
The 3M interval - with the 1,5 inverval for exceptions - guarantees that whatever facade - compositions still can be chosen without changing interfaces



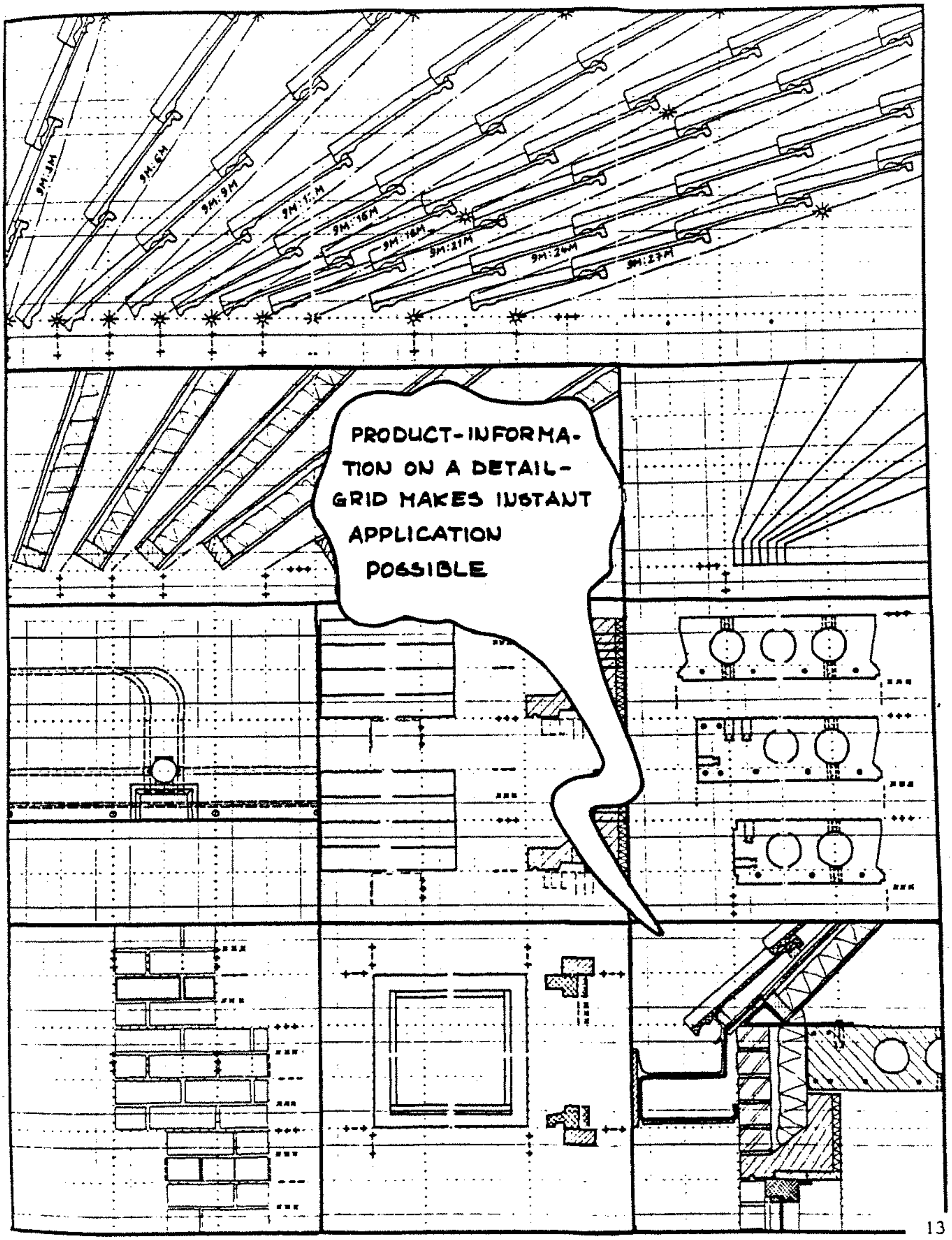
Spaces are designed on the 3M design module and their guaranteed space is n.3M - M. This means that a space-catalogue for different categories can be compiled. All the spaces from the catalogue can be used and inter-changed without causing trouble on the level of material



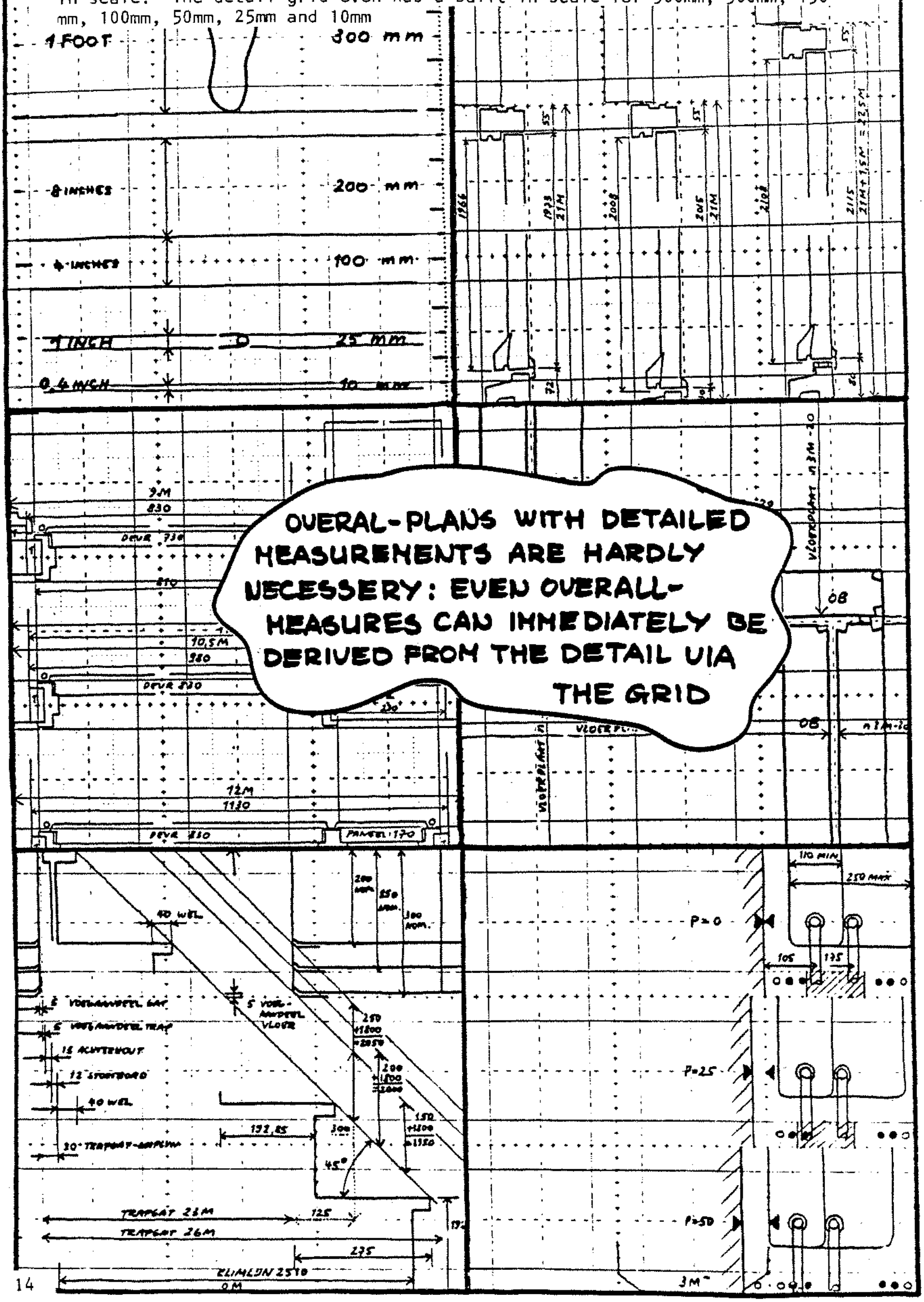
Details or parts of a detail that can be preserved do not have to change. It may not even be necessary to make a new drawing. Examples are "standard" details of a certain building-system or architects-office.
On the other hand: it is more easy to make a slight change in these standard-details because it will not cause an endless ripple-effect on the other ones or even on other parts within the detail. It will be more easy to use one's own "typical", "nice", "good" details. Or to accept the manufacturer's details of certain products, for instance of detachable units to be used in a support-project. It will even be much easier to improve details by experienc



In folders, certificates, standards, product information sheets building products can be drawn in a detail-grid. A designer in this way can more easily "compile" his detail: the position the specific product can have in relation to other parts is immediately visible



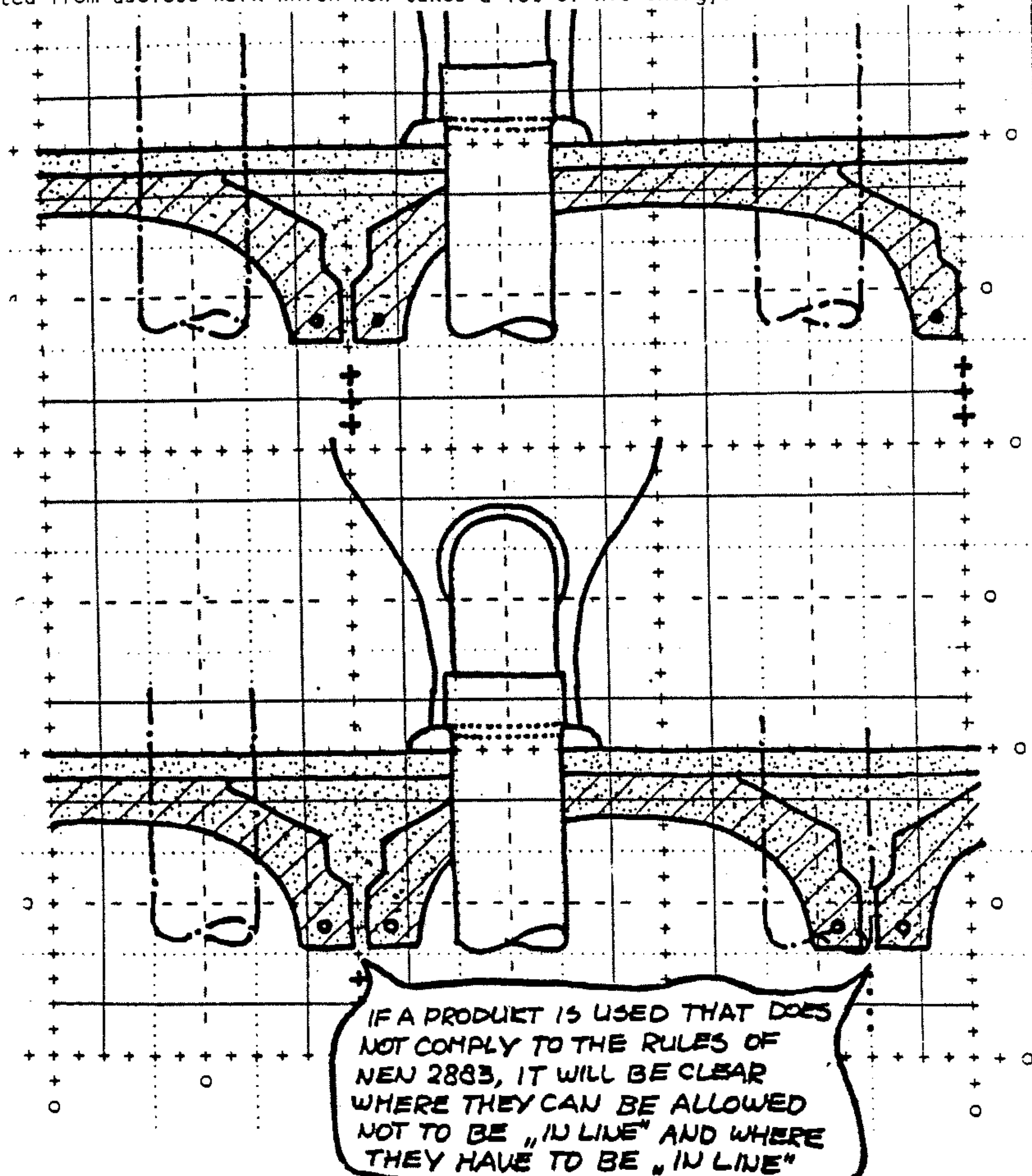
From each detail by means of the grid overall measures can immediately be derived. Even scale-rules are no longer a necessity. The grid has a built-in scale. The detail-grid even has a built-in scale for 900mm, 300mm, 150 mm, 100mm, 50mm, 25mm and 10mm



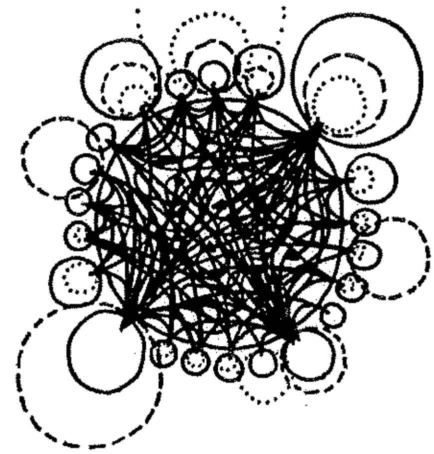
If exceptions have to be made, perhaps because of a product that does not (yet) comply to the rules, it will always be clear where this will be possible and where not, what implications it will have for other participants and where it is possible to be "in line" again

These are some advantages of NEN 2883. But it is a knife that cuts both ways: After a period of mastering the method detailing will get easier which means that more energy can go to quality, to variants, to consultation of the real users, to the environment, to the office and the people you work with etc.

But what is the most important, the architect will be able again to put all his energy into his role, as "man of the totality", because he has been liberated from useless work which now takes a lot of his energy.



SAR OPENHOUSE, vol. 3, no. 3, 1978



# NODES AND NOODLES

Prof. A. van Randen

Inaugural lecture delivered by Professor A. van Randen on Wednesday 21 January 1976 on the occasion of his taking up the chair of Building Construction in the department of Building Science, Delft University of Technology. Originally published by the Delft University Press 1976 under the title De bouw zit in de knoop.

Just imagine: 50, 100 or 200 families are given the chance to participate in the decision-making about the form their neighbourhood, their street, or their houses should have. They have a say in some of the choices to be made; others are left to them entirely. They have a say in determining the range of possibilities to be offered; and they are free to choose whichever possibility they prefer, in their own sector.

Just a few words, describing a very complex process, a real "business".

It's happening. Today. Still rather tentatively; but it is happening. Some of you may be aware that I am actively engaged in such projects.

Shifting decision-making from the expert's desk to the sitting-room table. Is that really possible? Is that what we want?

Another picture.

A new home has just been built, somewhere in Holland. Developed on the basis of the latest ideas about how to look after a special group of people. The result of 5 years of intensive collaboration.

But in the meantime, the "latest" ideas have been replaced by even newer ones - and it proves difficult or impossible to put these very latest ideas into practice in the "new" home. Ideas cast in stone: imprisoned, inflexible, out of date.

Ideas about life, standards, possibilities are changing. Fast. This state of flux is part of our lives today, something we will have to learn to live with.

Do we take this element of change into account in our building? How far can we? Must we?

Yet another picture.

There is a committee on "dimensional standardization for facade elements" in the Dutch Standardization Institute. The manufacturers of facade elements have a big production potential. But this production is project-orientated. Each project involves new requirements - sometimes completely different ones.

It goes without saying that the manufacturers are looking for possibilities of defining the limits of that "difference" somewhat more closely.
So that they themselves can have more say in the nature of their product, and thus realize a more efficient relation between product and production set-up.

A building supply sector which is slowly growing into an independent branch of industry, and is trying to find ways of making the best use of its potentialities.
Will they find them? Should they?
Three examples.
Three developments.
And lots of questions.
Questions that can be summarized as follows:

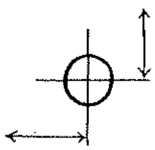
- What should we be building?
- Under what conditions?
- With what tools and materials?

Here in a nutshell we have that much discussed affair, the structural study of the building history.

The answers to these questions are of great importance. They will also have a great impact on the tasks of tomorrow's architects and constructional engineers - and hence on their training today.

I hope you don't expect to hear a complete answer to all these questions this afternoon.

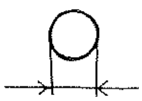
We will restrict ourselves in this lecture to a few recent developments, which we consider to be of great importance - also as regards the questions just mentioned.



POSITION

Developments in the creation process of our built environment, and in the process of modifying it once it has been built.

Let us have a closer look at these two processes.



DIMENSION

If we plan to build or renovate a building, we always have to start by deciding which materials go where.

PROPERTY

In other words, we always have to make binding statements concerning the "place, dimension and state of space and materials".

No more than that - but no less either. These statements form a central point in the building process. No matter what the considerations of the various parties involved in the building process may be, they will have to reach agreement about this point before they can go any further.

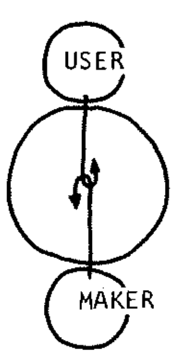
Now what are the considerations on which such statements can be based?

Roughly speaking, we can devide them into two categories:
- considerations of use
- considerations of production.


In other words, decisions have to be made in the force field between consumer desires and production possibilities.
Means and ends.
But also: profit and loss. What am I getting? And what sacrifices do I have to make for it?

Decisions in that force field.

When the user and the maker are the same, the decisions are fairly easy to make.




If you are building your own hut, it is a fairly easy matter to solve the conflicts between your consumer demands and your building potential as you go along.

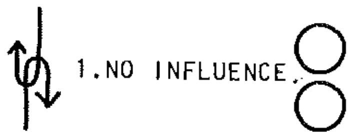
You improve and improvise on the basis of experience.

It may take generations ... a slow evolution. Maker and product "grow" together.

But where division of labour raises its head, user and maker are separated.

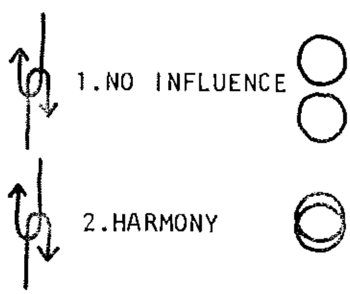
One of the first stages is a division of labour based on the development of a specialized tool, permitting more efficient use to be made of muscle power.

But the maker still designs the product himself. He decides on the basis of experience. In consultation with the user. And in direct confrontation with the creation process.

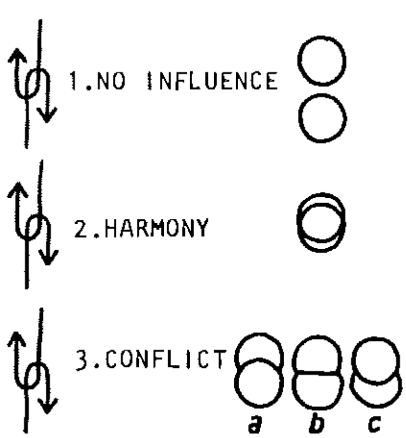



However, the dichotomy between considerations of use and considerations of production becomes more clearly apparent now.

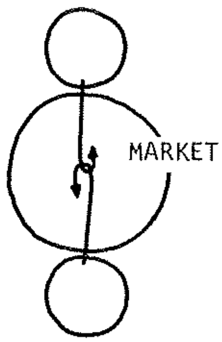
It may be that these considerations do not influence one another.




Alternately, they may harmonize: coincide, partially or wholly.



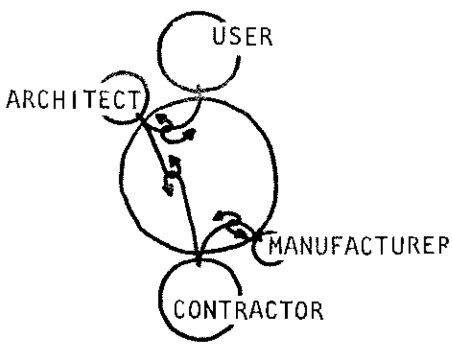

But they may also conflict; and in that case, the question is who gets dented. Who gives way? The user, or the maker? Or both?
It should be realized that such a conflict only arises when one of the parties, or both, departs from what is "usual". From what has grown up, often on the basis of years of use and experience. *Conflict is the child of change.*




Who has to give way? When user and maker are separated, two more "parties" are created.

These parties interact via some kind of barter mechanism, or on some other basis. A "market" is created - literally and figuratively. On this market, a solution may or may not be found to a conflict (if there is one). The parties reach agreement. Or they don't.
It follows that the more "change" there is, the more activity is generated on the market. As we shall see in a moment.

Division of labour and specialization continue; the tempo speeds up - especially during the industrial revolution. The designer, the architect, enters the scene. Designing becomes more and more separate from making.




A separate party has appeared, between the user and the maker. He "represents" the user of the building to be made. And, all being well, his design will realize an optimum balance between profit and loss for the user. Between considerations of use and considerations of production - taking the market situation into account.

It is about this time that the production of building materials and carpentry in specialized workshops or factories makes its appearance.

Initially, all parties are still fairly firmly embedded in "conventions" in this situation. In generally accepted standards and customs. In "you do this like this", and "you do that like that". The regulating action of the authorities in technical matters was therefore still limited.

It is true, "conventions" change, but all parties concerned could keep pace with these changes.

Until the 1950's, "designer" and contractor still learned their "trade" from the same books. In the Dutch situation, this meant Wattjes. And later Jellema, Meischke and Müller. But that was the last standard textbook (albeit a very bulky one) which contained all the answers.

That simplified communications.

My father, who is 81 now, still built from a 1:100 scale drawing. That's all he had.

There were no prescriptions concerning standard details; all details were standard.

And then, in the '50's, the tempo of change began to rise, almost imperceptibly at first.

This was the start of what proved to be an almost explosive development of know-how and its applications. With all the attendant consequences in the social sphere.

On the "users" side, new ideas about living and working grew up.

On the makers' side, new materials, new equipment, new methods and possibilities.

On the market, new relations, new parties to the bargaining.

The changes were many and varied.

We will have to learn to build on this basis. "Building and indeterminancy" was the title of a recent degree dissertation.

Will things go on this way? Won't a stop to, or a drastic cut in, economic growth not have a stabilizing effect? It could.

But it is unlikely that another important source of change - science - will cease its stimulating activities. And even fundamental re-thinking in this field would doubtless lead to a flood of changes.

Look at the new thermal insulation standards. A drastic and radical change.

User - architect - contractor. That was the stage we had reached. What is the situation now?

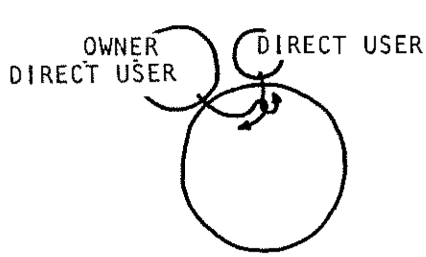
Let's have a closer look at the user first.

"The" user ... it's not as simple as that any more. We are gradually being forced to recognize several categories of users. On the basis of different interests. The basic distinction is that between:

- owner

and

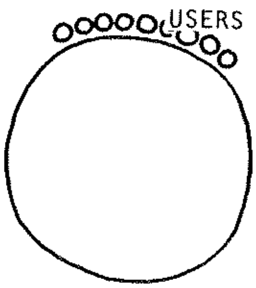
- direct user




In the old days, often one and the same person. And even if they weren't, there were well established conventions governing the relation between them. Generally a patriarchal relation, with the owner - the landlord - laying down the law. Now that things are changing at a high tempo in everybody's field of interests, the contradictions are becoming apparent.

For example, the scale of exploitation and management of real property is increasing. While the direct user remains an individual - though he may have difficulty in remaining himself, in not getting snowed under in the decisions made "for" him. He wants to have a say in his own lot; and to take the decision himself in certain cases. He doesn't want to be a cog in the wheels. 100 families round the bargaining table. In the "market".

And there's yet another category of users. We could call him the "indirect user".

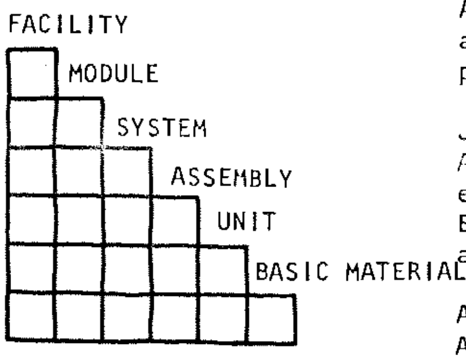



He's the one who has to live with the building, to undergo its influence, without being the owner (landlord) or the direct user. Literally the man in the street. Direct user of his own house; indirect user of that of his "neighbour". Here again, conventions are being blown away. So once again, more chance of conflict.

Can his interests only be protected by the authorities? Or can he have a say in things too? Participation for the indirect user?

And now the makers' side of things.

A dichotomy is becoming more and more apparent here. Between making on the building site and making in the factory.



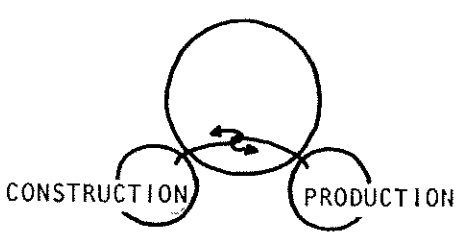

A diagram was brought to our attention recently. It was an attempt by Sweets Catalogue to reclassify building products.

Just in case you didn't know, Sweets Catalogue is the American builders' catalogue system, with a place for every builders' product that comes on to the market. Building in America without Sweets Catalogue is unthinkable.

Apparently the old classification was no longer adequate. And that shows that something's wrong somewhere.

Sweets started as a catalogue of building materials. And that's how everything was classified until recently: as building materials.

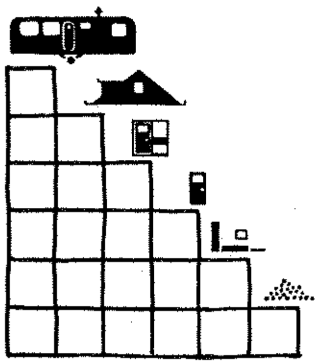
But more and more composite products are appearing on the market. So Sweets makes its new diagram to deal with them, arranged on an increasing scale from basic material to facility. With the unit, the component and the module in between.




Making on the building site.
Making in the factory.

Two manufacturing sectors, each with its own possibilities and impossibilities. And, we think, that's reason enough to make a verbal distinction betweem them. Between *construction* and *manufacture*.

"Construction" - putting the building together on the site. "Building products" - everything brought to the building site for the construction work. "Manufacture," making the building products.



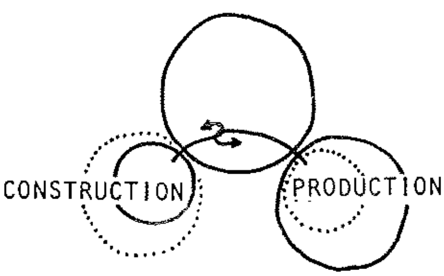
Building products from a pile of sand to a mobile home and everything in between.

Building products thus have a very wide range of properties - especially as regards the value added during the construction process. To make a building from its componenets.

Manufacture and construction.

The production process may exhibit the characteristics we regard as typical for industrial production. The construction process cannot - at least as long as we take as one of the basic features of industrial production that the product moves. Past the means of production.

The idea of "industrial construction" does not fit into the conceptual framework we have developed here. Of course this does not exclude the possibility of a certain degree of industrialization of the construction process.




This degree of industrialization of the construction will increase as the value added during the production phase increases relative to that in the construction phase.

A dynamic equilibrium. Dependent on many different factors. An equilibrium that should be able to adjust itself as flexible as possible to changes in circumstances. In both directions.

The construction sector.

Tied to a given place. Tied to a given project. A travelling circus. With its own typical possibilities and impossibilities. In the interests of cutting costs, it may be advisable to employ building products which involve little added value during construction: assembly kit construction. This may be advisable; it's not inevitable.

The manufacturing sector.

There are possibilities for industrial production here - the more so as the initiative for production becomes less tied to a given project.

No wonder more and more "off the hook" building products are appearing on the market. Generally "finished" products, embodying many different design decisions - more so as more functions and facilities are integrated into the product. Decisions which used to be made by the designer of the building, and which he now has simply to accept. Or not use the product.

It will at least be clear, in our opinion, that we have to take the production sector seriously.

*It may well be that the manufacturing sector now determines the design possibilities much more than the construction sector.*

Feedback between design and construction. The burning topic of the 'sixties. Because of the higher tempo of change. Both in design and in constructional techniques.

Have we reached the stage where feedback between design and manufacture (in both directions, of course) is possible? It's about time it was.

Construction and manufacture. Another two parties who have to learn to live with one another, and who certainly haven't mastered that art yet. There's too little effort to see how the other half lives (and works). Still too much tendency to pass the buck instead of concentrating on the other man's possibilities and problems.

Another development on the makers' side: DIY (do it yourself).

Part of the "construction" sector in our picture. User and maker the same. Small-scale demand coupled with small-scale construction work.

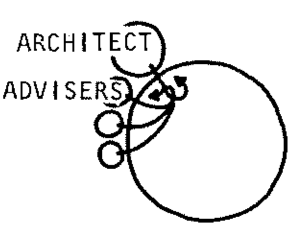
In parallel with this, we have a bit of the production sector: DIY building products. The sale of these products has achieved an enormous turnover: 1500 million fuilders (about US$ 600 million) per annum at present, and currently growing by 15 to 20% per annum.

These DIY developments have even had their effect on "normal" building. I recently read an interesting claim in a Dutch Ph.D. thesis:

'Products typically developed for the clumsy do-it-yourselfer will come to be used more and more by the skilled building worker'.

How about the architect?

Until the 'fifties, he was likely to be assisted by at most one adviser, for the support constructions.




What's the picture today? Division of labour and specialization have proliferated under the influence of the enormous explosion of knowledge and the creation of all kinds of new experts.

Here are just a few of them:
sociologists, social psychologists, educational experts, costing experts, organizational experts, glazing experts plastic experts, insurance adjusters, environmental experts. You name it, there's an expert for it.

Partial knowledge. How do you integrate it?

Besides, in whose interests are the experts working?

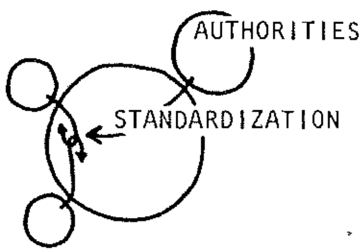
Moreover, the experts add their own dimension to these interestests, reinforcing or attentuating them by their expertise.

The use sector divided up between various parties, each with its own interests.

The manufacturing sector divided into two parts, each with its own typical interests.

In the design sector, a great many sub-sectors and partial expertises - and the whole no longer embedded in conventions. In a constant state of flux, due to the high tempo of change. Interactions in all directions.

Within the building process, but also in interaction with the circumstances "outside" the building process. Slowly but surely, a most complicated interplay of forces has built up. Is it any wonder that the authorities have become more and more involved in this whole set-up? In order to maintain a "proper" balance between the various interests involved.




But are there any conventions about what is "reasonable" here? Views on this subject are in a state of flux too. In constant development. In the last analysis, this is always a political matter.

This means that an analysis has to be made of the balance between the various political forces involved - at least insofar as they are of influence on ends and means in the building world.

No one can deny that the authorities are deeply involved in the interplay of forces in the building world. At most, one can differ about the extent to which this involvement is desirable. And that again is a political matter.

This is particularly true of the question as to how far the housing market should be controlled. The land market, what may be built and what may not, price controls, who it to get served first in case of shortage, who is to get subsidies, who is to be protected, etc., etc.

A balance of forces. Lots of government regulations which represent the crystallization of decisions concerning that balance.

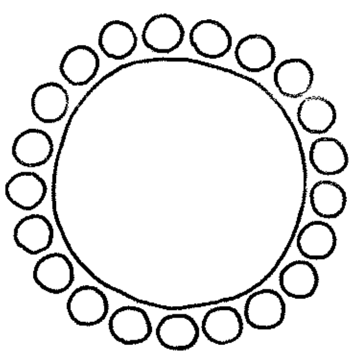
*In fact, these are all design decisions which have been brought before the public eye (and decided by the public's representatives). With a very important bearing on design possibilities.*

The regulations we have to follow.

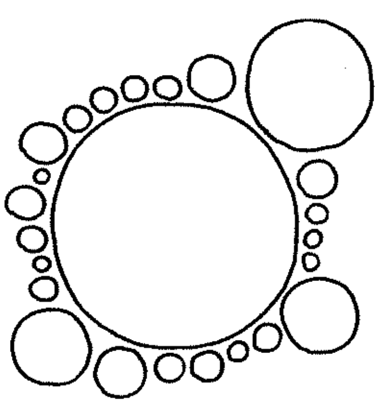
Most of these regulations arose in the time when the increasing rate of change in social affairs was causing chaos. As a result, they by no means form an ordered whole. Indeed, they sometimes conflict with one another. In any case, they do not form an adequate framework for change ... all too often, they obstruct change.

What is the over-all picture of the decision-making process in the housing field that arises from the above considerations? We could characterize it as follows:

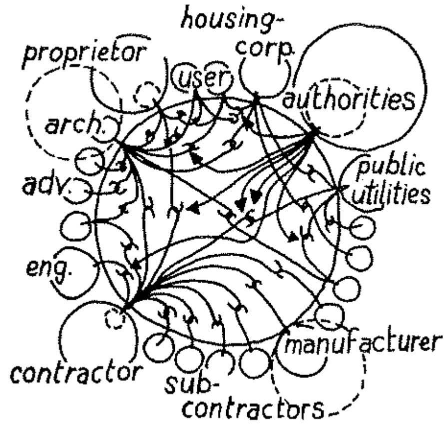
- *a multiplicity of interests*



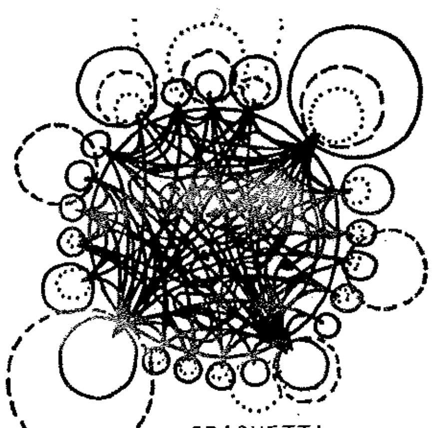
- *varying weight* of these interests



- *a multiplicity of relations* between interests of varying weight




- *intensive interaction* between the various interests, with some considerations and decisions often being tossed to and fro several times between the parties involved.


SPAGHETTI

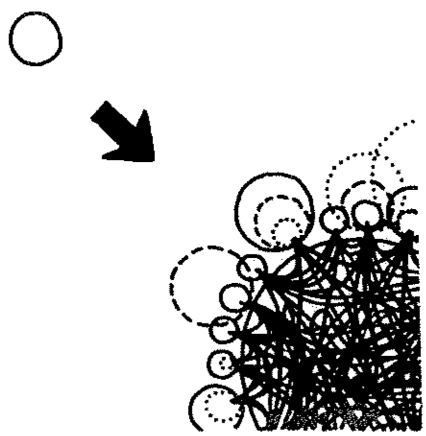
Decision-making. A complicated process of weighing up conflicting interests. You could say that the decision-making process currently runs a risk of pollution - of being clogged up - which makes it a very expensive matter.

Complicated and unexpected interactions between the various decisions taken.

We call this the spaghetti effect. If you pull on the end of one piece of spaghetti, you get movement at the most unexpected places on the plate. Once you start noticing it, you can hardly stop. Maybe that is the beginning of wisdom. Insight into how to reduce the spaghetti effect. We'll come back to that in a moment:

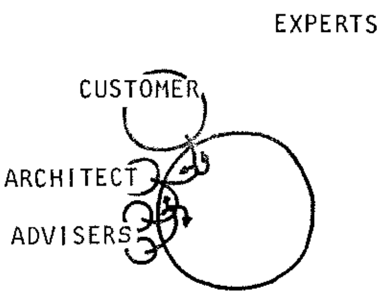
One thing is clear, anyway:

*Apart from the "user" and the "maker", the decision-making process in housing has become an important independent factor which has to be taken into consideration.* Considerations about decision-making. Considerations which help to determine the aspect of the finished buildings. A possible source of restrictions. Or inspiration.



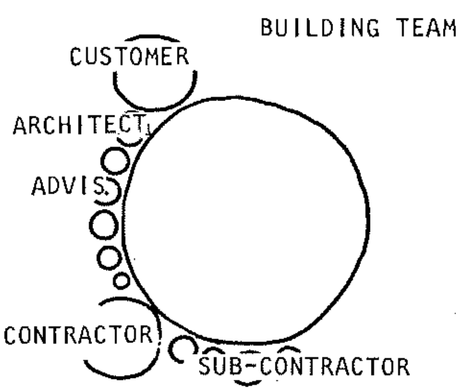
We have come a long way from our starting point, where user and maker were one and the same person. Is there any way back, without losing all we have gained? Combining small-scale needs and small-scale building with large-scale needs and large-scale building.

Possible ways out of this situation. Before we say anything about that, it is worth while spending a moment considering what we are doing at present. How we try to keep the situation in hand today.

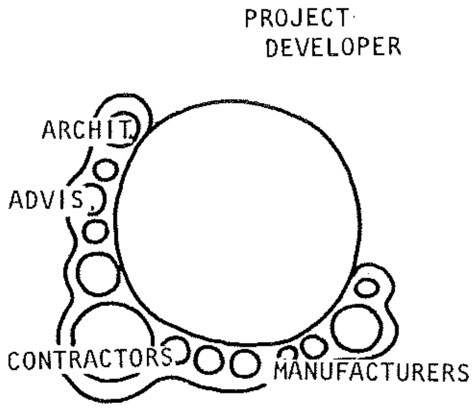



A few examples of ways these attempts have developed.

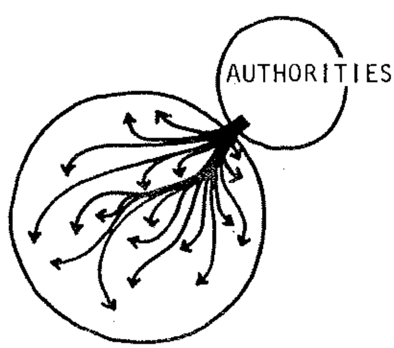
- The customer surrounds himself with more and more experts. Sometimes the architect occupies a central position here, and sometimes he doesn't. But the explosion of knowledge and change makes this an *expanding* universe.




- The building team.
  Arises when the gap between the changes in use (and hence in design) and those in building becomes too great. Not a solution in itself.




- The "all eggs in one basket" theory.
  Often used as an argument for the project developer or conglomerate, where project development, financing, construction and manufacturing are all under the control of one party. Basically, however, this does not solve the problem sketched above. Incompatibility of considerations, spaghetti effect and all their consequences just make themselves felt *within* the conglomerate.




- Call in the organizational consultants.
  Of course, they have their work cut out in this complicated situation: the more complicated, the more work for them. Buth they rarely do more than organize the *status quo.*

- The authorities intervene in the decision-making process. We've just been talking about that.

A few thoughts about more effective ways of directing out sights towards the situation in the building world we have just sketched.

In our opinion, room needs to be created for:

- *change*, flexible procedures for adapting both decisions and buildings to change in circumstances.
- *diversity* in demand and supply
- more say for the *direct user*
- more scope for the *production sector* to make its production decisions itself
- a *dynamic equilibrium between construction and production,* with flexible adaptation to changing circumstances - in both directions
- the *DIY enthusisast,* and other forms of small-scale building enterprise.

ROOM FOR:

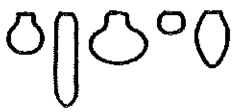
-CHANGE
-DIVERSITY
-DIRECT USER
-PRODUCTION SECTOR
-CONSTRUCTION⇄PRODUCTION
-DO IT YOURSELF

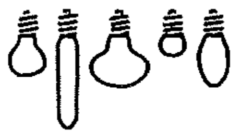
Six desiderata. One choice. And hence one standpoint, which determines the direction of our search. All these desiderata have one requirement in common:

the need for fragmentation - splitting up - of the decision-taking process ... and hence of the object about which the decisions are taken.

Divisibility. That's only possible if the spaghetti effect can be reduced, i.e. if decisions can be uncoupled from one another, so that unpredictable side-effects can be made predictable.


BULB FITTING

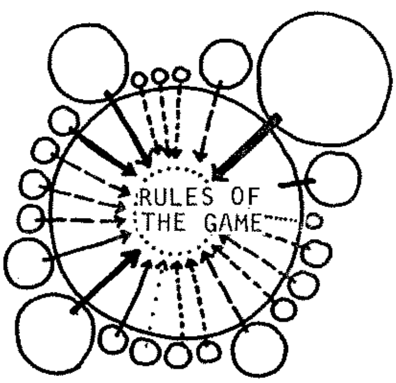

BULBS


LAMPS

Uncoupling decisions from one another.

Paradoxically enough, this can only be realized by *coupling* certain decisions together by agreements; by deciding on the "rules of the game" beforehand and keeping to them. Rules about the matters common to the various issues about which decisions have to be taken. Rules which fix the degree and manner of coupling of one group of decisions with another.

In other words, we want *ordered divisibility*.

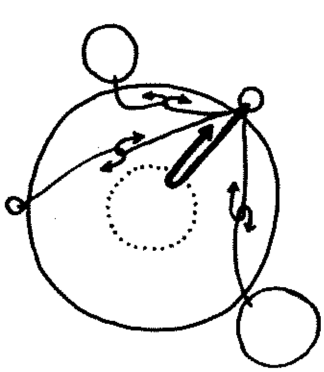



But:

The rules of the game should fix as little as possible,in freedom of decision should be left at a maximum. And the number of rules fixed should be no greater than strictly necessary: economy of agreements.

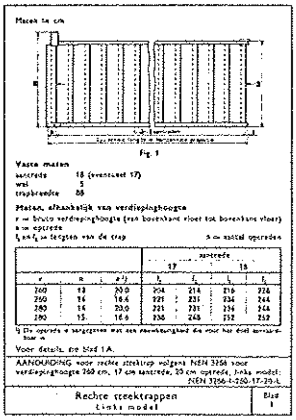
We need agreements about the bulb fitting, but not about the bulbs. Where we need agreement is at the interface, the boundary regions.

It is in these "rules of the game" that the different parties find a common ground. Accept obligations. They have to reach agreement here so that via the conventions they agree on, the restrictions they accept, they can leave one another free to go to work as independently as possible.



Because each party (in cases where many parties are involved) can get the information it needs out of the pool of agreements.

In our opinion, it goes without saying that the authorities - the most central decision-makers - have a key role in getting such rules of the game, such a system of decentralized decision-making, off the ground. But in the last resort, political choices will have to be made here.




NEN 3266

Let us take one example.

Some of you will know that wooden stairs for subsidized dwellings are standardized, i.e. there exists a standards sheet where the specifications of these stairs are accurately laid down.

For example, there are straight stairs and stairs with a quarter turn.

STRAIGHT
STAIRS

STAIRS WITH A
TOP QUARTER TURN

If we compare the standards for these two types of stairs, we see that there is a slight but definite difference between the space requirements in the two cases. The newel and the top tread of the staircase with the quarter turn project somewhat beyond the space required for the straight staircase.

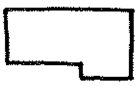
A slight difference; but one which means that the stairwells in the two cases must be dimensioned differently. And the dimensioning of the stairwell has certain consequences for the floors.

This means that e.g. decisions about the floor elements cannot be taken until it has been decided which type of stairs will be used.

Now suppose that we want to leave certain decisions about the layout of the dwelling to the occupant; or we simply want to postpone these decisions. And the over-all layout of the dwelling determines which type of staircase will be used. And the type of staircase determines the form of the stairwell. Then the layout of the dwelling must be determined (e.g. by the future occupant) before we get to the stage where decisions have to be taken about the floors. Moreover, we can't change things later if we want to.

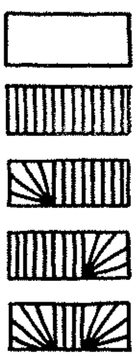
STAIRWELL FOR:

STRAIGHT STAIRS



STAIRS WITH A TOP QUARTER TURN

Now this standard was only drawn up in order to permit the making of cheaper ready-made staircases, and not with a view to decision-making. For uncoupling decisions.



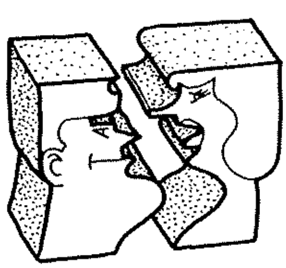
ONE STAIRWELL FOR:

FOUR TYPES OF STAIRS

If it's efficient decision-making we're after, it would be better to standardize the stairwell. The place where the stairs meet the floors. And to standardize it so that several different types of stairs can fit in one stairwell:

straight stairs
stairs with a quarter turn at top or bottom
stairs with two quarter turns.

PENETRATIVE JOIN



You see:

*changing the objectives changes the specifications, which in turn changes the standard.*
*What we want to do is standardize the technical boundary conditions and not the product. Not the "solution".*

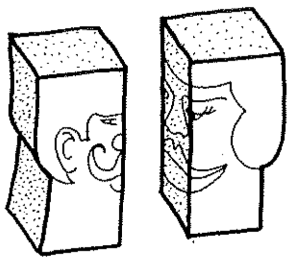
Fix the boundardy conditions. Leave the product, the solution free. Free to adapt to developments in demand and technical possibilities. Within the boundary conditions. A balance between freedom and restrictions.

A simple example. I hope it means something to you.

Two important boundary conditions proved to be: space requirements and joints.

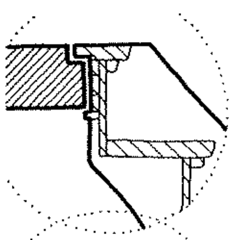
Space requirements. Where you've already got something, you can't put something else. Agreements about this concern the *place* of a given element and *dimensions*, its size.

FLUSH JOIN

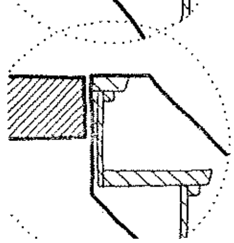


Joints. The fewer agreements the better, as we already said. One consequence of this is that we should'not make penetrative joints if we can help it. What we call Jack and Jill joints. Flush joints are better. Make Jack and Jill flush.

As regards the staircase, this means that we should not make the strings project *into* the floor. It should be *flush*with the floor.



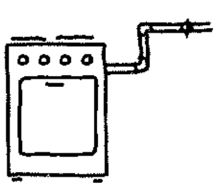
PROTECTING STRING



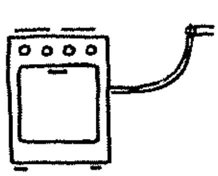
FLUSH STRING

We can go one step further. Avoid joints altogether if you can. There are many cases where a loose fit will do just as well.

The gas cooker is a good example. Building regulations used to specify a rigid connection using metal tubing; now we can use flexible rubber (or synthetic) tubing with a special coupling. Maybe water taps could be connected up in the same way?



FIXED CONNECTION



LOOSE FIT

Sometimes surprisingly simple. All it needs is a change of approach. Especially from the "experts".

Many of the changes we need in this field are very simple, obvious things. We just never saw them before - before we put on our spaghetti-uncoupling glasses.

When we do put on these glasses, we will notice that the spaghetti effect is often "built into" the product. To the disadvantage of both parties. Even with standardized staircases, as we have just seen.

Parallel divisibility of decision-making and product, we said before. And we saw that this means dividing the dwelling up into segments.

This is taken as the starting point for the new draft of Dutch standard NEN 2880, on modular coordination. If our view is correct, the importance of this standard can hardly be over-estimated. On both a national and an international scale. And even though it still has a lot of rough edges which still have to be smoothed down.

This makes it very difficult to understand why the Public Housing Council has advised the minister of housing to leave this development out of consideration when drawing up the new Rules and Guidelines for the building industry.

So that - if that is the way the minister decides - we can just go on talking about standardization of products in the "good" old way - on the basis of a concept of modular coordination which in no way lends itself to structuralization of decision-making.

It would be even more difficult to understand if the minister doesn't realize that a political, and not a technical, decision is needed here. What is involved is nothing more or less than a piece of restructuring of the policy-making apparatus. And that means, amont other things, more or less participation for the user.

But this is by the way.

In the new draft standard, the building is divided up into a number of "element groups", each of which can be assigned its own place with the aid of "tartan grids".

How are these element groups defined?

"a set of ......... elements with the common characteristics ......."

What are the common characteristics? An interesting question.

What characteristics are important from our viewpoint, that of restricting the spaghetti effect? Here are a number of possibilities:

- *simultaneity* of decisions. Can all decisions about the element group be taken at the same time?
- *period of validity* of decisions. Are the decisions for all elements of the group valid for roughly the same length of time?
- *interested parties*. Is the number of interested parties as small as possible?
- *production*. Are there possibilities of efficient production for the various elements of the group?

A proper balance will have to be reached between these and possibly other characteristics of the group.

That was a brief look at the new concept of "element group" introduced by the new draft standard.

Modular coordination rather than standardization of dimensions. Aimed first at the process, and only then at the product. A very significant shift in approach.

These considerations lead us almost imperceptibly to another concept that is going the rounds, viz that of decision levels.

These decision levels, among other things, are dealt with in the thesis "Measuring with two dimensions", with which a future colleague of ours, Dr. M.F.Th. Bax, gained his doctorate here in Eindhoven last week.

This concept covers much more than the building. It could be used as a basis for restructuring the whole decision-making process covering everything from umbrellas to urban agglomerations, to bring it more into line with the new situation sketched above.

Theoretical investigation will be needed to develop a comprehensive, consistent framework of concepts here. Prof. N.J. Habraken devotes a series of lectures to this subject here in Eindhoven, shortly before his departure for America.

But apart from theoretical definition of the concepts, the purpose for which the levels are to be used will determine the content to be given to each decision level. Practical experiments are being carried out in this direction. For example in Lunetten, a new suburb of Utrecht, where (at the suggestion of the architects) user participation is structured on the basis of decision levels.

Space requirements, connections, coordination of place and dimensions, element groups, levels. All concepts which could help us to give a new structure to the decision-making process.

Now a few words about design methods.

So far, the development of these methods has been mainly an activity for the architect. No wonder that the stress has come to fall mainly in two regions:

- considerations of functional and aesthetic value
- the generation of solutions (the "creative phase").

Two fields of particular interest for architects. They have never been all that interested in communication. Yet, as we have ssen, that's an important problem too.

Could this be a "missing link" in the development of design methods?

Statements about the *place, dimensions and state of space and materials,* we said at the start of this lecture. *That* is the point where everyone, and all considerations, meet. A possible starting point for further considerations about desing methods?

Apart, of course, from the objectives you are aiming at when you use a particular method. For methods are never neutral.

Statements about the place, dimensions and state of *materials.*

The subject of our professional field: building methods and finishing constructions.

A breakdown in communications between the various parties concerned is sure to lead to trouble here. You can agree to differ about ideas. Space is sometimes flexible. But you can't try to put two *things* in the same place without accidents. And you can't spend your money twice over.

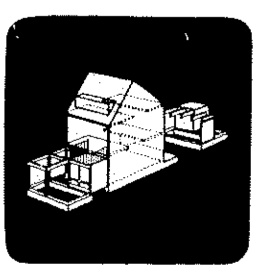
Two facts which fully explain our interest in the spaghetti effect.

Look at the drawing entitled "A not uncommon division into elements". A simple house, split up into parts. That's the way we do it. That's the way it's done. Someone makes the floors, someone else the walls, and so on. Not all that complicated.

Or is it? Have a look at the next picture, entitled "Services in a single-family dwelling". Spaghetti. A maze of pipes and wiring connecting the various parts of the house.

Uncoupling decisions.

In our professional field, that means taking an interst in the building nodes. The points where the various parts come together. Where the various decisions have to be mated. Including decisions already embodied in concrete products.



Not a simple matter.

As students discovered in one of our practical projects. Where the task set was to convert the spatial design for a bare dwelling without finishings, by the architect Haaksma, an assembly-kit dwelling where units could be built in or on, into a material design. Using only ready-made prefabricated products on the market. A casco-system, and so on. It's all there. And arranged so that future occupants can modify the set-up if they want to.

What a problem to fit it all together!
In the building nodes.

Problems of use, of production and of construction all demand attention.

The various builders' products are hardly designed to match. There is a serious lack of information about connection possibilities, adaptation possibilities.

A nice practical example of the spaghetti effect. A decision about the guttering joints has side-effects reaching to the foundations, or the roof ridge line. Or both. The secret lies in the building node.

We had another project of the same type. Each student had to observe what went on round a particular node during actual construction, on the building site. From start to finish. What an experience. What a lot you can learn from that. The spaghetti effect and the building node.

What a reality. There's no doubt about that.

A real eye-opener, to see what you can achieve in a building project with participation, when a team of good people works together well, when people are happy in their work and get on well together .... it's incredible.

I was involved not so long ago in an 85-dwelling project. Eighty-five families had had a say in the design. Each house was different, within the framework allowed by the participation, just as no two families are alike. And still not expensive. That meant a challenge to the builder. Do you know what he told me recently? He only had one problem. The men who make these houses had told him that they would never to back to a "dull" old project with 100, 200 or 300 identical houses. They'd had such fun building these houses. And that went for everyone connected with the project. Not least the occupants. Make people free to participate, and you've solved half your problems.

We have not had time to give more than a few ideas, a few suggestions, this afternoon.

We hope that this will nevertheless be enough to stimulate your imagination, to get you thinking along with us. About the nature of the spaghetti effect. About the possibilities of uncoupling decisions. Because we really need your contribution too.

From people who are occupied with other aspects of design. Such as town planning. Or design methods.

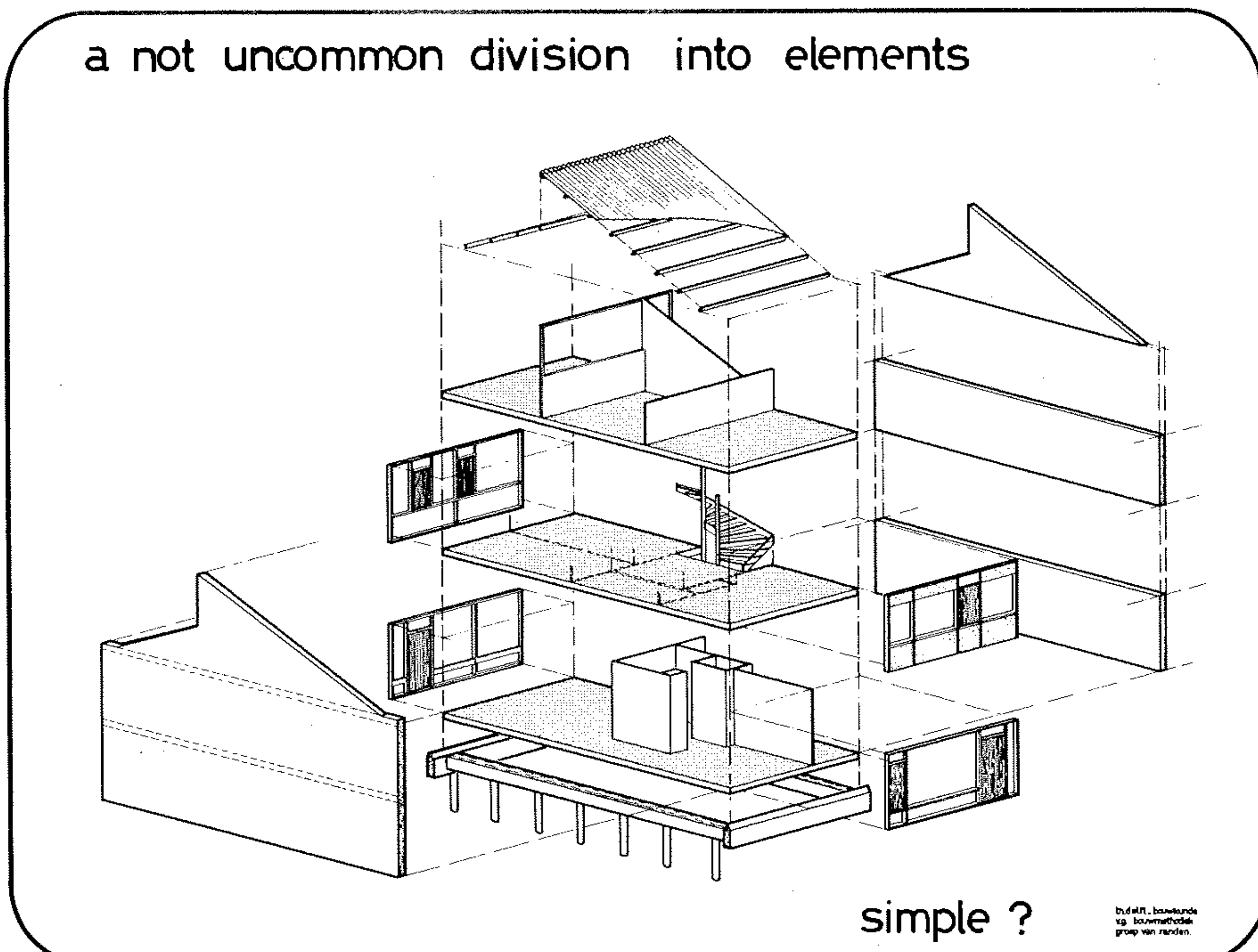
But in particular from people working on the practical, constructional side of the building world. From the production sector too, and the users' sector; and the authorities - to mention but a few.

We hope you will know whose door to knock on if you have ideas about this subject that you would like to share. And that we may call on your cooperation if we need feedback from the practical side of things. Some of you have already helped us in this way; and I would like to take this opportunity of thanking you.

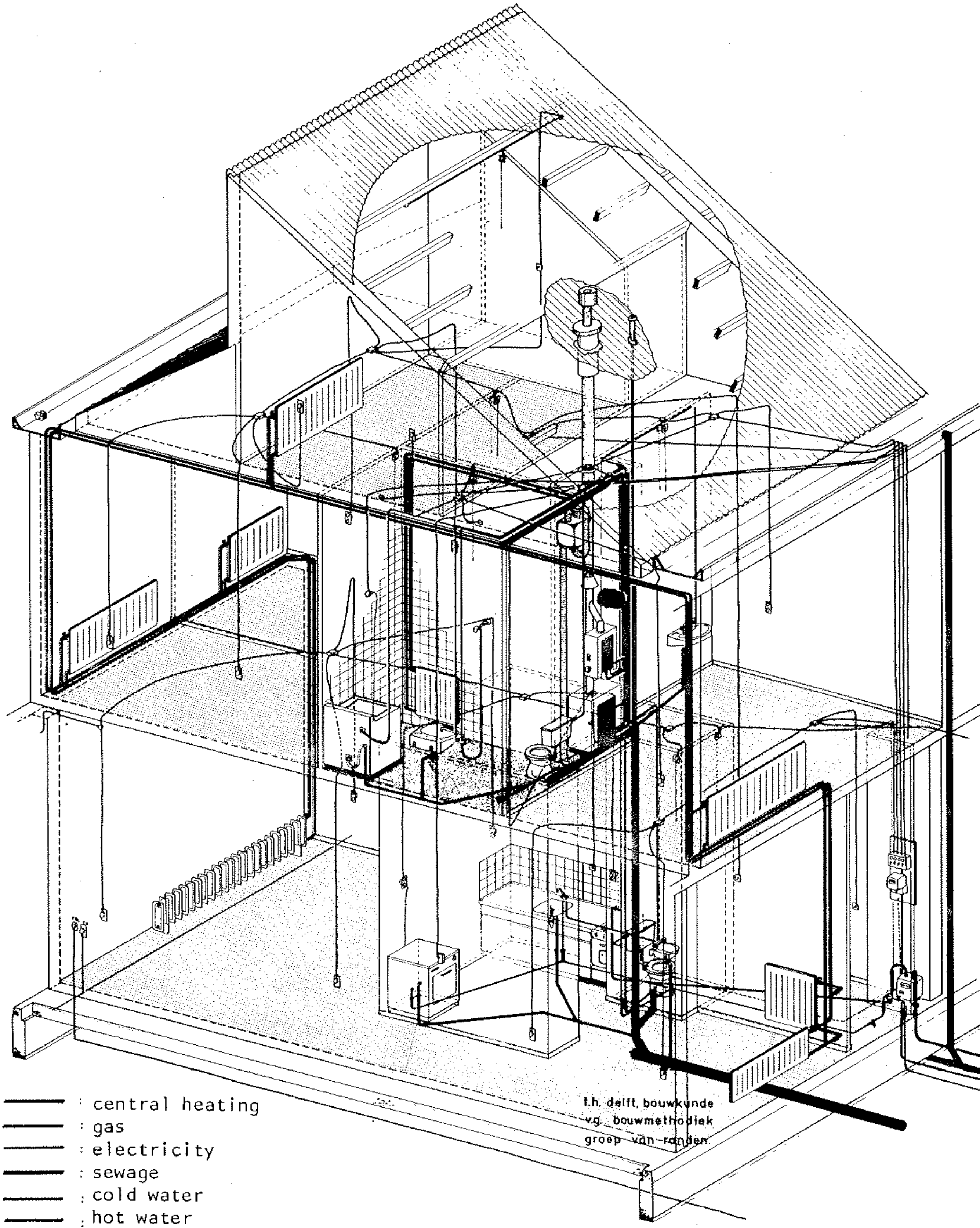
We hope further that our collaboration within this University of Technology, with the Department of Civil Engineering, and with the Department of Building Science of the University of Technology in Eindhoven, will continue to grow.

Our running-in period is behind us now. In this paper, we have presented you with some of the ideas that developed during this running-in period. Ideas about problems which will certainly influence the teaching of building methods and finishing techniques in the years to come.

We look forward to even more intense inter-action with the other members of our Department of Building Science. Because inter-action between people is what counts. In research and education. And on the building site too. Together with 50, 100 or 200 families.



# services in a single family dwelling




: central heating
: gas
: electricity
: sewage
: cold water
: hot water
: ventilation
: flue gases

**ARCHITECTURE AND AGREEMENT.**
A report on research for new design methods.

The following report is in four parts. The first part will give the theoretical concepts on which rest the SAR design methods discussed in the second part. The third part will discuss the variety of research directions build on the initial methodological and theoretical principles. Finally a fourth part will briefly review the most important experimental projects done in the last ten years in which the methods and principles have been implemented.

## I. THEORETICAL CONCEPTS

My theoretical work is mainly an attempt to describe and clarify the built environment as a complex artefact. The way we describe the built environment determines the way we will act towards it. I believe we need today a new way to see the built environment, allowing more effective methods of working for designers, builders, and manufacturers. This new way of seeing describes the built environment as the result of agreement among many parties rather than as the result of original interventions by individual designers.

Trying to give this new description of the built environment I have introduced a number of new concepts and also stressed some concepts we are already familiar with. These key concepts will be briefly discussed first.

### 1.1. SUPPORTS AND INFILL.

In my first book "Supports, an alternative to Mass Housing" (1963) I proposed to distinguish in buildings two levels of architectural intervention. These levels I called 'Support' and 'Infill'. The 'infill system' is the system found between the higher level system of the 'support' and the lower level system of furniture.

The infill system changes in response to the needs of a single household. The Support system responds to the needs of the larger, collective group of the households within the building. The 'Support' ressembles very much the traditional building but it has no partitioning walls, nor kitchen or bathroom equipment, or other elements that must change in response to individual household needs: all these belong to the infill level.

The following arguments for the introduction of the infill level can be given:

1.1.1. Increasing number of technical systems.

In the past half century the infill of buildings has become increasingly complex. We have not only partitioning but also kitchen and bathroom equipment and the distribution of electricity, gas, water, television cables, telephone cables and connections for computers. The user wants to control these subsystems and their configuration will change much faster than the building in which they are found.

1.1.2. Larger projects.

In larger architectural projecs one building contains many individual dwelling units. Separation of the infill system makes each living unit respond to the individual needs of the user.

1.1.3. Long-term and Short term products.

Infill systems are of the nature of durable consumer goods like cars. They lend themselves to industrial production because they can be used in many places. Their design, like with other consumer goods, is related to current taste and values. Their use life is relatively short.

The support, on the other hand, is a long term product and must serve several generations. It is part of the collective environment.

1.1.4. Architecture is related to long term values.

Architecture is always for the long term, but to last a long time the building should not freeze everything in it but must be a stable framework within which change can take place.

When our buildings can not effectively accomodate change they will not last long.

1.2. URBAN TISSUE

Starting from the two levels of Support and Infill a higher level of intervention can be defined as the 'urban tissue' It is the level where the network of streets and squares combines with other infrastructures to make a context for the building level. Architecturally the tissue level comprises all the patterns and elements that make the context for architectural intervention. It is a level in which three dimensional space is still important and must be distinguished from the even higher level of the urban structure where land use and infrastructures determine the organisation of a predominantly two dimensional sustem.

1.3 TRANSFORMATIONS

The idea of Support and Infill was first introduced intuitively. When we found that it gave practical advantages I became more and more interested in understanding the theoretical background. The key to the Support principle is the idea of Change. We see the distinction between Support and Infill only when we are interested in the way the built environment transforms over time. All my theories and researches, -from the publication of "Supports" through the work done at SAR and MIT in the following twenty years-, rest on the fundamental idea that the built environment is not a static entity but always changing.

From this idea flow all other concepts I have explored in architectural theory and methodology.

1.3.1. Architecture of change.

We should not see the architect's creation as a immovable monument to be preserved for posterity but as an act in a continuously transforming physical context.

Architecture, in this view, is always the transformation of what is already there and it creates, in turn, an environment for new acts of transformation.

### 1.4. CONTROL

The transformations in the built environment are the result of human action. They reflect the patterns of control by which the built environment exists and renews itself. Control, in my theories on the built environment, is the ability to transform that environment. In the book "Transformations of the Site" (1983) I describe the built environment from the point of view of control and try to show the correspondence between patterns of physical organisation and patterns of control. This correspondence reveals the laws that govern man-made environments.

### 1.5. DEPENDENCY HIERARCHIES.

All complex organisations have a hierarchical structure. In the book on "Transformations of the Site" the hierarchical structure of the built environment is explained in terms of control. We find what can be called 'dependency hierarchies' in the built environment.

#### 1.5.1. Example: Room and Furniture.

When, for instance, we distinguish the system of furniture from the system of walls that make the room in which the furniture is found we can observe what happens when transformation takes place. The furniture can change without disturbing the system of walls. But the walls can not change their configuration without disturbing the arrangement of the furniture. Therefore the furniture system is dependent of the wall configuration and we can say that the furniture level is lower than the wall level in the dependency hierarchy of the building.

#### 1.5.2. Example: Street System and Houses.

In the same way the building is on a lower level compared to the system of streets and houselots, because the buildings can change and renew and merge without disturbing the system of streets and public spaces but a re-arrangement of the street system will inevitably disturb the buildings.

1.5.3. Difference with Assembly Hierarchies.

The usual way to discuss hierarchies in physical organisations is in terms of assembly. In a assembly hierarchy the elements of the lower level are parts of the element of the higher level. For instance the bricks with the mortar make the wall, while the walls with the floors make the loadbearing structure. This is a technical way of seeing the built environment. We must not confuse it with the depency hierarchy explained above. It is easy to see that we cannot assemble a room out of furniture or a street network out of buildings.

1.5.4. Levels of Control.

The levels in the dependency hierachy are levels of control because the change that makes us see them is the result of control. As such we are intuitively familiar with them. We have indeed structured our professional activities on the basis of dependency hierachies. We have interior designers, architects, and urban designers and planners. Each manipulates and transforms systems on a different level in the dependency hierarchy of the built environment.

1.5.5. Technical Systems.

We cannot see dependency levels when we only think in terms of technical systems. The following examples show that we cannot always determine from the technical element itself to what level it belongs but must see it in the context of transformations and control.

1.5.5.1. First example. A technical system of plumbing, providing water and drainage in a building, will operate on both the support level and the infill level. Some parts of the system will be under control of the individual household (for instance the bathroom and kitchen elements of the plumbing system) therefore they will belong to the infill level. Other parts will serve several households (like for instance the vertical drainage shaft draining bathrooms of several dwellings) therefore these belong to the support level.

1.5.5.2. Second example. In the same way we can find a non-load-bearing wall in the infill level as well as in the support level. When this wall is on the support level it responds to the control of the larger group. If, for instance, it is a party wall between two households, it is by definition a support wall. But the same wall inside the household will be an infill wall. (See also Fig.3.3.D.)

1.6. TERRITORIES.

We can find another hierarchy based on control in the built environment. This one has to do with the control of space. 'Territory' can be defined as a unit of space and control. Territorial control has to do with the ability to decide what elements and people have access to the territorial space. We are in control of a space when we can keep things out: o (See also Fig.3.2.A.) nce more the key is in control and the movement of things. (See also Fig.3.2.A.)

<u>1.6.1. Territorial Hiearchy.</u>

In 'Transformations of the Site' it is shown how we can see a territorial hierachy in the built environment as well. In this hierarchy territories are always located in other territories.

For instance, the dwelling as a territorial unit is located within in the neighborhood as a higher level territorial unit. The space in the neighborhood, not part of individual dwellings and their gardens, is seen as public space. Thus the territory called 'neighborhood' includes both private and public space.

This is true of all territories. Given a larger territory with smaller, territories included in it, the included territories occupy the private space of the larger territory and the remaining space is public space in that larger territory.

<u>1.6.2. Relativity of the idea of Public space.</u>

In this way the concept of public space is relative. when we move upwards through the territorial hierarchy, we always move into another public space: from the living room in the house we go into the street, and from there into the public highway. When we move downward in the territorial hierarchy we always move into private space, from the public highway into the neighborhood street and from the street into the house.

Fig.1.6.2.A Territorial Hierarchy. Part of the historic distric of Cairo indicating the individual building units and their territorial depth. The darker the shade given the deeper the unit is in the territorial hierarchy. Depth is measured by the number of gates, or teritorial boundaries, one must cross. All dead end streets have gates, so do some through streets.

From a study by Sawsan Bakr; Form and Territory, a comparison between four areas in Cairo. MIT thesis MSarchS, 1977.

## 1.6.3. Two ways of seeing the built environment.

It is important to make a clear distinction between the built environment as a physical organisation (with levels of dependency) and the built environment as a territorial organisation. Although they influence each other they are not the same.

For instance, a door, as a physical element, need not be a territorial boundary but can simply separate two parts of a same territory. For instance the door of a house standing in a private garden has no territorial function because the territory of the household begins with the garden gate.

Moreover a territorial boundary may not be defined in physical terms but only in terms of control as is the case with the boundaries between nations or municipalities.

Fig.1.6.3.A. Schematic representation of the hierarchy of systems (left side) and the hierarchy of territorial units (right side) It shows how a territorial unit is always determined by ~~technical~~ physical systems on different levels. Thus the room as a territorial unit is related to the ~~technical~~ physical systems in such a way that the systems from the wall up are not under control of the territorial power, while the systems from the furniture down are under its control. In daily life we are most familiar with the territorial units than with ~~technical~~ physical levels because they relate most directly to our normal perception of the built environment. Those who make the environment, however, must understand the ~~technical~~ physical systems as well.

## 1.7. AGREEMENTS.

In another book, called 'The Appearance of the Form' (1985), all these concepts are discussed again, but this time from the point of view of designing. The book describes how the structure of the built environment (composed of the hierarchies and systems discussed above) determines the relations between the designers who exercise control over its parts.

The book suggests we can learn much about designing when we observe the interaction between those involved in the design process.

1.7.1. Designing as the Making of a Proposal.

Designing, in my view, is primarily the making of a proposal. It is therefore aimed at agreement between parties. Of course designing is a creative act but many human activities have a creative dimension. What distinguishes the act of designing from other creative activities is that it relies on agreement between different parties.

It relates the designer to the client, who must approve the proposal.

It also relates the designer to the builder, who must build the plan.

1.7.2. Relations between Designers.

Moreover, there are two major conditions demanding that designers cooperate with one another.

1.7.2.1. Often the systems, cotrolled by different designers, must be integrated (like with the architect, the structural engineer, and the designer of the environmental control systems working on the same building.)

1.7.2.2. In addition, interaction and cooperation among designers is important when they operate on different levels and have a dependency relation (like with the architect, the urban designer, and the interior designer).

1.7.3.Agreements, Rules, and Conventions.

Reaching agreements and making rules is therèfore very important in designing. Without it the design of complex configurations is not possible.

Agreements and rules produce systems, they also establish relations between systems on the same level, and they define the interface between systems on different levels.

Agreements and rules also establish the territorial boundaries within which design processes take place. Very often the rules we follow are implicit. We all know them but they are seldom mentioned and never written down. In that case we speak of 'conventions'.

We see how the structure of the built environment itself is, to a very large extent, the result of agreements , rules, and conventions.

### 1.7.4. Architecture and Agreements.

When we see architecture only as a matter of individual creative expression, resulting in the making of a static artefact, we do not have much need for rules or agreements. But when we see architecture as an act in a physical and social context which is in constant transformation and when we recognise control patterns in these transformations, we need agreements and rules to make architecture meaningful.

Therefore we should be less interested in how original architecture is, but give more attention to the conventions and agreements it is based on.

## 1.8. THEMATIC SYSTEMS.

The idea of the built environment as the result of agreements and always changing under the impact of control patterns is described in more detail in 'Appearance of the Form'. Here I introduce the concept of 'Thematic Systems' Those are the systems people make; they are artificial systems as distinct from the natural systems. Thematic systems always are the result of agreement among people and they only exist as long as people agree they are useful. All the technical systems we discuss here are tematic systems, so are patterns and styles.

### 1.8.1. Thematic Design.

I have come to use the term 'Thematic Design' for the way of designing which deliberately uses the principles of transformation and agreement.

## 2. METHODOLOGICAL TOOLS.

My methodological work is related to the need for designers of complex environmental organisations to make rules and agreements and to follow them. Usually, when methodology is mentioned, architects think of 'standard procedures'. But I am not interested in procedures and certainly not in standardizing them. I like to call myself a 'toolmaker' making tools for designers. The methodology of 'tools' is to be distinguished from the methodology of 'procedures'. Procedures often change from project to project but in all procedures a designer can work with the same 'design tools', choosing those he can use best in each specific project, much in the way a carpenter always uses the same toolbox although the procedure he follows depends on what he is making.

At the the Foundation of Architects Research (SAR) during the years from 1965 untill 1975 we developed the methodological tools needed to design Supports and Infill Systems as well as Urban Tissues. The methodological tools worked out by SAR were published in two reports under the titles 'SAR 65' and 'SAR 73' which received wide attention over the years and have served as the basis for numerous studies by many designers and researchers.

Explaining a method of working soon leads to a detailed and technical discussion which is not approriate in the context of this general introduction. As an example of what 'design tools' can be like the SAR principles are briefly summarized.

Figs.2 The SAR approach allows for the development of variantions on all levels:
Fig.2.A. A support structure based on a certain dwelling type.
Fig.2.B. This principle leads to different supports depending the way party walls are chosen: territorial capacity analysis.

Fig.2.C. When party walls have been determined support space is aailable for infill: note indication of zones, margins and secors by dotted lines.

Fig.2.D. Infill variations of the support of 2C.

Fig.2.E.1 and 2.E.2. the support principle of 2A can be used for different tissue organisations.

From a study by Shoji Korokawa, "Process of designing city housing in Japan", MSarchS thesis MIT 1983.

2.1. MODULAR POSITIONING.

The SAR studies re-examine and re-formulate the principles of modular coordination, making modular coordination a real design tool. The major purpose for the use of modular grids is <u>not</u> to standardise components for more efficient production, but to coordinate design decisions. If design is well coordinated, efficient production, with or without standardisation will follow. (see also fig.3.1.1.A.)

<u>2.1.1. Grids for Position Rules.</u>

In design, decisions on the position of elements relative to one another are more basic than decisions on the exact dimensions of these elements. We can say that, in designing, usually, "dimension follows position". Grids are usefull to make general position rules. SAR 65 proposes the uses of a band grid for making position rules.

In principle different grids and different position rules can be adopted for each project following the intentions of the designers. In practice it is efficient to work on a standard basic grid with a few basic position rules. More detailed rules can be added for each particular project we work on. From the basic grid with the small module larger grids can be derived for particular projects. (see also Fig. 3.4.A)

2.2. ZONES.

The Sar studies also introduce a new methodological tool with the concept of 'zones' and 'margins'. Zones are areas with specific, but general spatial qualities. The principle of zones can be used on all levels of the built environment. But on each level we will define other kinds of zones.

For instance, in SAR 65, on the support level, a 'Alpha zone' is an area inside the dwelling with relation to the outside and for private use; wheras a 'Gamma zone' is an area for public use and a 'delta' zone is outside but for private use. On the tissue level SAR 73 proposes zones for buildings and zones for open spaces. (See Fig.2.D.)

### 2.2.1. Arrangement of Zones.

By the arrangement of zones the designer determines the most general organisation of spaces. For instance dwelling types each have their their specific combination of zones.

The distribution of zones is a a first general ordering of space to be specified in later stages of the design process. In this case we later will add more and more elements using the zoning arrangement as a framework.

### 2.2.2. Agreements and Zones.

In both previous examples the zones will help us to formulate rules and agreements.

In a design project more specific agreements can be attached to the zones: the designer can propose what kinds of spaces and what kinds of elements are allowed in the zone. He makes rules about the way the zones can be used. These agreements may serve to coordinate the work of different designers cooperating in complex projects.

Agreements on the use of zones can also coordinate the work of designers operating on different levels in the built environment. Thus zone agreements attached to Supports serve to guide the processes of infill, and zone agreements in tissue design serve to guide the design of buildings in the urban tissue.

Fig.2.2.2.A Example of the use of zones on the support level. The same zone distribution is given three times; Above: giving positions of support walls and entryways Middle: giving positions of stairs. Below: giving positions of furniture, internal stairs and possoble outdoor spaces.

To the right are more detailed studies of the entry elements .

Study by Renee Chow for the 'Grunsfeld Variations' see also 3.1.1.

Fig.2.2.2.B. Example of the use of zones on the tissue level. Development of a new district at Boston harbour by John Dale (SMarchS thesis 1986) uses zones to develop alternative profiles for buildings and streets. Note the occasional indication of the zones on the building level with small dotted lines, coneecting zones on thwo levels.

Fig.2.2.2.C. Birds eye view of the Bostob Harbour project.

## 2.3. CAPACITY.

The designer who operates on a higher level will produce a design in which another designer on a lower level will find space to work. For instance; the support design makes the context for infill design and the tissue design makes the context for the design of supports.

In each case the higher level designer wants to know what lower level design is possible by his design decisions. For instance, the designer of the room wants to know what arrangements of furniture are possible in the room. In SAR's terminology the room designer wants to know the 'capacity' of the room.

### 2.3.1. Capacity Analisis.

Questions of capacity become important and often difficult when designers must work together on different levels. Capacity is what designers on different levels discuss and capacity studies must be formalized when projects become complex. SAR methodology distighuishes several formal capacity studies:

'Zoning analysis' investigates the capacity of zones (fig.2.2.2.A)

'Sector analysis' investigates the capacity of a specific space located in a zone.

'Sector group analysis' investigates the capacity of a combination of sectors. Often the sector group coincides with a territory as a unit of occupation. (Fig.2.D)

'Territorial analisis. looks at the different territories powssible within a support principle. (Fig.2B)

This terminology can be used on all levels of the built environment and reveals the common structure of environmental design activities regardless of their scale or subject.

Making agreements about the uses of zones, as discussed under 2.2.2.

can easily take the form of a capacity study. The designer, in that case, determines the capacity of the zones he wants to follow.

## 3 LATER DIRECTIONS.

Most of my methodological work later on is based on the principles developed at at SAR. I became interested in their application in architectural design in general and in their use for teamwork in complex design projects. The issue of agreements made me interested in the various forms in which implicit agreement can be established. I became interested in Types, Patterns, and Styles as expressions of agreement among designers, builders and users.

Many other researcher-architects became interested in the same questions. Many visited SAR in the Netherlands and some stayed there for some time to study. Others came to MIT. Together they established a broad agenda of inquiry pointing in a variety of directions.

Some of the most important research areas related to the methodological and theoretical prinicples discussed here are identified in what follows. It is not a attempt to cover all the work that is done nor to do justice to all the people I had the opportunity to work with or to exchange views with, but only to sketch, in broad strokes, the variety in the field of research sustained by the same basic philosophy.

### 3.1. Teamwork Coordination: the Grunsfeld Variations.

In 1981, supported by funds from the Grunsfeld foundation, ten designers were selected for a six week period to develop an urban tissue principle esablished beforehand. The intention of the project was to demonstrate that teamwork between architects could be efficient and could leave freedom to the individual team members while, at the same time, producing a coherent thematic whole.

3.1.1. The first day the team was given a series of twenty diagrammatic sketches in which the principles of the urban tissue were established. Participants were asked to copy the sketches in order to memorize the coordinating principles.

3.1.2. The first three week phase of the project participants were asked to choose a specific aspect of the whole and to develop it in a systematic way; producing further rules and patterns to be used in the second phase of the project. In other words: they had to propose 'agreements' for the whole team to follow. The aspects choosen were: The profiles and details of the street scape; the circulation interface between buildings and streets; the facade systems; the support system and its capacity; the larger deployment and deformations of the tissue; the application of non-thematic buildings and spaces in the tissue.

3.1.3. Participants were encouraged to make clear design decisions, exploring their preferences and values but expressing them in a systematic way to make them available to other participants later on.

The second phase of the project the chosen site was divided among the participants and each was asked to develop his/her part of the whole, using the studies of all teammembers to arrive at an integrated whole.

The study has been published in 1981 under the title: <u>'The Grunsfeld Variations'</u> distributed by he Laboratory of Architecture and Planning.MIT. Participants: Jose Aldrete Haas, Renee Chow, Tom Hille, Paula Krugmeier, Martha Lampkin, Anthony Mallows, Andres Mignucci, Toshihito Yokuchi ,Yutaka Takase, Kimberly Weller

Fig.3.1.1.A. One of the preliminary sketches is an example of how design agreements can be formulated. It gives the position rules for some of the key elenments in the design. A raised street gives acces to a garage under the buildings. The sidewalk is again raised above the street. Building, sidewalk, steps to the street, street, and parking places aare all related to a modular grid by their own position rules. The grid has 4' and 8' bands.

Fig.3.1.1.B. Another of the initial sketches gives a examle of the tissue layout. Note the larger modules in which he buildings, streets, and alleys are positioned. This larger grid is related to the smaller one of fig.3.1.1.A.

Fig.3.1.2.A. Facades were one of the subsystems to be developed in the first phase. Separate positioning rules were developed for the placement of facade elements. Within these rules three distinct catalogues of facade elements were designed. This one was designed by Andres Mignucci.

Fig.3.1.2.B. A second facade catalogue designed by Tom Hille.

Fig.3.1.2.C. Subsystem study by Yutake Takase on agreement for the firelane design.

Fig.3.1.3.A. For the second phase this sketch was given to determine the general organisation of the tissue. Because the subsystems were known the hand sketch could contain dimensionally accurate information on street types, their positions and relations.

Fig.3.1.3.B. Overview of the final result in the relation of buildings and open space. Grey is private outside space. Note the variety within the same typology.

fig.3.1.3.C. View of the tissue designed by Toshihito Yokouchi. Birdseye view.

Fig.3.1.3.D. Part of the sythesis by Yokouchi. Note the degree of detailing possible because of the available sybsystem studies done by other team members.

## 3.2 Understanding the Implicit: Games

I became increasingly interested in the power of informal understandings among designers and users as we find it not only in vernacular architecture but in all interactions among designers and between designers and builders, clients and users. Such understandings and sgreements, by definition are not written but can only be seen in what people actually do. Types, patterns, themes, and styles are all different ways to establish agreements without words but by doing. Development in designing begins with acts, when the new way of doing is successfull explicit formulations and theories follow. This we also found in our own work. Grids, Zones and Levels were developed while doing. Only later we formulated a more coherent theoretical explanation of what we were doing and why it was successful.

How can one study the doing of design short of looking over the shoulder of designers when they work? Games seem to offer a context in which people can act but where the action is in a well defined context which can be manipulated. We became interested in games as tools for research about designing.

At the end of 1986 we completed a study, funded by the National

Science Foundation about the use of a new kind of games for purposes of design research. 'Concept Design Games' are abstract games, played with simple elements like clothespins and nails, but the players experience the interactions, problems, and dilemmas of designers in the real world. We hope that these games can be shared with designers in other disciplines who also work at complex, hierachical forms to be designed by teams and subject to negotiation, agreement making and rule making.

This is the summary of the projec given in the report:

*The project introduces 'concept design games' as board games that do not simulate real life design tasks but represent, in an abstract way, concepts generally used by designers; offering players topological and interactive situations typical for designing.*

*The study intends to allow the reader to develop his/her own games for the examination of design theoretical and design methodological questions. For that purpose the formal structure of the games is established, a set of game pieces is given with a survey of the kinds of physical conditions ('Technical Universes') they may provide, and strategic issues of interest to game developers are identified and examined.*

*A separate chapter compares the idea of 'concept design games' with the uses of 'language games' as introduced by Wittgenstein.*

*Eight games, representing different concepts and aspects of designing, have been developed and are made available for playing. An example of a game played is given for each. The theoretical background of the concepts on which these particular games are built is explained.*

Fig. 3.2.A. Detail of a complex configuration from one of the concept design games. This game produces a territorial organisation in which the white configurations with gates C share a wall and a gate B. Together they are on the same level as the other configurations with gates B. The whole is enclosed with a wall and gate A.

Fig.3.2.B. Configuration of nails and washers of different sizes which is the result of the

"silent Game" in which players must make patterns to be followed by the next player who then introduces a second pattern and so on...

Fig.3.2.C. A game of two levels in which the rectangular 'slabs' must stay surrounded by the oblong 'pegs'. Sequence runs from left to right and top to bottom.

### 3.3. Adaptability of the freestanding house.

The US housing market is dominated by the free standing house which has been manufactured quite sucessfully over the years. (Nevertheless, rising costs of land and labour make developers move towards rowhouses and other more clustered types, making the Support Infill approach of interest to improve long term use by adaptation over time.)

But there also is reason to re-examine the freestanding housetype and make a separation of 'Shell' and 'Infill' This seems advantageous, not only for greater adaptability but for more efficient production. Builders can offer more variety in plans within the same basic shell and can postpone the decision about the infill to a later stage when the occupant is known. In addition more systematization is possible.

In 1984 we did a pilot study examining different dwelling types for their potential in separation of Support and Infill. This study was limited to questions of spatial arrangement. Later Stephen Kendal conducted a study (with Thomas Chalmers) in which the re-arrangement of the technical subsystems, necessary for Shell Infill separation was examined. The conclusion of these first studies is that the Shell Infill separation is a matter of design and organisation, but that there are no technical barriers to the approach within the present state of the art. It is expected that such a re-arrangement will yield greater variety coupled to greater efficiency as is the case in the Dutch experience.

Titles of the two studies:

Infill packages in Housing Rehabilitation; Suburban Houses, Triple Deckers, and Public Housing. Habraken, Hamdi, Hellinghausen, Testa, Woods. Report, Design Methods and Housing Group, Dep. of Architecture, MIT. 1984.

Shell/Infill. A technical Study of a New Strategy for 2*4 Building. Stephen Kendall and

Thomas Chalmers. Design and Housing Group, Dept of Arch. MIT. 1986.

Fig.3.3.A. Plans and elevation of a standard US tract house.
Fig.3.3.B. The same house transformed into a support.
Fig.3.3.C. Zoning distribution of the Support.
Fig.3.3.D. Examples of floor plan variations in the support, showing respectively one, two, three and four dwellings in the same volume.

Fig.3.3.D. Chart from the Kendall study showing how the various subsystems of the building all must be divided in a Support part and a Infill part. The chart is from a two story freestanding house.

3.4. Modular Systems on Different Levels.

Thys Bax in the Netherlands studied the use of grids on different levels in the built environment and is presently conducting design methodological studies as a professor (and former chairman) at the Department of Architecture in Eindhoven Technical University. His dissertation (Meten met Twee Maten, 1975, Eindhoven) is on the uses of dimensional systems as means for decisionmaking in environmental design. The principles he developed were later applied in practice by Euroconsult, a large international consulting organisation in the Netherlands. The example given here is from a study for the extension of Macao, 1984.

Fig.3.4.A. Schematic presentation of the relation of six modular grids, ranging from the level of the building detail to the urban scale
1. Detail level, 10 cm module
2. Infill design level. 10/20 cm. band grid based on 30 cm module.
3. Support design level. 30/90 cm. band grid based on 120 cm. module.
4. Tissue-support level. 240/360 cm. band grid based on 600 cm. module.
5. Tissue level. 1200/2400 cm. band grid based on 3600 module.
6. Tissue-urban grid. 14400 cm. module single grid.

3.5. Control Patterns and Traditional Architecture.

Jamil Akbar, presently Dean of research at the Department of Architecture at King Feisal University, Dammam, Saudi Arabia studied the control patterns behind the traditional muslim urban environment. He describes in his Ph.D. dissertation the conventions by means of which people could transform their buildings. ( Jamel Akbar, Responsibility and the Traditional Muslim built Environment MIT. 1984.) He studied medieval legal documents about disputes between neighbors, and shows how the traditional Middle Eastern urban tissue is the result of conventions about control and responsibility rooted in the Arab society.

Akbar proposes, in his dissertation, a model of possible forms of responsibility in the built environment which can be generally applied in the study of responsibility patterns.

FIG.3.5.A. A party can have responsibility to a building in seven ways, according to Akbar, depending on the combination of three modes of control called Control as such, Ownership and Use: 1. A party owns, controls and uses. 2 A party owns and controls. 3. A party uses. 4. A party controls and uses. 5. A party owns. 6. A party owns and uses. 7 A party controls.

These seven ways can be conmbined towars a piece of property. The property can be in five forms of submission named Unified, Dispersed, Permissive, Possessive, and Trusteeship. Akbar demonstrates that the first, being the most unified offers the most dynamic environment in which change is easiest without destabilizing the system.

3.6. Making the Computer Understand Agreement.

One of the most intriguing challenges in design methodology is about how the computer can aid the designer. Present CAD programs are not much more than good drafting machines, or are narrowly limited to a specific area of knowledge related to designing.

It is my conviction that the next generation of CAD programs must be those in which the computer can 'understand' rules, agreements and conventions or any other kind of constraint pertinent to designing. These constraints should be given to the computer by the designer while he is working and they may change from project to project.

Mark Gross is a computer scientist and architect by training. In his Ph.D. dissertation ( Design as Exploring Constraints, Mark D. Gross, MIT 1985) he articulates a theory of design as the exploration of alternative sets of constraints. Based on this theory he proposes a computational model and discusses its implementation.

If such a program would be available it would be wide open; that is to say, the user would have to bring into it the systematic organisation of constraints he wants to work with. The more methodical the designer works , the more effective he would be to use the program. In other words, it would not be the machine that imposes a method on the designer, but the designer would teach his method to the machine while working with it. The proposed program itself imposes no particular design method but can manipulate constraints. For instance it can:

- Recognize constraints in a drawing; deciding whether constraints have been folowed or not.
- Calculate consequenses of design decisions.
- Choose between alternatives following given preferences.
- Partition large and complicated design problems into simpler parts along the lines of least overlap of constraints.

Much work needs to be done to implement allthis but the theoretical and methodological principles have been formulated by Gross.

a portal

Fig.3.6. From Gross' constraint theory: A diagrammatic description of ~~an~~ Arch showing relevant constraint relations to be specified further. For instance: Column-supports-lintel, and: Maximum distance between column 1 and column 2 relates to lintel.

Fig.3.6.B. Detail of the column-supports-lintel relation.

## 3.7.The Basic Elements of Transformation: Moves.

When we look upon designing as the art of making transformation the single act of transformation becomes important. Such an act we call a 'move'. A move is to transform a situation from state A to state B.

Ming Hung Wang argues in his recently completed Ph.D. dissertation that a limited number of moves is sufficient for the construction of any given configuration. He proposes a set of 'Arrangement Moves' These in turn, can be composed of 'Generic Moves' like 'connection' or 'separation' and "Ordering Moves' that establish spatial relations using 'implied lines of reference. It is the latter moves that are particularly used by designers.

Wang further demonstrates that the arrangement moves, as defined by him, allow for the construction of inference rules for perceiving spatial relations. Thus the arrangement moves can be the basis for a particular design logic. This would allow a computer program which 'knows' arrangement moves to deduct what relations might exist between element A and B when A and B are each part of different moves relative to a same configuration. ( If in configuration C we move A relative to C and we move B relative to C, what relation exists between A and B?)

fig. 3.7.A. To demonstrate the uses of arangement moves Wang translates design rules formulated by Frank Lloyd Wright for the Usonian House Type in terms of arrangement moves and demonstrates how they apply to a formal description of a specific house by Wright. This figure shows the aggregation of spatial relation rules.

Fig.3.7.B. In the same demonstration Wang shows how Wright uses a four level system of walls. This allows him to summarize the wall rules as follows: "a string can be made by all kinds of elements; lower level elements can abutt to higher level elements; higher level elements do not abutt to lower level elements; the highest level elements cn only converge at ends, but not abutt; other levels can do both. (the underlined terms are terms for ordering moves.)

## 3.8 Using Traditional House Types.

One of the most interesting subjects to study is how new architecture can be developed from traditional types. Many researchers acrosss the world have studied this question. The support methodology can be helpful here because one must extract from the evidence of the traditional houses, the underlying systemic principles. The Thematic system of the type must be discovered. From there a new thematic system is developed combining the traditional elements with new. The example shown here is from Jorge Andrade. It shows how a very simple type can serve to make a urban environment in which variety combines with coherence.

(Jorge Andrade Narvaez visited SAR in 1972. He later worked with COPEVI, a semi public research and consulting office devoted to establishing workers housing cooperatives. He designed and built a first support project in the Guerrero neighborhood in Mexico City (1982) and later completed another one in Tepito neighborhood in that same city

(1985). He is also the author of numerous studies on the uses of local dwelling types in support design. He did his Masters thesis at MIT in 1981 on the architectural transformations over time in the 'informal housing sector' in Mexico city. Presently Jorge Andrade is head of the department of Architecture in the Metropolitan Univiersity at Xoxemilco, Mexico City.)

Figs.3.8. Are from a study by Andrade for the development of housing in the state of Tabasco, based on the local house typology.

Fig.3.8.A One of the types of the region.

Fig.3.8.B. Extraction of thematic elements of the structure.

Fig.3.8.C. Example of the gradual development over time of a new house within the new thematic principles.

Fig.3.3.1.D. One of several alternatives for houses above stores or workplaces.

Fig.3.3.1.E. overview of the combination of the new types in a urban tissue.

### 3.9. Tracking the Assembly of buildings.

We can see the process of building as a process of continuous movement of parts from the sources where they are made via many sub-assemblies, to their final destination in the building. The way this movement takes place is determined by the structure of the building industry. Changes in this industry -for instance a shift towards prefabrication or towards centralized control of assembly v. decentralized control - will influence this flow.

By looking at the transformations of the actual hardware we may learn more about the health of the building process. We found that there does not exist a adequate method for tracking the flow of elements through the building process and to see this flow in relation to the control patterns in the building industry.

Stephen Kendall, assistant Professor at the school of Environmental design at the University of Colorado, Boulder, Colorado and presently a PH.D. candidate at MIT is developing such a method. Called Staged Assembly Method (SAM), it will give a visual representation of the relation of assemblies and sub assemblies and the domains of control under which they move. This work involves the development of a notation technique which should enable its users to study the impact of various control parties on the systems used in housing construction. He applies this technique in a study of the traditional '2 by 4' building method in the US.

fig.3.8.A Example of a SAM diagram.

3.10. Second Generation Infill systems.

Very important research yet to be done is to develop better principles for infill systems. Present infill systems are mainly adaptable wall systems in combination with conventional systems for plumbing, electricity, heating, etc. The technical service systems, however, take up about 60 % of the infill costs. The future infill system will be the one which makes the distribution of plumbing and electricity easier and more flexible. Most of the costs for infill are for labour. Better and more expensive subsystems can be used to reduce substantially the time for labour, resulting in a better product for less costs. Presently a group of architects, builders and researchers is looking into new principles of infill in the Netherlands.

## 4 DEVELOPMENTS IN PRACTICE.

In the course of time many architects have worked to bring the SAR principles in practice; many projects have been done and it is not possible to give a complete overview. Here follow a few of the most important initiatives taken in the course of time to demonstrate the SAR approach in practice.

4.1. Frans Van der Werf.

Frans Van der Werf, of KOKON collaborative, Rotterdam, worked at SAR for three years where he collaborated on the SAR73 tissue methodology. He won the competition for a housing project in Papendrecht, a town near Rotterdam, which eventually resulted in the Molenvliet Support project which was among the first of a series of experimental projects in the Netherlands (1977). The Molenvliet project of about 120 units established the feasibility of the support idea. Van Der Werf since has built more support projects. The most extensive one was Lunetten near the city of Utrecht. Most recently Keyenburg in Rotterdam was completed and presently two more are under construction in Enschede and Almere while another support project near Paris is in preparation.

Fig.4.1. A birds eye view of the Molenvliet project.

Fig.4.1.B. Ground level of the Molenvliet project in two stages. 1. The support structure with the adaptable party walls in place. 2. The support with infill. 3. Analysis of the floorplans indicating different functions.

4.2. Psshak, Adelaide Road, London

Nabeel Hamdi (presently teaching at MIT) and Nicholas Wilkinson (now teaching at Newcastle, England and editor of the Open House magazine), were among the first to build a support project while working with the Greater London Council. A early attempt was completed in 1972 at Stamford Hill. A second project was the Adelaide Road scheme for maximal 64 dwellings, completed in 1977.

Fig.4.2.A. Adelaide road. Much attention was given to help the users make their own floorplans. They were given cut-out sheets with furniture printed on it to arrange on a drawing of the support.

4.3. Dordrecht.

Another of the earlier experimental projects that led to the acceptance of the support idea in the Netherlands was done in Dordrecht by Fokke de Jong of De Jong and Van Olphen, Architects in Maarssen. De Jong and Van Olphen were among the first collaborators at SAR and participated in the development of SAR 65. De Jong believes that the users need not consult the architect for their infill. He produced the support and a catalogue of infill alternatives and left the choice to the user who, after having visited the empty support, could directly instruct the builder about the infill of the dwelling which was subsequently delivered several weeks later.

Fig.4.3A. Dordrecht project (will be sent later)

## 4.4. Geleen.

Architect Bart Wouben developed a support principle in his Masters Thesis as a student at the Technical University in Eindhoven. (1973) It was implemented in a project of 122 units in 1979. In addition to internal adaptability this project offers external space for expansion on all floors of the support buildings.

Fig.4.4.A. Geleen project. Terraces are for future expansion. The wood beam with gutter will support the future roof.

Fig.4.4.B. geleen project. second floor of four storey support, showing the support structure and terraces for later expansion.

## 4.5. Open Building

Presently the support approach has been accepted in the Netherlands as a viable alternative, offering variety and efficiency if well designed and executed with appropriate logistics.

A new organisation was founded in 1984 to promote the large scale implementation of the support approach in the Netherlands. This organisation, under the name of 'Open Building', now has more than a hundred members among whom architects, builders, developers and manufacturers cooperating to remove the regulatory and technical barriers towards a more efficient implementation of the Support Idea.

## 4.6.OBOM.

Another initiative for coordination is found in the 'OBOM' (Open Building Development Model) under the leadership of Professor Age van Randen at the department of Architecture, Technical University of Delft. OBOM is a laboratory for design coordination and implementation. It is finantially supported by the Dutch Ministry for Economic Development and draws on the expertise of a advisory body of about fourteen professors from the universities in Delft, Eindhoven, Rotterdam and Wageningen.

*Quote from the OBOM brochure:*

*Open Building is a new approach which can not be realized without changing old and approved methods in building. These methods will have to be changed into new 'tools'.*

*Open Building tools can be abstract: for exemple:*

*New rules for manufaturers, contractors, and designers concerning the positioning and dimensioning fo building materials.*

*New ways of contracting, new financing methods and new subsidy methods, all respecting a division between fixed and changeable parts of the building.*

*Open Building tools can be material: for exemple:*

*Flexible gas and water conduit fittings permitting easier installation and easier changing of the dwelling layout.*

*Inner partitioning walls that can be replaced without demolishing.*

*A substantial part of the OBOM is formed by the 'Simulation Project'. This is a fictitious housing project, detailed on several scales. Its main potential is to simulate all possible problems occuring in the building process. This makes it the ideal background for projecting and testing new developments. The Simulation project is an aid for developing and testing new Open Building tools.*

~~Fig~~.4.7. Beverwaard, Rotterdam.

Architect Henk Reyenga worked with Van der Werf and myself at SAR on the SAR73 tissue method. He later used the tissue method as coordinator and urban designer for the Beverwaard neighborhood of the city of Rotterdam for 15000 inhabitants. Reyenga established zoning principles and patterns to coordinate the design by a variety of architects offices. (1977). The project is based on the believe that a strong and regular tissue structure with a clear hierarchy of streets, canals, and pedestrian walkways; combined with a strong typology of lowrise buildings, should allow for rich variation in floorplans, facades, and street details. In addition to the zoning agreements there are also patterns fo r parking, playgrounds, entryways etc. The density is 65 dwellings per HA.

Fig.4.7.A Tissue Model of the whole area. The canals (white) and the streets (black lines) are given as zones without exact width and length. Note that there are two paralel roads between two canals in the central district and only one in the periphery, making two variations on the same tissue model.

Fig.4.7.B. One of the two tissue model variations used in the project, giving zones for waterways and streets and minimum built surface.

Fig.4.7C. The same tissue model; demonstration of the uses of the margins for the public space dimensions.

Fig, 4.7.E. Demonstration of use of the tissue model by Ryenga.

Fig.4.7.F. Actual result by 1981.

Fig. 4.7. G. Reyenga's work creates a variety of forms in an efficient way because it is extremely systematic. This is not only on the tissue level but also in his architecture: Subsidized housing along one of the historical canals in Delft.

# Towards a new professional role

N John Habraken

*Department of Architecture, Massachussetts Institute of Technology, Cambridge, MA 02139, USA*

*This paper explores the implications for professional roles of the new attitude towards participation. The professional is perhaps not to be made entirely redundant but must learn to adopt a new, less arrogant role. This change may already be happening in many professions.*

*Keywords: participation, professions*

The idea of participation is a quarter of a century old, give or take a few years depending on how one interprets past events. It was iu the early 1960s that the role of the user became discussed in professional circles. I remember I found it encouraging that John Turner published a first article about his experiences in the *barrios* of Peru within a year from the publication of my own writing, based on observations in The Netherlands. In those same years many began to speak and write about these concerns. But it was only in the second half of the sixties that the term 'participation' came into use as a result of an intensified and increasingly politicised discussion.

A review of the past must be left to the historian. I only recall the old days to suggest that the idea of participation has been around long enough for us to ask ourselves how useful it still is and to what extent the idea can serve us in the future. This, of course, is very much a matter of conjecture and personal opinion, but it seems, nevertheless, a reasonable question to raise. I hope we will formulate a new agenda for the future and do some projective thinking. Such thinking can not only be an extrapolation of the past but must also include a critical look at what has happened so far. Perhaps the best contribution I can make is to give you some of my personal thinking on where we are, in the hope that it will stimulate others to do the same.

To begin with, I must confess that I have always been ill at ease with the term 'participation'. I try not to use it that frequently. It is easy to uuderstand how the word indicates a certain position one can take relative to matters of habitation with which I sympathise. The term, however, is used for two meanings that point in opposite directions. Some advocates of user participation mean user decision-making power. They want to place under the responsibility of the user certain decisions that the professional is used to taking. In this case the word indicates a new balance that can only be achieved wheu some transfer of power takes place. It is a meaning that demands fundamental, structural change.

The other meaning does not denote a transfer of responsibility; the professional domain remains the same. Here the term participation means that the layman is asked to voice his opinion. He is promised to be heard and to be taken seriously. This meaning indicates a change of procedure within an unchanged balance of power. The difference, is significant. The Dutch language has two distinct terms for it: 'inspraak' and 'zeggenschap'. These can be translated as: 'to have a voice' and 'to have decision-making power'. Unfortunately there are no exact equivalents in English.

We all know the different positions one can adopt relative to these two meanings. I do not want to go into that now. There is another aspect to the term participation which is perhaps more pertinent. In the two distinct meanings we have discussed so far the issue is the relationship between the professional world and the world of the lay people; the nsers, as we call them. Those who advocated participation, in whatever meaning of the word, were always those who felt that we should reconsider our professional task. The so-called participa-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tion movement was basically a reaction to the tacit belief that professionals could do it all. We are here because we know it takes both sides to have a healthy evironment to live in. Participation is advocated, in whatever form, by those who refuse the paternalistic model and know that experience and knowledge resides with lay people as much as with experts.

But when we take a somewhat broader view, along a historic perspective, the term participation is peculiar, because when we use it we mean that the user must participate in what we, the professionals, do. We want the people to participate in the emergence of their shelter. Yet, at the same time we know that even today the majority of settlements come about without the direct intervention of any professional designer or, for that matter, any other professional except local craftsmen. We also know that, in history, most dwellings came about without the use of designers or engineers as we know them today. In the past the professionals we are thinking of wheu we argue participation, professionals like us, were at best active in the design aud coustruction of mouumental buildings serving the temporal and spiritual powers of the day. We mnst also remind ourselves that we come from a more recent Western European tradition in a bourgeois society in which the architect was invited by the client to come and design his house. This relationship is still with us, in its pure form, when architects design villas for individuals who can afford their help.

In other words, until a few generations ago, until the beginning of this century in fact, we were always to be invited by the user client to participate in the birth of a building. Earlier, that same kind of building usually came about without a professioual designer acting as the midwife. In this broader, historic perspective it is legitimate to ask, who is participating in what?

That architects at a certain point came to think that perhaps the user should participate, could only occur because in modern times something extraordinary happened. For a number of understandable and, I am sure, unavoidable, reasons the responsibility for the shelter of a large part of the population in Europe came into the hands of a professional class: bureaucrats, lawyers, architects, engineers. This is the period of the mass housing projects. For several generations professionals could think that human settlement completely depended on them. Architects sincerely thought they carried the future of the built environment on their shoulders. (I remember a prominent colleague declaring that, if we designed the right kind of cities, there would be no more war.) To us today this notion sounds naive, indeed unbelievable. But that is the way it was and therefore, in the sixties, it had to be argued that this was impossible if not plain wrong and it was proposed that the users be brought into play.

Now, after all these years, we must again take a distance from what we are doing. What is happening in a broader historic perspective is, I believe, that a professional class is still trying to find the proper way to participate in the age-old process of human settlement. Indeed, it is us who must participate. Humanity has done without us for a long time and would, we can be sure, survive and continue to build if we were to disappear overnight. Yet, we feel we have something important to contribute. What is it?

This question is much less rhetorical than it sounds. I do not turn the participation issne upside-down to make a witty remark, but because it illuminates the very quality of our task. By reversing the issue and asking ourselves how we can best participate, we really ask what it is that we contribute to the process of settlement that no oue else can. And this, it seems to me, is the question to be answered. We cannot be responsible for everything, nor can we control everything. We participate in the drama of life and settlement, and the more precisely we can formulate what exactly is our irreplaceable contribution to it, the more effective we will be; the better we will be able to educate the next generation and the better we will protect research and experimentation to improve our professional performance. The participation movement has questioned the professional's role. It was, inevitably in the beginning, a negative position. The advocates of participation knew something was wrong but could not know yet what the new professional model should be. This new model, I want to argue, is not that of the benevolent practitioner who lets people participate (in either of the two previously found meanings). It is the model that comes from the perspective I propose here: that shelter is part of daily human life and will come about wherever and whenever people share space. Today, in a new age where so much more is possible, the professional plays a crucial role in that process. Yes, our participation is important. That, I suggest is the correct way to state our position.

All this is to say we have passed the ideological stage. By now it ought to be possible to point out what are the makings of the new professional we represent. A professional is not known by what he does, but by the way he does it. Anything a professional does—building, healing, writing contracts or teaching—laymen have done first and will continue to do. Professionalism lies in expertise and expertise rests on skill and method and knowledge. Much work has already been done on this score. A new body of knowledge and professional know-how is emerging. Much of that experience has found its way to others by means of publications but even more circulates by word of mouth in seminars and meetings and through personal contacts and by papers and reports; world-wide networks are working and overlapping with one another, all operating, in the true spirit of its participants, in an informal way.

However, this implicit way of developing new expertise may soon no longer be sufficient. Today we must become much more explicit about the skills, methods and knowledge we can bring to bear in the new role we have chosen. At a certain point more formal structures and more organised networks must be available to allow for further growth. This is particularly important in a field where the individuals who represent it are scattered over the world and still relatively small in number. There are a very few institutions that actively seek to promote and support the development of the new knowledge we are talking about. National agencies, like those for aid to developing countries and, on an international scale, institutions like the World Bank may be providers of resources but do not play an active role in research for new methods and skills nor do they actively exchange information. Few architectural schools seek to educate the new professional we have in mind here, and even fewer can find money for research or sufficient resources to build strong links with practice in the field. John Turner has been a tireless advocate for a better exchange of information among all concerned, but so far his valuable work remained largely exploratory. A magazine like *Open House International* clearly answers a need and can therefore survive on a minimum budget, but could do much more if proper funding were available. SAR in Eindhoven has begun to think about an international role but it is too soon to tell what the results may be. In short, we seem to be at the stage where stronger structures must surface that serve the future growth of skills, methods and knowledge of the new practitioner who is already operating.

Our new professionalism—because that is really what we are talking about here—calls for practical and effective organisational steps to secure its growth and future development. But, important as this by itself may be, it is secondary to the vision that must drive us. Experience must be gained, methods must be developed and tried, new knowledge must be codified and new teaching must be done. But all this will only happen if we know what we are about: if we know what our participation really must accomplish. The practitioners of the new kind go about their work in a self-evident manner and are not very interested in what the glossy magazines say. They do not measure their accomplishments against the teachings of professional schools or the awards of professional organisations. They go their own way and find pride and satisfaction in the work they do, keeping informed through those more informal, less pretentious channels. They may work for years to reorganise a squatter settlement, may be involved in upgrading an old urban quarter, may design and develop simple components from local materials, find a smart little program for a hand-held calculator to be used in the field, or they may design an infrastructure for a new settlement, an expandable housetype, an adaptable building. We all know the variety of activities no one had heard of 20 years ago.

How can we describe this new role? Is there a model? It is, of course, difficult to characterise the common attitude of such a variety of individuals and activities. Perhaps it is even foolish to try. But I do believe I detect a common denominator in the sum of the incidental examples that come to mind. What brings us together and what motivates so many others is what we discussed earlier: the knowledge that the environment is a phenomenon that will occur, spontaneously, wherever people live and share space; the knowledge that we need not protect 'Architecture' or determine 'Its Direction'. Our mission is to understand what is going on, how this natural phenomenon of settlement occurs, how it can stay healthy, how it gets sick, how it can recover. Most importantly, we see ourselves as those who not only study the health and well-being of the built environment, but who know—a little bit—how to help it become better, how the single, incidental act can contribute to the whole, how the whole can improve, can be nourished by our particular intervention.

It is this knowing of our position towards the built environment that gives direction to all we do. Sometimes the well-being of the environment requires physical design and the proposition of new forms, sometimes it requires the availability of certain resources, sometimes it means work with people and sometimes with materials. Sometimes it is geared to the specific conditions of a locality, and sometimes it has to do with general principles that are applicable under generally stated conditions. But in all cases we see ourselves, not exploiting a situation for the sake of an extraneous peer group standard, but nourishing something that is alive to make it better, stronger and beautiful.

The attitude that I try to indicate here is the attitude of the gardener who works to let plants grow, who knows what soil and light and rain they need and intervenes in a process to improve it. To have a good garden we sometimes must make an infrastructure: dig the soil, make paths and provide water. Sometimes we must reorganise the distribution of plants. Sometimes we must feed and stimulate. Sometimes we must weed and trim. At all times we must propose forms, suggest forms, help forms to come about. The gardener is in touch with physical things, working with his hands, but he also understands life and knows he cannot make plants but he can only help them grow and become healthy.

Our traditional role model is that of the carpenter. We are builders by inclination and know how to put materials together into a coherent whole. This is indeed the trade we come from, and the instinct for built form moves us. There is nothing wrong with that, but designing is not carpentry. To be a carpenter one must work the wood. It is a trade to be exercised. The designer, on the other hand, puts down the piece of wood to think and propose to others how things might be put together. He stands between things and people. He cannot push aside people to impose his own form, nor can he just talk to people and be ignorant of buildings.

I know metaphors have their limitations. However, what I like about the image of the gardener is that it includes all the dimensions our profession aspires to: giving form, understanding a site, light, colour, texture, proportion, organic forms, nature and, above all, environmental space. The gardener, like the architect, is conversant with all of this but something important is added: the dimension of change and growth. The gardener's subject has a life of its own. Trees will grow and make shadow. Shadow will make new species emerge, these will in turn stimulate changes elsewhere. What distinguishes the gardener from the carpenter is the dimension of time. The traditional architect was there to build the monument; his role was to defy time and place a stone in the river of life. This is a worthy role but a limited one, because it is only appropriate for the exceptional case. The new practitioner, I am sure, is the one who accepts the fluid movements of everyday environment and rejoices in them. He knows that life is rich, unpredictable and ever changing and that buildings and cities are part of life: are the product of life itself.

Change is the key to our new professionalism. Not the technical change of flexibility—this technical term is inadequate here—but the change of everyday life. Not the disruptive change for the sake of 'progress' either, but the change that comes from continuous adaptations and accommodations that are the heartbeat of the environment; the change that assures continuity. It is this kind of change that comes naturally like life and which is, indeed, hardly known when it is there. We only notice what goes too fast or too slow, not what goes right.

It is remarkable that architecture, as distinct from engineering or the sciences, never acknowledged change as positive. Only when we study the transformations of things we will find what is constant. Therefore a body of knowledge particular to architecture will not come about unless we can identify the particular way in which architects see change in things, as distinct from the ways engineers and physicists see it. I am convinced that the new professional attitude we are discussing here is the key to a new concept of architecture: it is not, to be sure, a new style—styles are results, not causes—but a new discipline with its skills, methods and knowledge. Our newly gained interest in the dimension of time, and the uses we learn to make of it in our work, will render obsolete the skills of yesterday.

By now I have moved far beyond the scope of participatory issues. This I did on purpose because I believe that there is a larger picture we should not ignore. The attitude of the gardener, the practitioner who by intervention seeks to participate in a live process, is the model we have found to be effective. One can come to this attitude, it seems to me, by many routes; the route of participation is only one. And if I am not mistaken, this is precisely what is beginning to happen. Let me try to explain the signs I see.

To begin with, there is architectural research. It is understandable that much of what is called architectural research today is, in its ways of working, still close to engineering and the sciences. Environmental control, behavioural studies and building systems could already begin to develop without the uew perspective we are exploring here. However, the new architectural understanding of the phenomenon of change is beginning to influence these very fields. In The Netherlands at least, systems builders have begun to connect their products to specific levels of intervention. This link between the material system and the party who manipulates it over time was missing so far in the more general trend towards open systems. In Japan the nationwide invesigation under the title *Century Housing System* is also interesting in this regard. Advocating open systems it likewise links usetime to systems identification. In building economics studies are conducted to introduce the concept of the building as composed of different systems with different lifetimes. This approach emerged independently from the idea of user intervention, but is obviously compatible with it, bringing economists and architects together, comparing notes.

Equally interesting from our point of view are the great many studies of particular environments that have been done in the last 10 years. Observation is the foundation of all research. There is among architectural students and researchers a considerable interest in documenting everyday built enviroumenis; their forms, their transformations over time, their uses, their territorial interpretations and so on. It is almost as if we have begun to see, for the first time, the built world we live in. Some of us know for instance the work of Fernando Domeyko who has spent many years documenting, with the kind of relentless impartiality that can only come from great love, the ways and forms of everyday urban environments. He not only shows us the streets and the buildings but also the interiors and all the furniture and utensils that have their places in them. His work, never published so far, and ever growing, is unique in many respects.

In a very different way, but with similar singleminded power, Christopher Alexander has brought to our attention the timeless patterns of the built environment—patterns that come about when people settle and are given a chance to cultivate their environments. There may be different opinions as to what they mean and to how we should use them, but Alexander brought them to our attention. People like Domeyko and Alexander make us see, and it is only when we accept the built environment as something that lives by its own energies that we can begin to observe it in the ways they teach us.

That same attitude we find in architectural schools when students, given the opportunity, begin to observe and document environments that they are familiar with, demonstrating a similar love and attention for details. They come with maps, photographs and written observations, and it is astonishing how much knowledge comes to the surface once they discover that it is a good thing just to recognise an environment. There is no such thing as an uninteresting environment, there are only uninterested observers. We are beginning to discover the built world all over again, just at the time that we are in danger of losing it by the tragic ignorance induced by the 'isms' of our ideological discussions.

The experience we have through SAR is another indication that research begins to develop once one accepts the new attitude we are discussing here. The methods proposed by SAR could come about because the environment was seen as a complex form consisting of different levels of intervention with different actors on each level. We were not interested in the architect's ideas and personal values, although these are, obviously, important, but in the way the architect could contribute to the freedom and growth of forms under the responsibility of the users. We focused on the interface between the professional and the living environment itself. This approach paid off when builders, manufacturers and managers began to see its potential. Here we have an example of architect's research feeding into technology and management. The irony is that it is therefore not recognised by some architects as relevant to architecture. It is precisely this broadening of the field, that is significant but it is understandable that it causes confusion in the beginning.

With the introduction of the computer we find an increased interest among researchers to find out what designing is about. If we do not know what we are doing, how can we make a computer help us, or take over some of our tasks? Thus methodology becomes the key to the computer. Methodology, perhaps more than any other aspect of architecture, is based on the understanding of change in the built environment. It is the study of ways to intervene; that is, to change. Change reveals the laws that are constant and it is on the constants that methodology is founded. As a researcher I came to appreciate this connection and began to realise that my interest in participation was primarily because it makes the issue of change unavoidable. It was not, I must confess, the user's interests that drove me, but the broader interest of a healthy built environment which, without the user's intervention, is unattainable.

If I have a message, therefore, it is that we must begin to see participation as a component of a broader development. The ground is shifting in our profession, making obsolete the labels of yesterday. It is the power of the new attitude we discuss here that it frees those who adopt it and makes them move into directions that are rejected by the traditional professional ideology as 'not architecture'. it is again the younger generation that has the courage to trust its instincts. At MIT we find an increasing interest among architecture students to connect their design studies to other disciplines such as economy, management, technology and housing. Of course one can advance a practical explanation for this—where jobs become hard to get, it may be prudent to have some additional expertise—but things are never that one-dimensional. It also has to do with intellectual hunger and a feeling that we have drawn too tight a boundary around architecture. Where, on the one hand, the discussions about architecture become more and more esoteric there are, on the other hand, those among the younger generation who simply go into new directions venturing outside the ever higher fences around the increasingly barren fields of the post-modern movements. Like those interested in the participation of users much earlier, they begin to explore new, uncharted territories.

Ours is not the only profession that seeks a new definition for its mission. Lawyers and medical doctors are also discovering that life may go on and may find new ways without them. At the time I was preparing for this paper I saw an article in the *New York Times* by Henry G. Miller, a lawyer, titled 'The lawyer is no 2, not no 1', and he states among other things: 'There is no intrinsic necessity for a legal profession. They can do away with us. One may not easily conceive of a world without physicians or engineers, but the role of the lawyer could be supplanted by others'. I would not be that at ease if I were a physician, or engineer but the fact that I found this article in the paper right then was no coincidence. Signals like this have appeared for years to those who would listen.

But while I am an architect and interested in the architect's new role, you may permit me to return to my own field to conclude. All I have said, obviously, reveals my bias more than anything else. My purpose was to open the debate. The question that is of interest to the historian who may be watching the current scene is whether we will see a new professionalism emerge in addition to the traditional architect's role as the master builder; or whether we will find the new professionalism to replace the old. There may only be a new kind of specialist. But I believe a more profound force attracts us and makes us seek a new role. Today the future of architecture will not announce itself by grand statements and manifestos as used to be fashionable with the modernist generation. Nevertheless, there is a profound shift taking place: coming from a quiet but thoughtful and very matter-of-fact re-evaluation by a growing number of individuals who do not shout when they don't like what they see, but just move into more interesting and promising directions, expanding the field. This shift will change the very nature of our expertise and touch all architecture. There always will be prima donnas and there always will be many others who do not need the limelight to grow, but the future of the profession rests with those who seek to re-define its role.

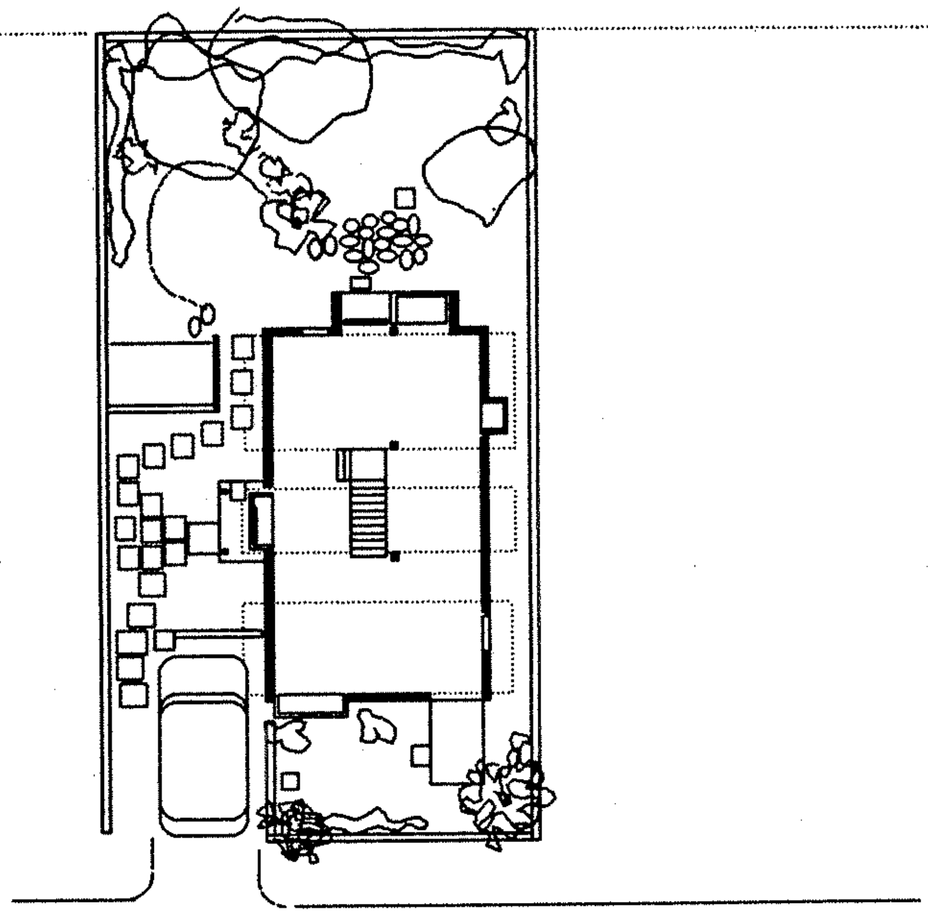
SHELL
[illegible]
HOUSE

# SHELL
# INFILL
# HOUSE

A STUDY ON THE
APPLICATION
OF THE
OPEN
SYSTEMS
APPROACH
IN
HOUSING DESIGN
SUBMITTED TO
MY
COLLEAGUES
AND FRIENDS
IN
JAPAN
MAY/JUNE
1987
N. JOHN
HABRAKEN.

NJH

SHELL
INFILL
HOUSE



THIS PARTICULAR DESIGN IS ONLY TO DEMONSTRATE THE METHOD OF WORKING□A SIMILAR DEMONSTRATION COULD BE GIVEN WITH ANY OTHER TYPE OF DWELLING□THE DESIGN DOES NOT PROPOSE ANY STANDARD OR ANY PARTICULAR WAY OF LIVING□ALL DESIGN DECISIONS WERE ONLY MADE FOR THE SAKE OF DEMONSTRATION□

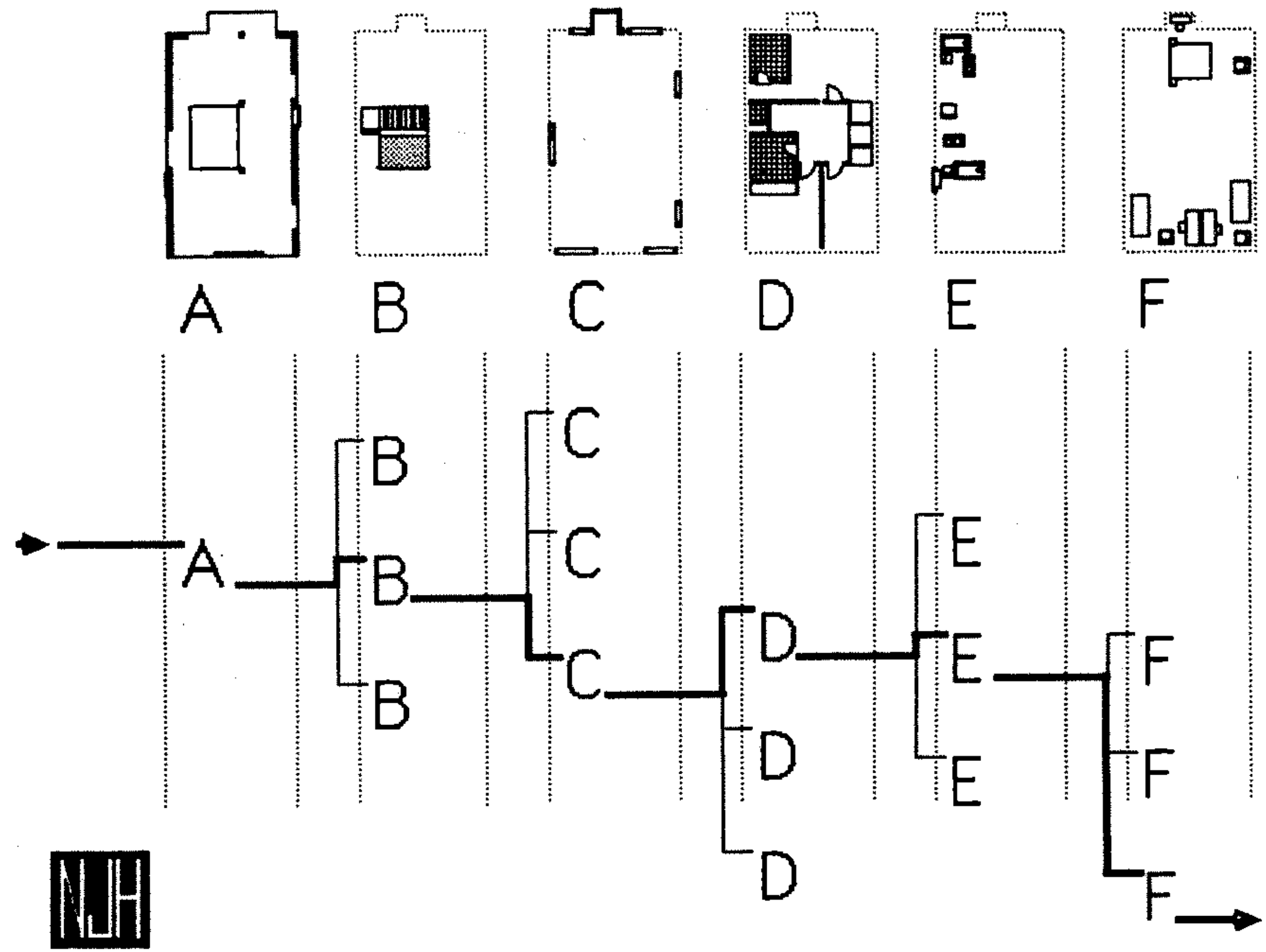
THIS IS THE GROUND FLOOR PLAN OF A HOUSE SHELL■
IN THE SHELL MANY DIFFERENT FLOOR PLANS CAN BE MADE■
THE DESIGN OF THE HOUSE IS DONE ON THE BASIS OF THE OPEN SYSTEMS METHOD■
THIS METHOD SEES THE HOUSE AS COMPOSED OF MANY SUBSYSTEMS THAT RELATE TO ONE ANOTHER IN A HIERARCHICAL WAY■THIS MEANS THAT WE RANK THE SUBSYSTEMS IN SUCH A WAY THAT EACH CAN ONLY BE DEPLOYED AFTER THE SYSTEMS HIGHER IN THE ORDER HAVE BEEN DEPLOYED FIRST■
EACH SUBSYSTEM IN TURN MAKES THE CONTEXT FOR THE NEXT SUBSYSTEM TO BE DEPLOYED■IN THE FOLLOWING PAGES THIS WAY OF WORKING IS ILLUSTRATED.

SHELL INFILL HOUSE
1


OVERVIEW OF THE MAJOR SUBSYSTEMS THAT MAKE THE HOUSE DESIGN■ A. THE SHELL OF THE HOUSE■ B.THE STAIRS■ C.THE WINDOWS AND OTHER FACADE ELEMENTS■ D. THE INFILL WALL SYSTEM■ E. THE KITCHEN AND BATHROOM EQUIPMENT■ F. THE FURNITURE■ THE RESOURCE SYSTEMS LIKE PLUMBING AND ELECTRICITY ARE NOT SHOWN HERE, THEY MAKE A SEPARATE ORGANISATION DISCUSSED LATER■

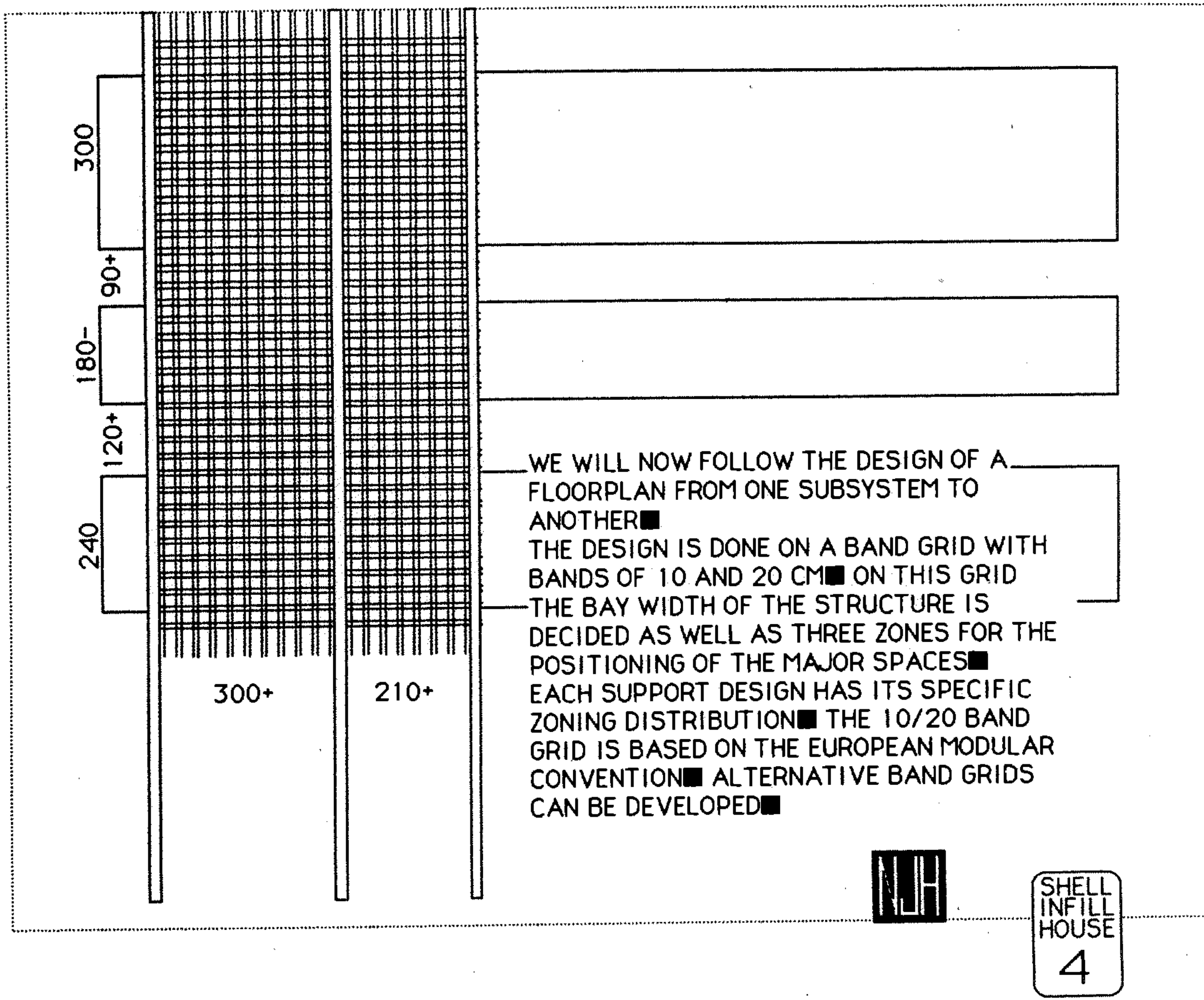
SHELL INFILL HOUSE

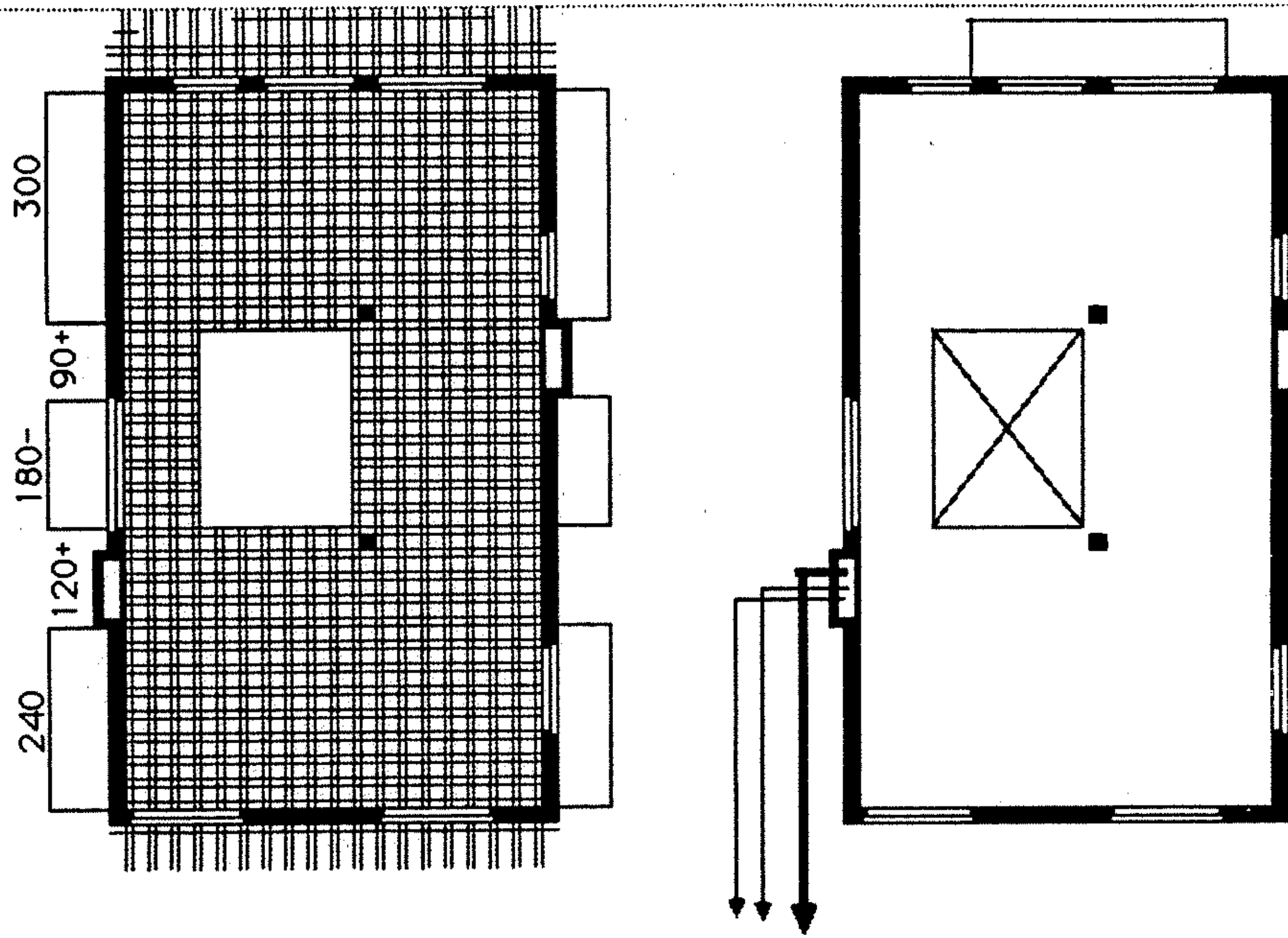
2




THE DESIGN OF THE HOUSE CAN BE SEEN AS A PATH DOWN A TREE STRUCTURE■ GIVEN THE SHELL A, DIFFERENT ALTERNATIVES FOR THE STAIRS B EXIST■ WHEN THE STAIR IS CHOSEN DIFFERENT ELEMENTS FOR THE FACADE CAN BE CHOSEN, AFTER WHICH THE POSITIONS OF THE INFILL WALL ARE DETERMINED TO MAKE ROOMS, ETC■

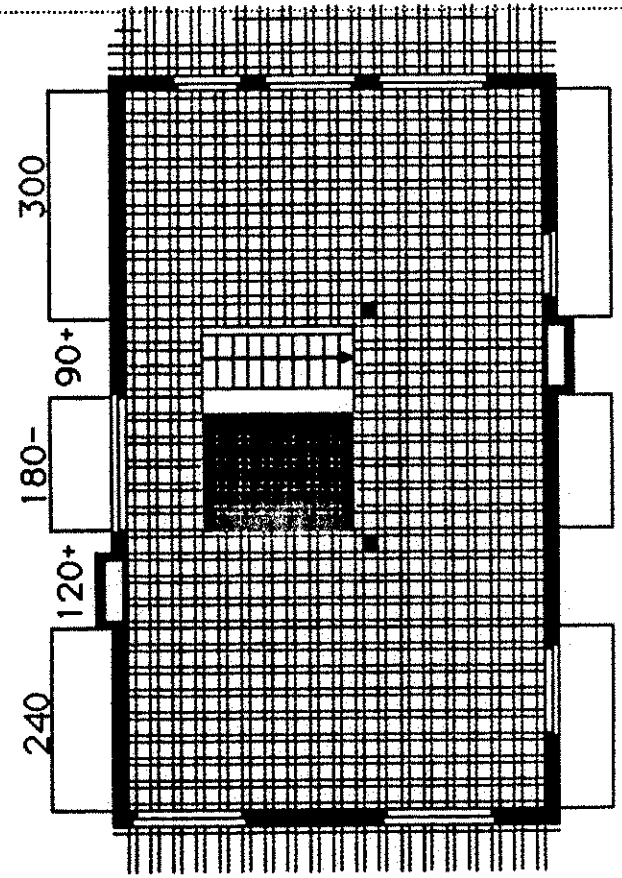
SHELL INFILL HOUSE 3

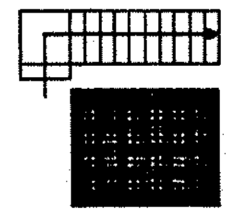

300
90+
180-
120+
240
300+
210+
WE WILL NOW FOLLOW THE DESIGN OF A FLOORPLAN FROM ONE SUBSYSTEM TO ANOTHER■
THE DESIGN IS DONE ON A BAND GRID WITH BANDS OF 10 AND 20 CM■ ON THIS GRID THE BAY WIDTH OF THE STRUCTURE IS DECIDED AS WELL AS THREE ZONES FOR THE POSITIONING OF THE MAJOR SPACES■
EACH SUPPORT DESIGN HAS ITS SPECIFIC ZONING DISTRIBUTION■ THE 10/20 BAND GRID IS BASED ON THE EUROPEAN MODULAR CONVENTION■ ALTERNATIVE BAND GRIDS CAN BE DEVELOPED■
NJH
SHELL
INFILL
HOUSE
4




THE MINIMUM SHELL CONSISTS
OF FOUNDATION, OUTSIDE WALLS, COLUMNS,
FLOORS, AND ROOF■ BUT IT ALSO CONTAINS PARTS
OF THE PLUMBING SYSTEM AND OTHER RESOURCE
SYSTEMS LIKE THOSE FOR ELECTRICITY, TELEVISION,
AND TELEPHONE, AS WELL AS WATER AND GAS■

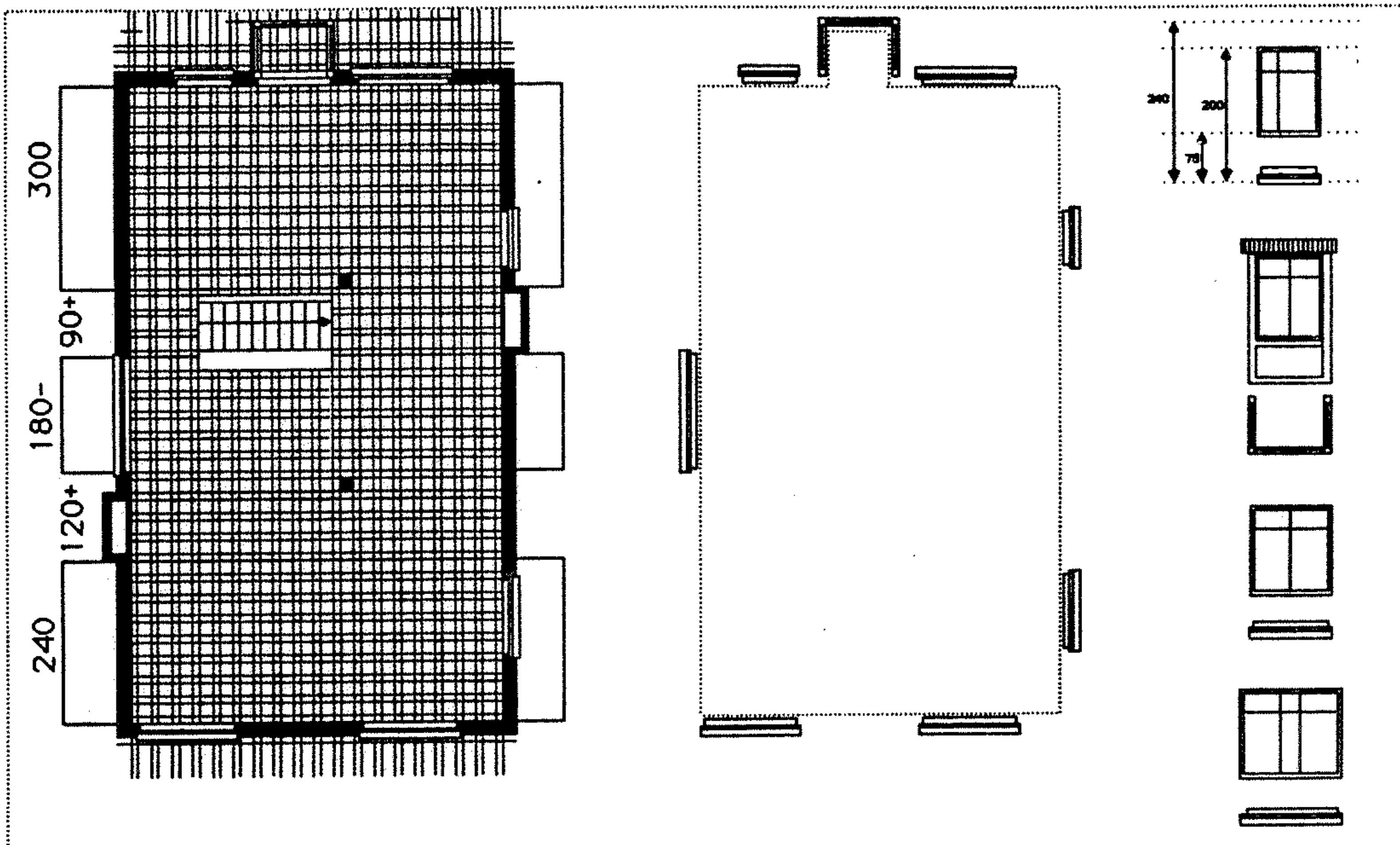
SHELL
INFILL
HOUSE
5



WITH THE SAME OPENING IN
THE FLOOR DIFFERENT STAIRS
CAN BE MADE■
FOR EACH STAIR
DIFFERENT PARTS
OF THE FLOOR
CAN BE CLOSED■

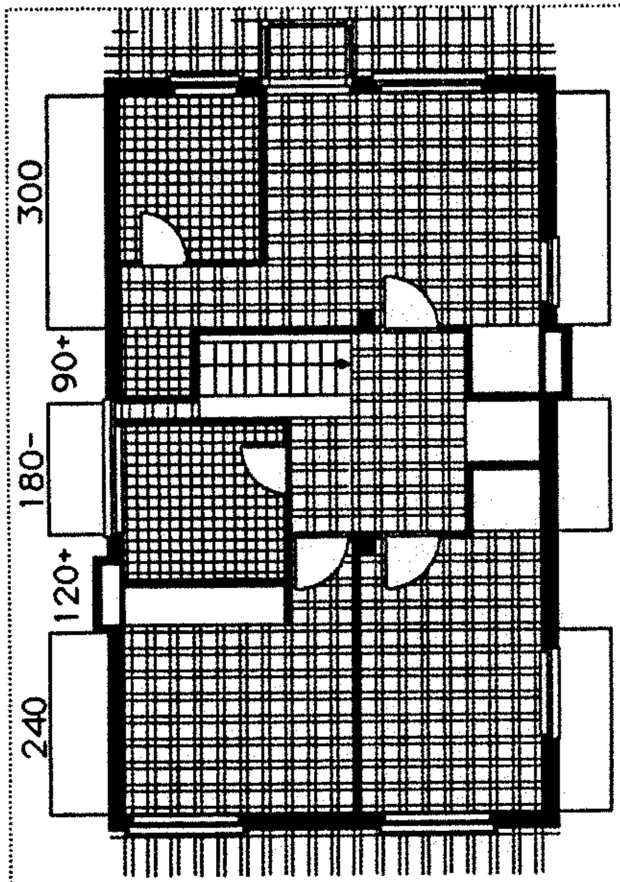
SHELL
INFILL
HOUSE
6

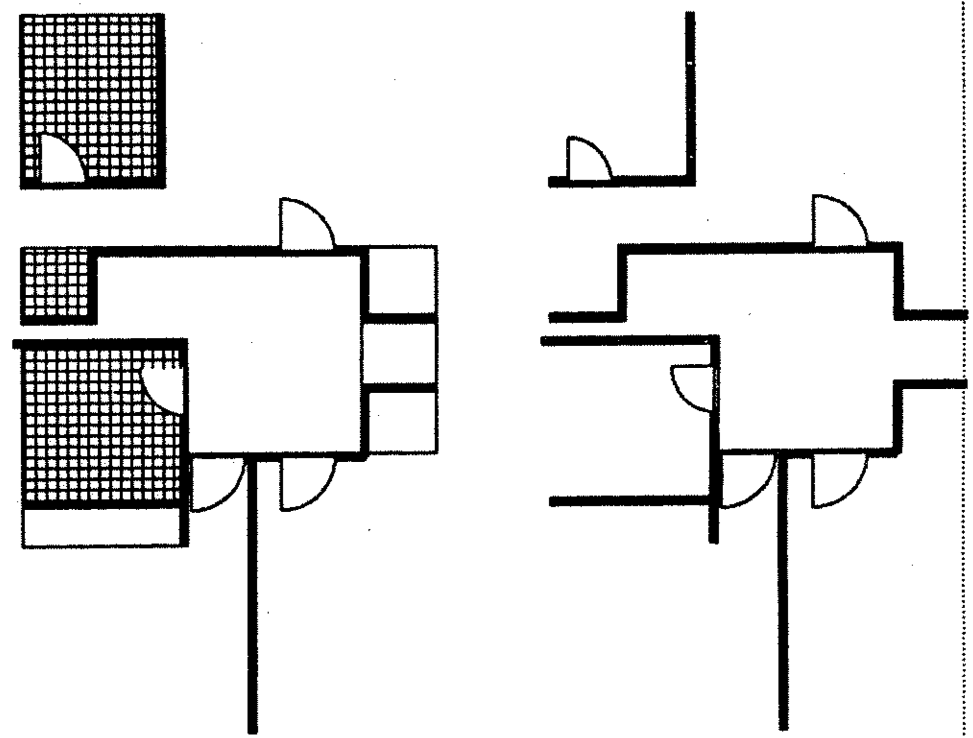



THE WINDOWS, DOORS AND OTHER FACADE ELEMENTS ARE BROUGHT IN■ WHILE THE OPENINGS IN THE SUPPORT STRUCTURE ARE FIXED THE WINDOWS CAN BE DETACHABLE AND BECOME PART OF THE INFILL SYSTEM TO BE CHOSEN WHEN THE FLOORPLAN IS KNOWN■

THE ALTERNATIVE IS TO DETERMINE THE WINDOWS BEFORE THE FLOOR PLAN■ AN INTERMEDIATE SOLUTION ALLOWS FOR PARTIAL CHANGE OF WINDOW PANELS OR MULLIONS WITHIN A FIXED WINDOW FRAME■

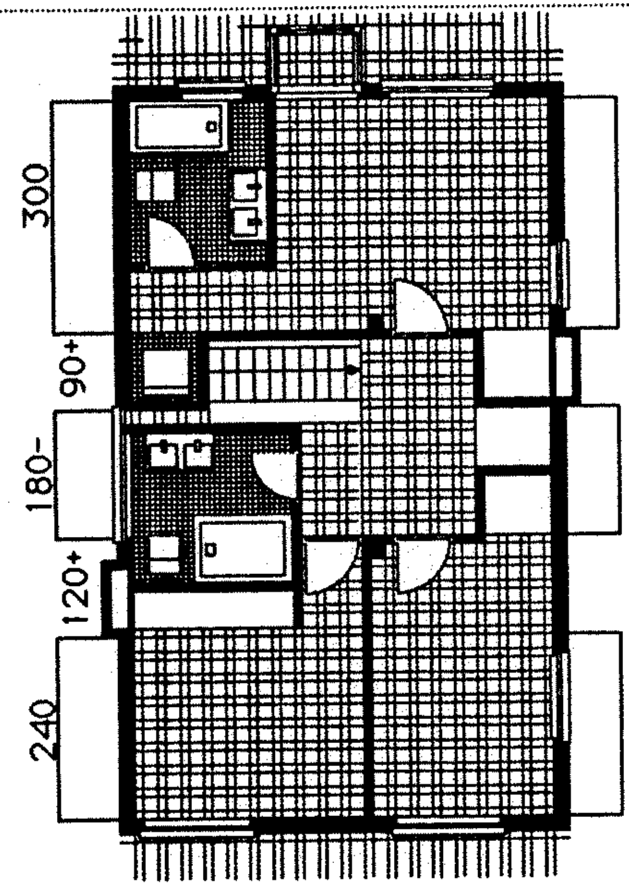
SHELL INFILL HOUSE 7

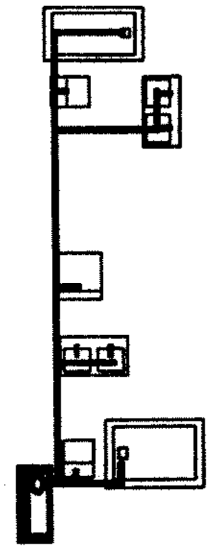


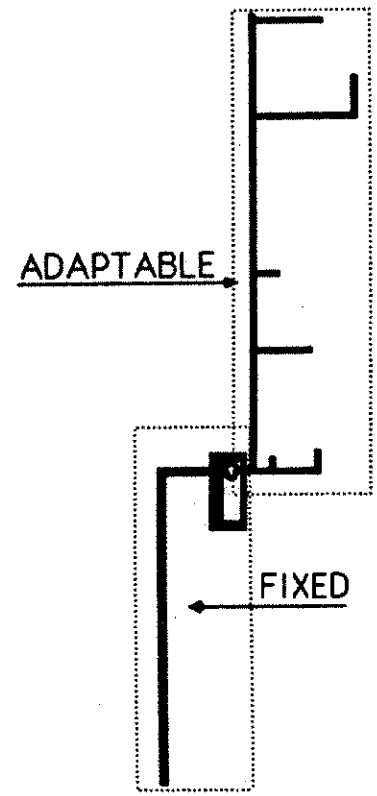



SHELL INFILL HOUSE 8

THE SYSTEM OF INFILL WALLS■ TO THIS SYSTEM ARE ADDED THE FLOOR FINISHES LIKE THE TILES IN THE BATHROOMS■ ALSO, CUPBOARDS AND OTHER STORAGE SPACES ARE ADDED AS A SEPARATE SYSTEM■ IN THIS EXAMPLE THE WINDOWS ARE ALREADY PLACED. MODIFICATIONS OF SOME WINDOWPANELS MAY BE NEEDED TO ADJUST TO THE INFILL, LIKE IN THE WINDOW SERVING BOTH BATHROOM AND STAIRWELL■

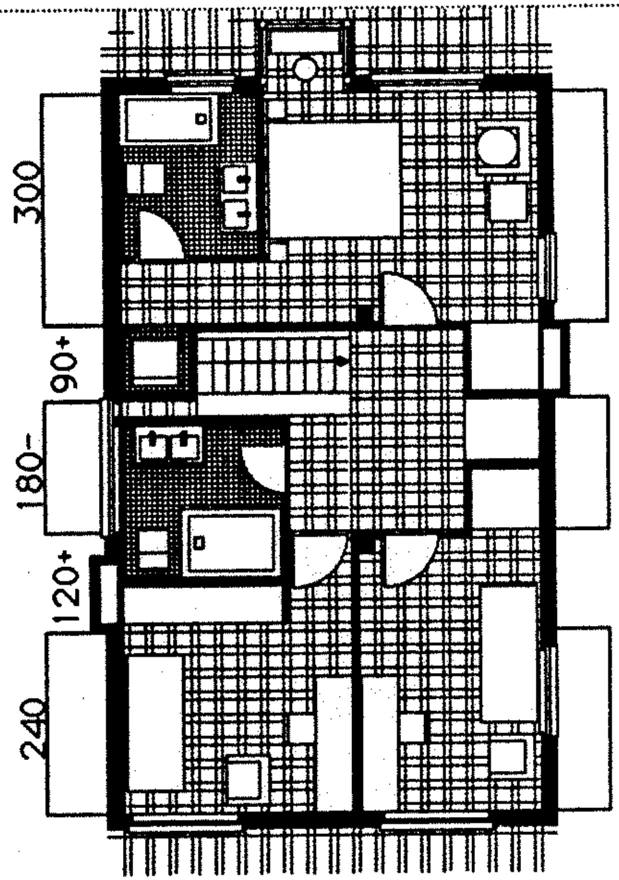


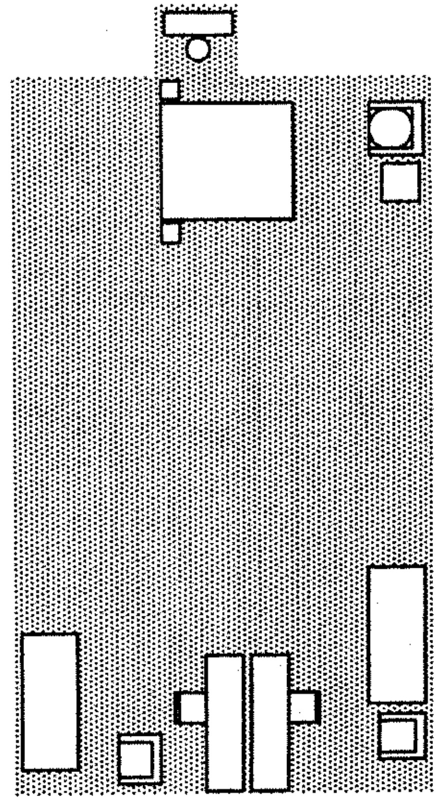






THE SANITARY EQUIPMENT
IS ADDED■ IT IS CONNECTED
TO THE PLUMBING SYSTEM■
THE EQUIPMENT IS ADAPTABLE■
THE PLUMBING IS PARTLY ADAPTABLE
AND PARTLY FIXED WITH THE SHELL■

SHELL
INFILL
HOUSE
9

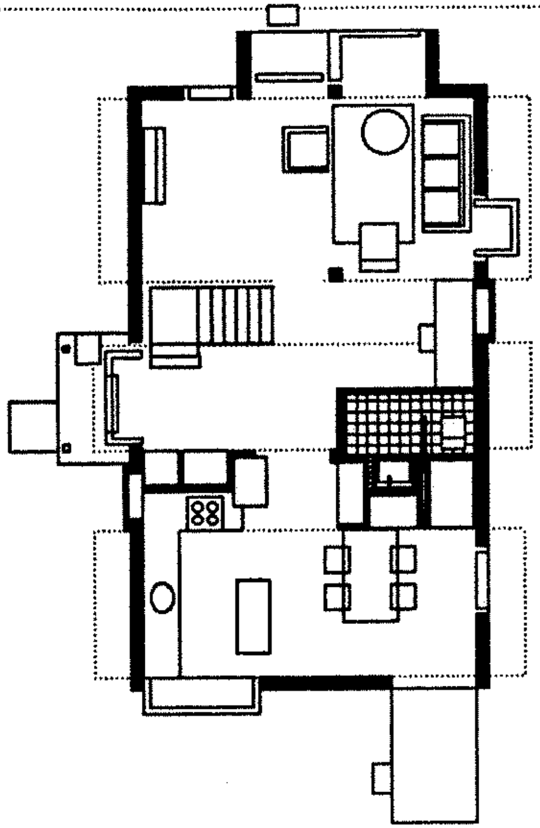


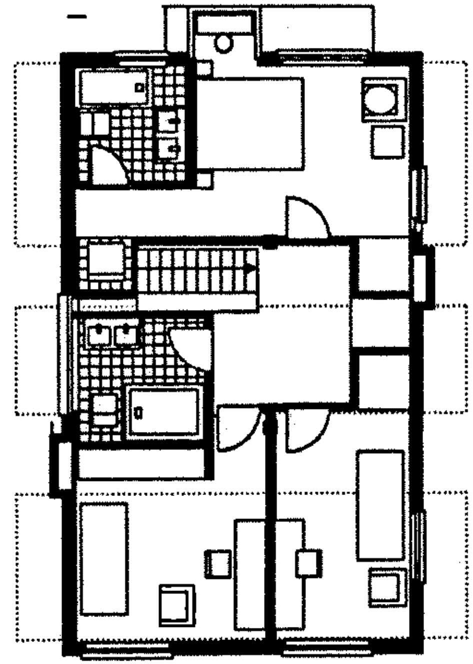



SHELL
INFILL
HOUSE
10

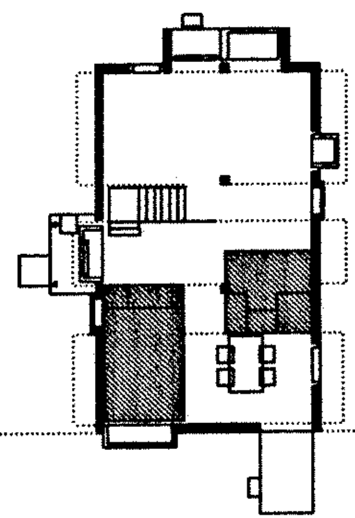
FURNITURE
IS THE
LAST
SYSTEM
TO BE
ADDED

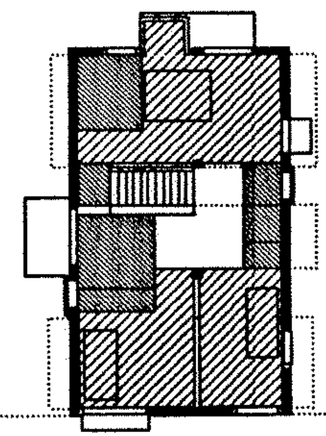
JAPAN 5.1F

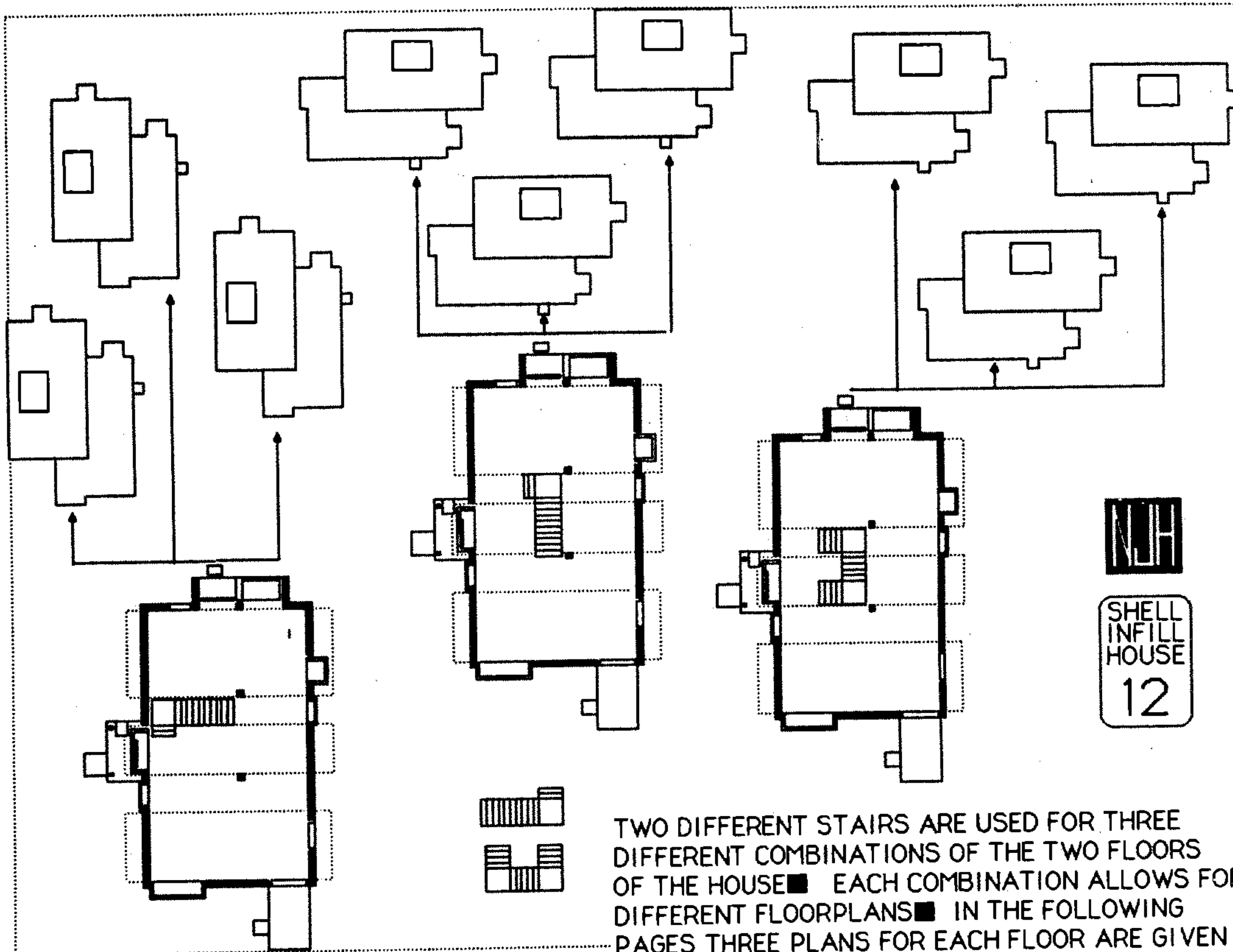




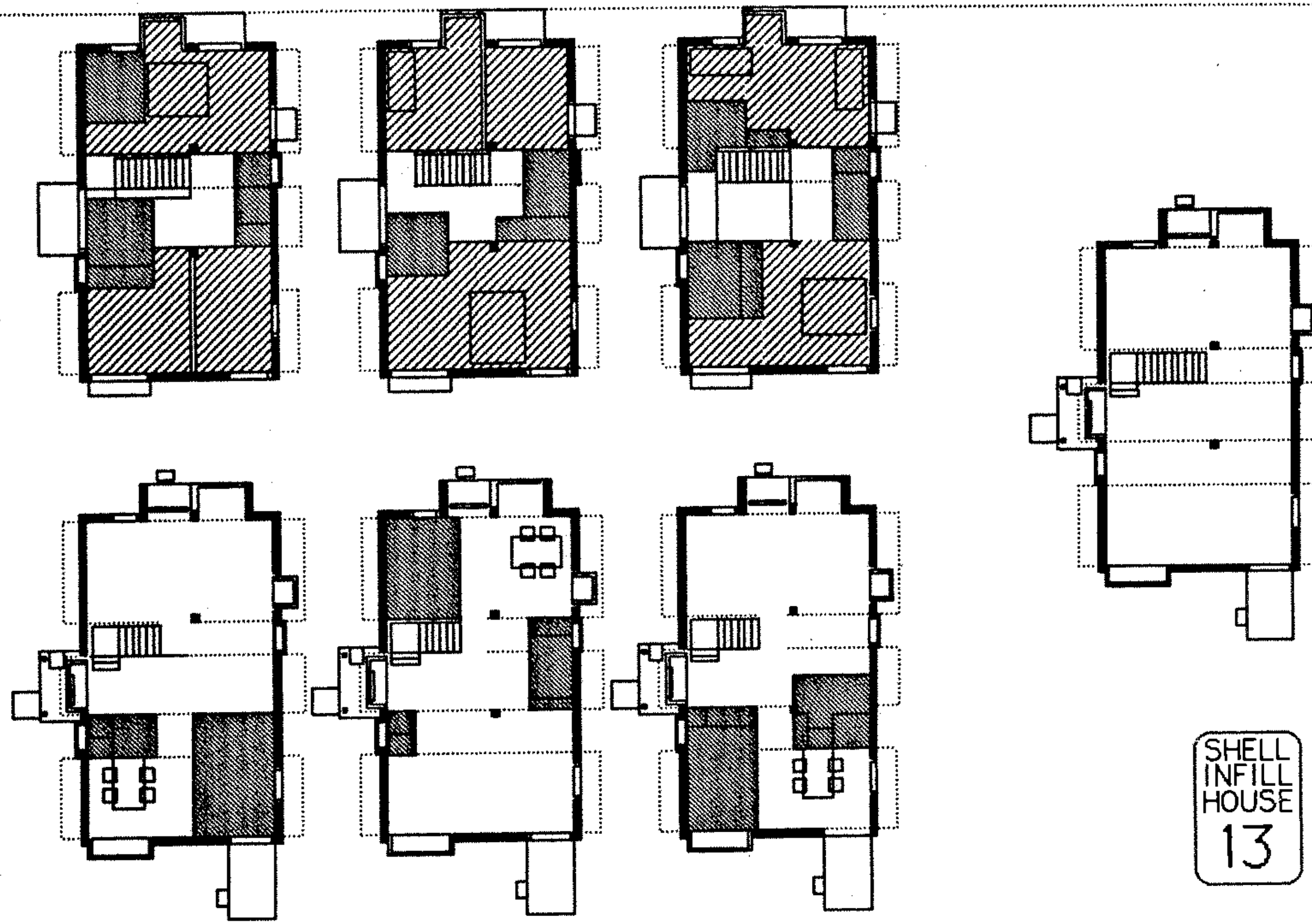
AN EXAMPLE OF TWO FLOOR PLANS THAT TOGETHER MAKE A HOUSE■
IN THE FOLLOWING PAGES WE WILL SYSTEMATICALLY DEVELOP A SET OF EIGHTEEN PLANS USING THE HIERARCHY OF SUBSYSTEMS■
THE PLANS WILL BE GIVEN IN A SIMPLIFIED FORM AS SHOWN BELOW■



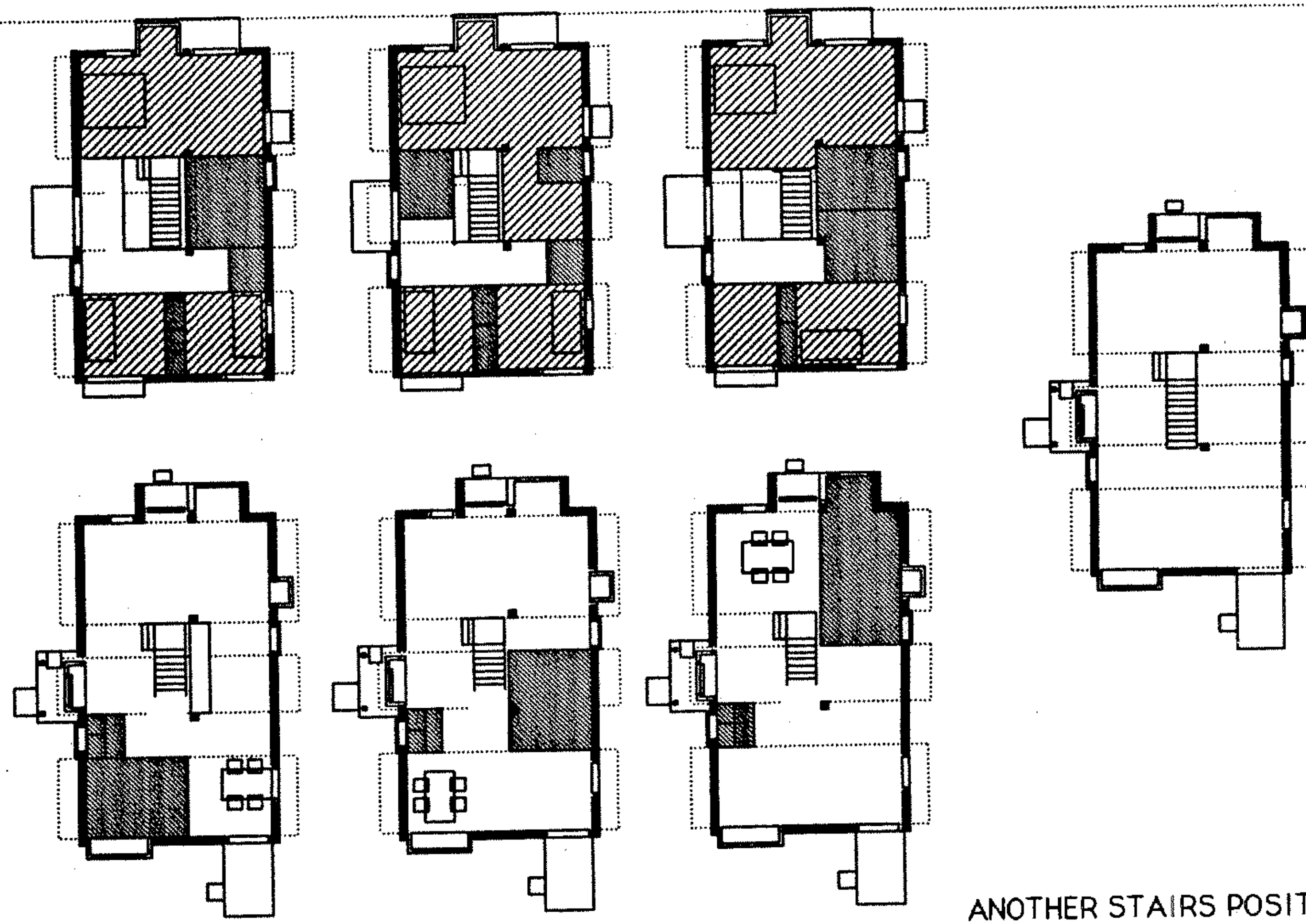





TWO DIFFERENT STAIRS ARE USED FOR THREE DIFFERENT COMBINATIONS OF THE TWO FLOORS OF THE HOUSE■ EACH COMBINATION ALLOWS FOR DIFFERENT FLOORPLANS■ IN THE FOLLOWING PAGES THREE PLANS FOR EACH FLOOR ARE GIVEN FOR EACH COMBINATION, A TOTAL OF EIGHTEEN PLOORPLANS YIELDING TWENTYSEVEN POSSIBLE COMBINATIONS■




FOR THE SAME STAIRS POSITION
THREE GROUND FLOOR PLANS
ARE GIVEN AND THREE PLANS
FOR THE SECOND FLOOR■
EACH FIRST FLOOR PLAN CAN BE
COMBINED WITH EACH SECOND
FLOOR PLAN■

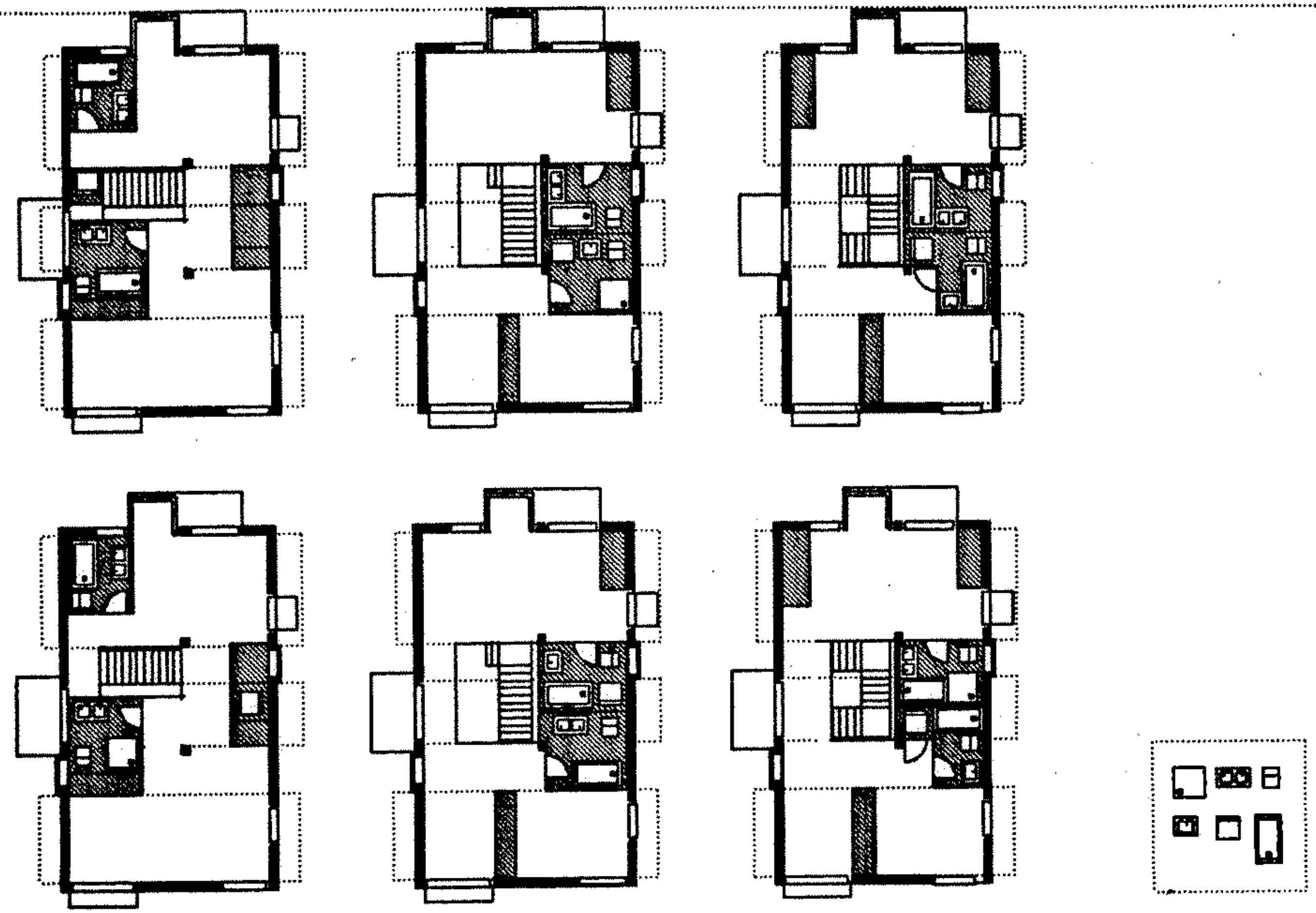


ANOTHER STAIRS POSITION
YIELDS SIX MORE PLANS;
THREE ON EACH FLOOR■

SHELL
INFILL
HOUSE
14

A THIRD STAIRS POSITION
AND AGAIN THREE PLANS ON
EACH FLOOR■

SHELL
INFILL
HOUSE
15

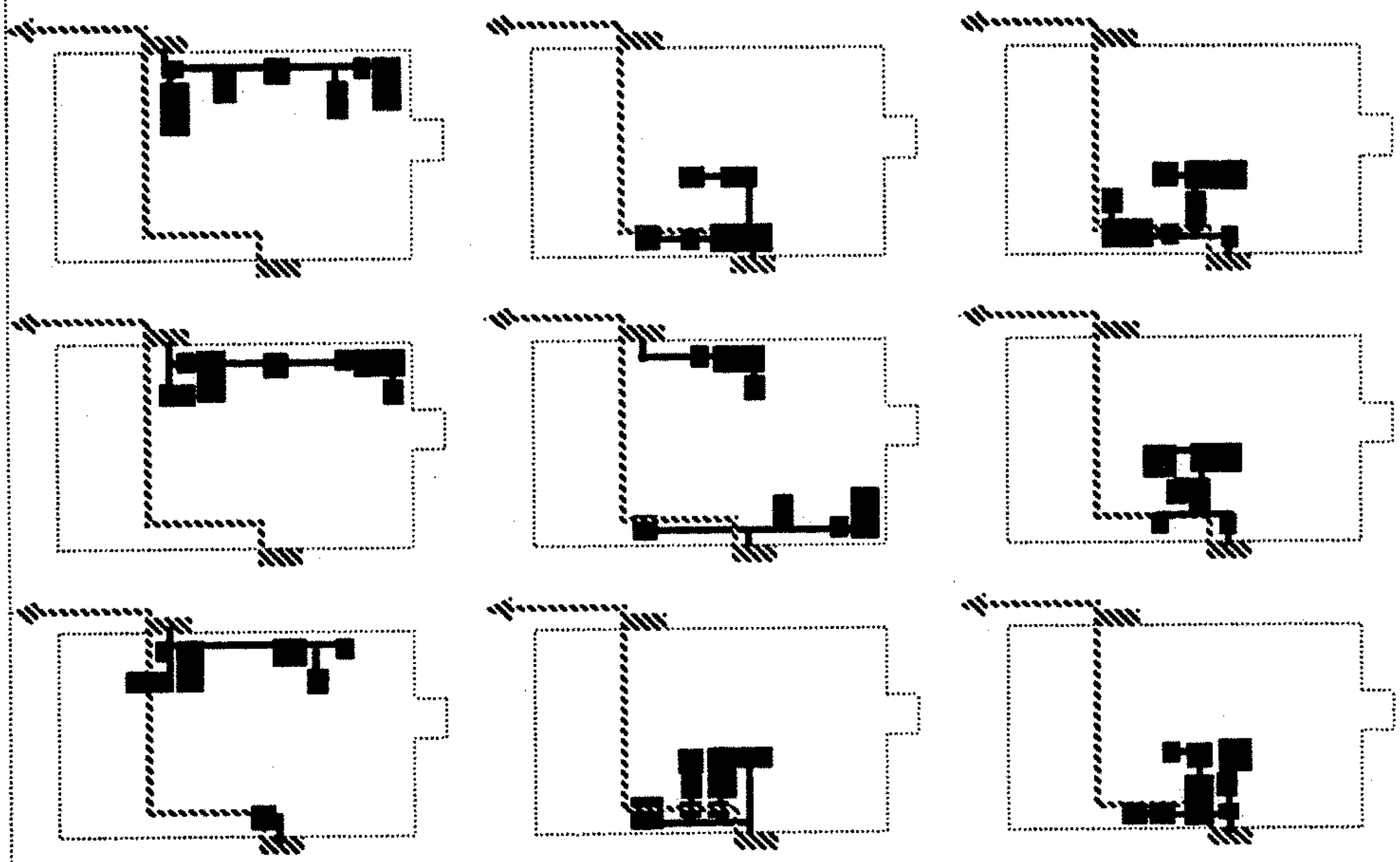


BATHROOM AND KITCHEN EQUIPMENT CAN BE ARRANGED IN DIFFERENT WAYS ONCE THE ROOMS HAVE BEEN LAYD OUT■ HERE ARE THREE SECOND FLOOR PLANS CORRESPONDING TO THE THREE STAIRS POSITIONS GIVEN EARLIER■ EACH PLAN HAS TWO ALTERNATIVE ARRANGEMENTS FOR THE BATHROOM EQUIPMENT■

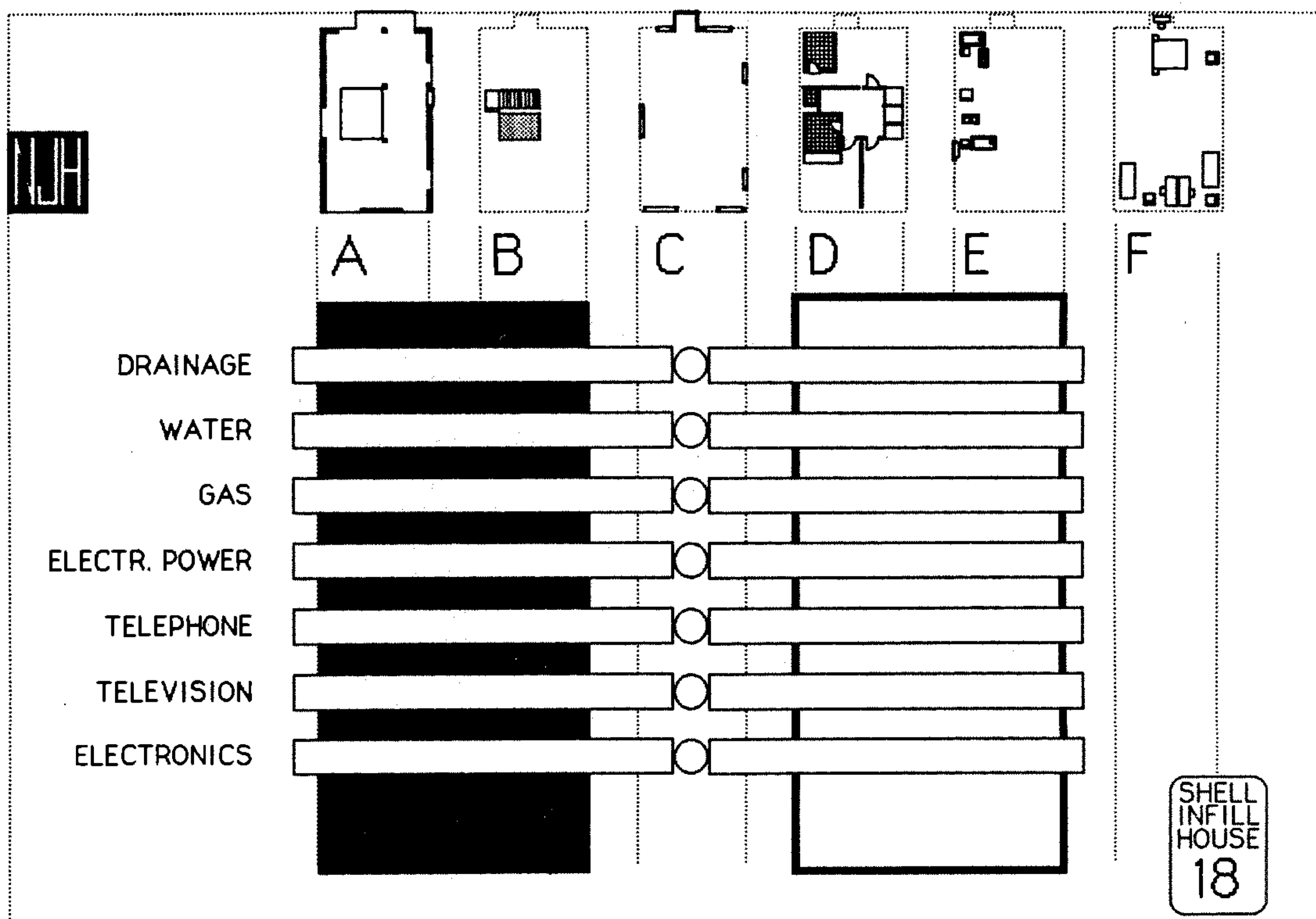
NJH

SHELL
INFILL
HOUSE
16

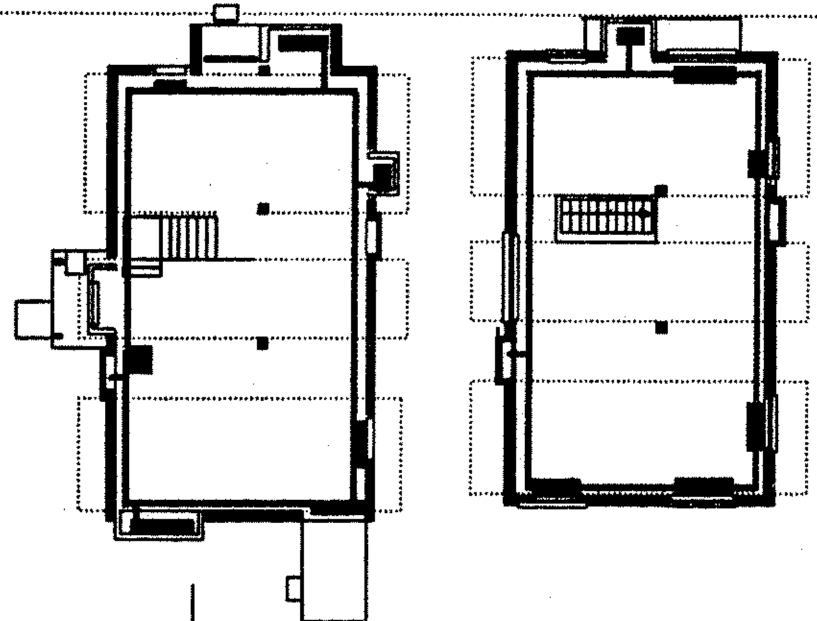
SHELL
INFILL
HOUSE
17



THE DRAINAGE SYSTEM AS IT IS CONNECTED TO THE BATHROOM EQUIPMENT BELONGS PARTLY TO THE SHELL AND PARTLY TO THE INFILL LIKE ALL RESOURCE SYSTEMS■ THE NINE VARIANTS SHOW HOW THE INFILL IS ALWAYS DIFFERENT WHILE THE SHELL PART (AS SHOWN TO THE RIGHT) REMAINS THE SAME■

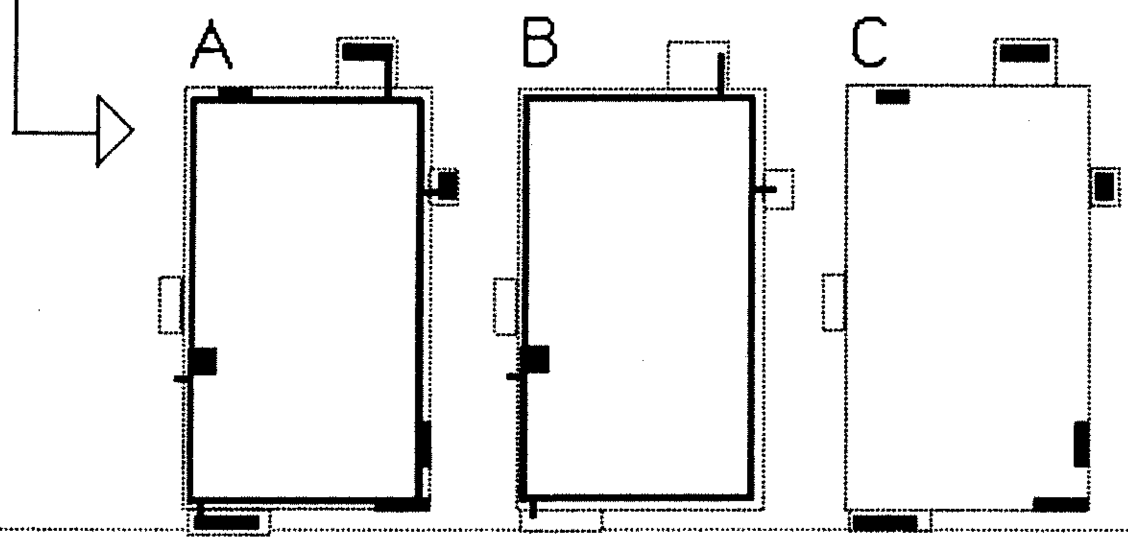



PUTTING ASIDE THE FACADE ELEMENTS AND THE FURNITURE WE CAN DISTINGUISH TWO COMPOSITE SYSTEMS: THE HOUSE SHELL INCLUDING THE STAIRS, AND THE INFILL WALLS INCLUDING SURFACE FINISHES AND STORAGE■ EACH RESOURCE SYSTEM
HAS A PERMANENT PART CONNECTED TO THE SHELL AND A ADAPTABLE PART CONNECTED TO THE INFILL■

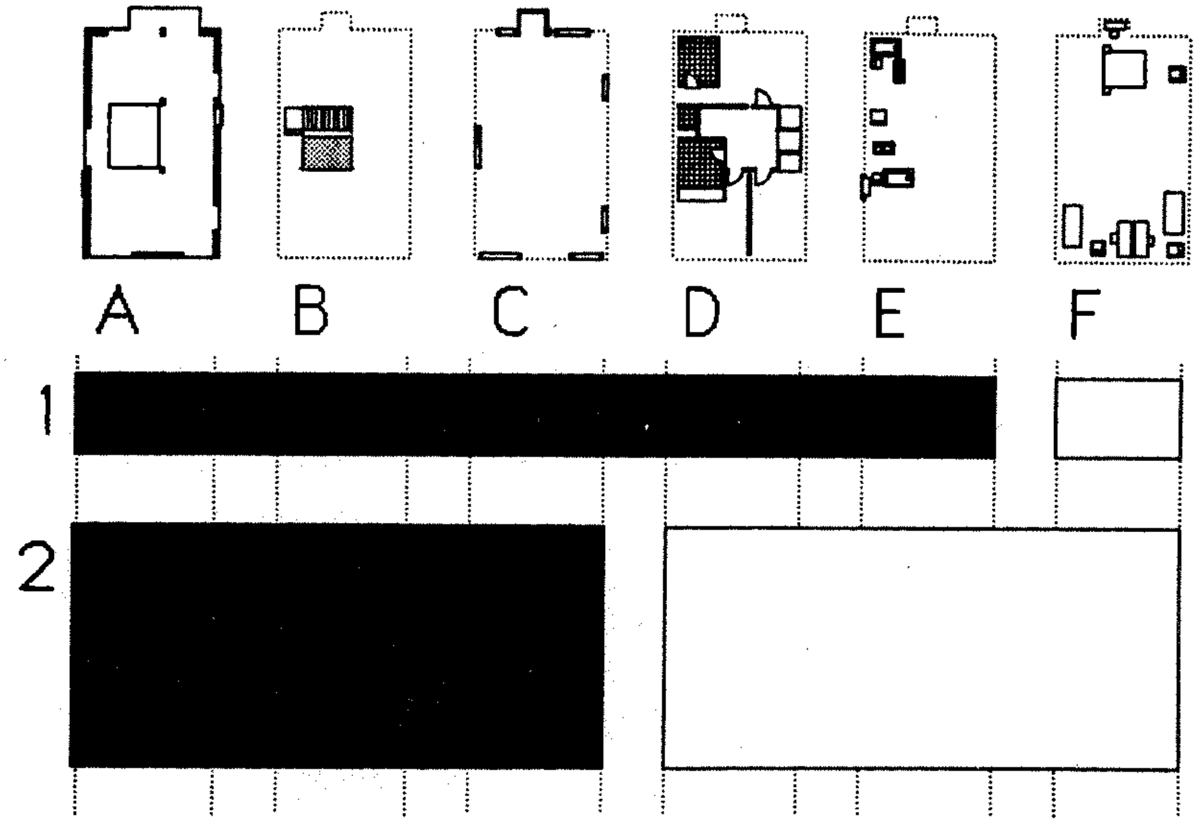


FOR THE EXAMPLES OF THIS STUDY THE DISTRIBUTION OF THE HEATING SYSTEM CAN BE PART OF THE SHELL BECAUSE THE WINDOW OPENINGS ARE FIXED■ THE HEATING UNIT ITSELF IS ON A FIXED PLACE NEXT TO THE ENTRANCE■

BUT OFTEN THE WHOLE SYSTEM AS SKETCHED BELOW (A), CAN BE COMPOSED OF A PERMANENT PART (B) THAT GOES WITH THE SHELL, AND A ADAPTABLE PART (C) THAT CAN ADJUST TO THE INFILL (C)■

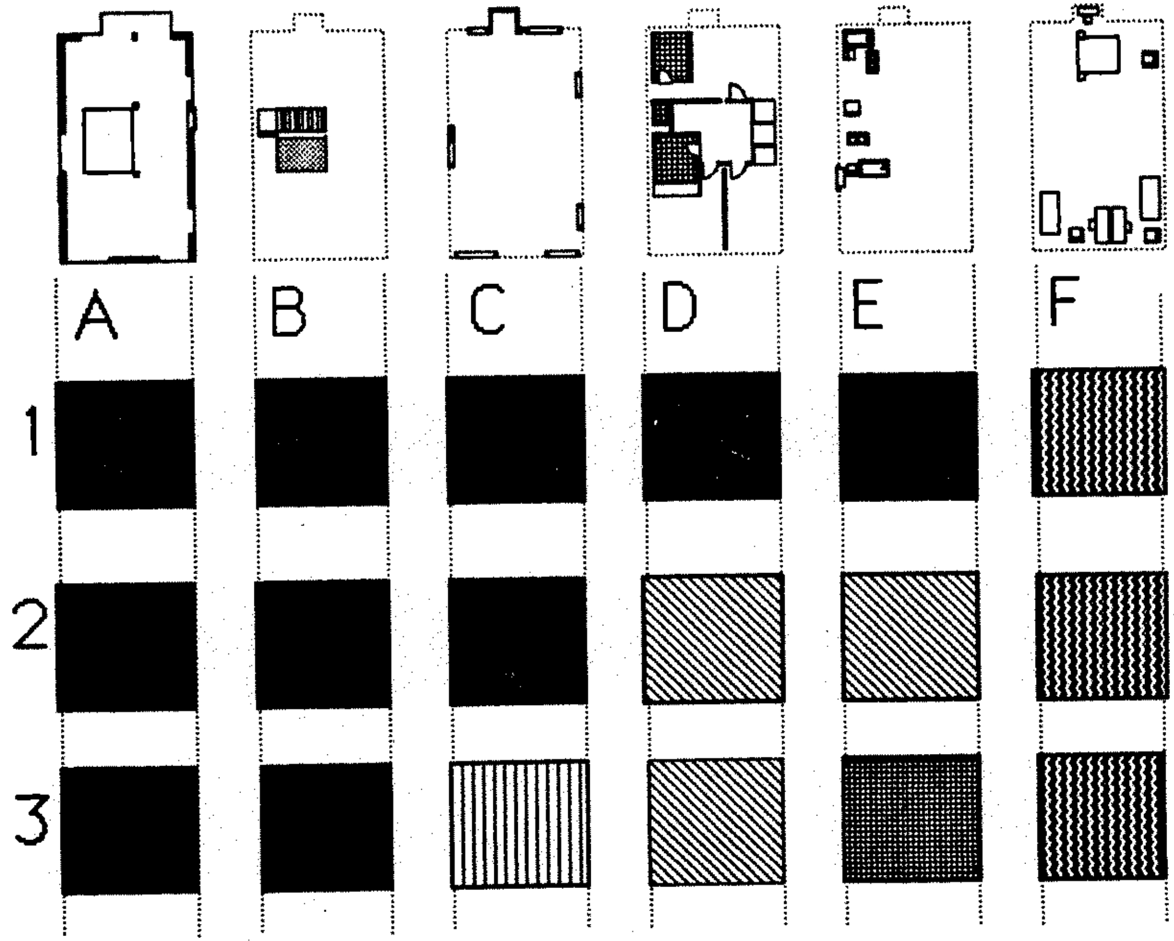



SHELL INFILL HOUSE 19




THE SUBSYSTEMS WE HAVE DISCUSSED SO FAR MAKE FOR A VARIETY OF PLANS THAT CAN BE PRODUCED AND DESIGNED EFFICIENTLY■ BUT THIS SYSTEMATIC WAY OF WORKING ALSO MAKES FUTURE ADAPTATION TO USER PREFERENCES EASIER TO ACHIEVE■

IN TODAY'S TECHNOLOGY IT IS ONLY THE FURNITURE THAT IS EASILY ADAPTABLE TO USER NEEDS■ ALL OTHER SUBSYSTEMS, ONCE INSTALLED, ARE DIFFICULT TO CHANGE OR TO SEPARATE. (1)■ THE SHELL-INFILL APPROACH SEEKS TO MAKE THE SUBSYSTEMS D AND E MUCH MORE ADAPTABLE INCLUDING THE RESOURCE SYSTEMS THAT ARE CONNECTED TO IT■ THIS INFILL CAN BE DISTINGUISHED FROM THE SYSTEMS A, B, AND C THAT MAKE THE MORE PERMANENT SHELL (2)■




THE SUBSYSTEMS THAT MAKE ONE HOUSE CAN BE PRODUCED BY DIFFERENT COMPANIES■ DIAGRAM 1 GIVES THE NORMAL SITUATION WHERE ONE COMPANY OFFERS THE WHOLE HOUSE TO THE CUSTOMER EXCEPT FOR THE FURNITURE■ NO.2 SUGGESTS HOW THE BUYER CAN FIND A SHELL WITH ONE COMPANY AND A INFILL SYSTEM WITH ANOTHER■ CASE NO.3 GIVES A SITUATION WHERE A LOCAL BUILDER PUTS TOGETHER A HOUSE WITH PRODUCTS FROM DIFFERENT COMPANIES■

NJH

SHELL INFILL HOUSE

# THE USES OF LEVELS

N.JOHN HABRAKEN

# THE USES OF LEVELS

## Keynote Address
## Unesco Regional Seminar
## on
## Shelter for the Homeless
## Seoul 1988

N. John Habraken
Professor of Architecture
Massachusetts Institute
of Technology.

**Introduction.**

An international meeting of professionals offers a good opportunity to ask ourselves where we stand in relation to the complex problem called housing. One can have different opinions about the question when housing as we understand it today - as a professional occupation- really began. Some may argue that it was with the passing of the first housing laws in Europe at the turn of the century. Others feel that the system only came into its own in the thirties or even only after the second world war. But it is safe to say that we can look back at at least a half century of professional effort on behalf of those in need of better shelter.

Against that background I would like to pose two questions:

First: what have we learned, in that period, about human settlement; what knowledge have we gained by research and experience that we did not have fifty years ago?

Second: How did we adapt our ways of working, our methods, to the new knowledge acquired?

If you ask me to answer these questions in a few words my response to question one would be: "very much; we now know much more about all aspects of human settlement. Compared to what we know now, the generations before the second world war seem ignorant."

But my response to question two would be: "poorly, our ways of working have responded inadequately to the new knowledge we gained. Our methods are still based on those first applied half a century ago."

Our major problem today as professionals - architects and planners, developers and engineers, involved in housing- is exactly this serious discrepancy between what we know and what we actually can handle. Like all other professions we must develop new skills and methods to meet the challenges of our times.

In my talk today I would like to discuss this gap between knowledge and capability in some depth. I also want to present to you a way of looking at the built environment, a model if you like, that may help us to bridge it.

Today we need a fresh look at what we are doing. In conferences on housing, like the one we are having here, it is customary to point out how complex the problem of housing is: how many actors are involved and how many aspects are of importance to it. We also tend to remind ourselves of the magnitude of the problem: how many millions of people are in need of better shelter. It is easy to believe the task is really too large and too complex and that therefore the results will always fall short of our expectations. We try hard, but the problem is very difficult. We all would like to contribute to the well-being of mankind. We dream of a better world. But our work falls short of our expectations: there is so much more to be desired.

In a situation like that it is often useful to step back a while and reconsider the premises from where we operate. I want to argue that our vision of the built environment is outdated and show you a new model which is presently emerging among us: a model that fits better the more sophisticated knowledge we have gained over time. This new model is the major subject of my talk.

**Things we have learned.**

I have composed a short list of things we have learned about the built environment and human settlement. Things that our view of the built environment must respond to if we want to act effectively. Things that today are important to keep in mind.

My list is not complete and I am sure you could add to it. You may also feel that some things are less important than others. However, I am confident that most of us will agree that the items of my list should belong on our housing agenda and that we must be able to incorporate them in our ways of working. Here we go:

1) Housing is only partially a matter of production of buildings. We have learned that in housing the issue is not just to provide a roof over people's heads but to create conditions that will, eventually, give everybody a decent house. In other words: the issue is not production of houses but the cultivation of a process. As you know, the World Bank has gone so far as not to give money any more for building projects, but only for training and organization to improve the housing process itself.

(the old model said: The primary goal is to give shelter, build as many units as you can, there is no time to waste, the need is to large. Mass production and industrialization of housing are most important.)

2) The job is not just professional. To produce cars it is best to hire the best engineers, managers, and marketing people: a professional crew. In housing this is not enough. Professionals are important and, indeed, indispensable, but they must work together with users, user groups, and those who represent them: the politicians and other elected officials. I leave aside here the very important role of bureaucracy which probably must be seen as a class apart, neither professional, nor user.

( In the old model housing was seen as a professional job: The experts had to make all decisions. The engineers and designers had to provide shelter for the masses in the most efficient and scientific way possible. User needs had to be studied but users could not be involved in the process.)

3) Change over time is important. The recognition that things change over time and must improve over time is perhaps the single most important new aspect introduced in our thinking about housing.

Housing projects and neighborhoods must grow and develop over time. There is no such thing as a instant environment. What is good today is insufficient tomorrow. Many housing projects that were built in Europe in the fifties , and were considered examples for other countries to follow, are now obsolete. They lack the amenities - central heating the kitchen and bathroom equipment - that people now expect but were not available twenty five years ago. Being built in concrete these projects are extremely expensive to be renovated or to be demolished.

(In the old model the dimension of time was not considered: "We must design the best possible houses for the people. We must design the house for the future, for the better world of tomorrow....now!")

4) Uniformity is not efficient. Uniform floorplans and uniform buildings do not guarantee industrialized building methods. On the other hand, truly industrial methods make different solutions possible. Hence there need not be a contradiction between variety and industrial production. Indeed we have now learned that the emphasis on uniform floorplans has slowed down the development of truly industrialized systems.

(In the traditional model it was believed uniformity ensured efficiency and industrialization. This is perhaps the most tenacious misunderstanding in housing and I suspect some of you may challenge my denial of this principle. I will say more about it later on.)

5) Users have different values and different needs. It is impossible to find a solution that fits everybody. A house is a personal thing and must adapt to the user. People like to share the same type of dwellings and to conform to certain lifestyles. But within that common context they want to identify themselves as different from their neighbors. The functional needs of households differ too. Individual preferences are very important and can only be taken care of on a individual basis.

(The traditional mass housing model needs the uniform floorplan and therefore can not recognize individual differences. It seeks the ideal prototype to be designed on the basis of scientific user needs surveys.)

6) local lifestyles and typology are important. Cultural values for each country and each region are important.

People want to connect to their heritage. Of course they also want modern amenities and they want to be respected in a international perspective. But these two demands must both be met.

(The old model believed in a international style and never considered different cultural values in the world.)

7) Housing projects must fit into their urban context and connect to existing urban fabrics. Context is important and can no longer be ignored.

(The generation of the modernist movement hated the existing cities and did not believe anything could be learned from them. The example was Le Corbusier's Plan Voisin.)

**The new model.**

I do not believe anything on my list is really new to you. We are all familiar with the issues raised. But to most of us the list will look unrealistic as a agenda for action. How can all these things be achieved efficiently and effectively? Of course we know that many parties, including users, are involved in the housing process. But how to organize it? Of course variety would be better than uniformity but how can you control a process with so much variety? Of course it would be good if individual user needs could be met but how can this be achieved? And so on, and so on.....

These are understandable doubts, but I suggest that they illustrate exactly the dilemma we are in. As long as we follow the ways of thinking and working we have inherited from the past we will only see problems: things remain problematic.

Therefore we need a new model in which the new agenda will fit more easily. I would like to describe to you a way of seeing the built environment in which the new issues fall into place more naturally. This new model relates to the work of many among us who have seriously tried to renew the housing process. It is currently the subject of discussion and study of a small but growing group of practitioners. It is based on a single, central concept: the idea of 'levels' in the built environment. This concept I would like to explain first. Of course, having a new model will not solve instantly all the problems we may have. But I believe it gives us a direction we must follow to be more successful.

I will first talk about the concept of levels and the model based on it. Next I will refer to work already done in practice to illustrate the new approach described by the model.

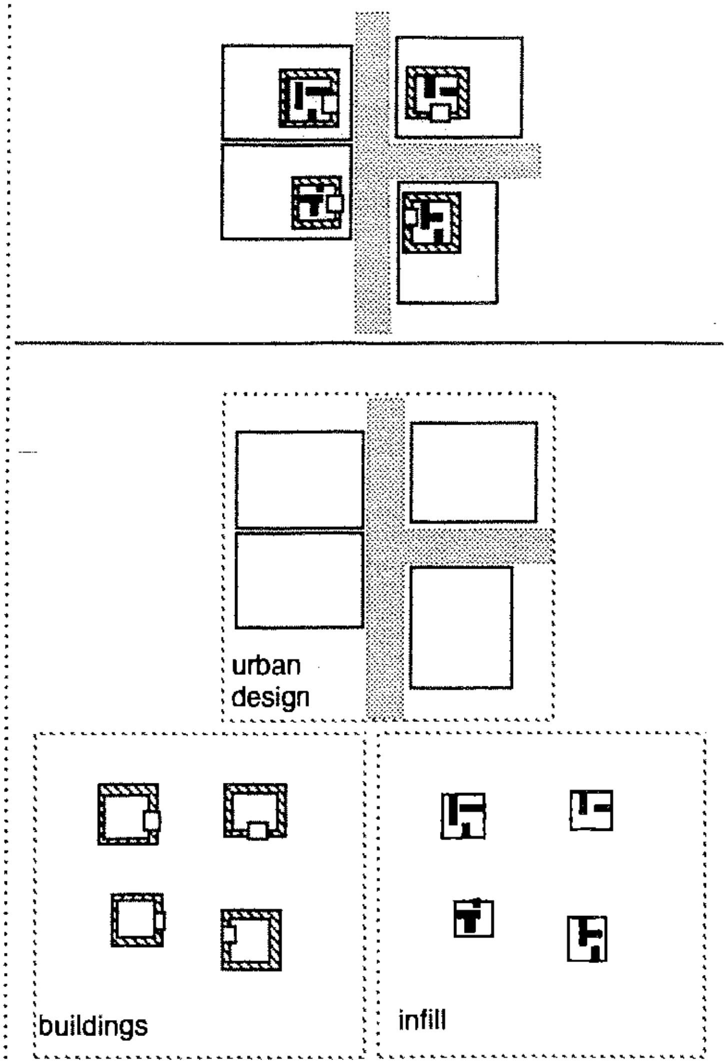



fig.1 three levels in the built environment.

**Levels.**

The concept of 'levels' is not really new. We already say, for instance, that the urban designer 'operates on another level' than the architect. (Fig.1) What does this mean? Apparently we understand the built environment to be divided in two groups of things. Those that are decided about by the urban designer and those that are the concern of the architect.

To understand the distinction better we must ask ourselves what happens when things change on one level or another. The architect designs a building within the context designed by the urban designer. He must respect, for instance, the layout of streets and the division of lots in the block. But within that context he is free to act. He can change the design of his building in many ways. Indeed, different architects can build different buildings in different places but will share the same street network designed by the urban designer. Although the urban design constraints their work they are free within those constraints to do their own thing.

However, when the street network must be changed the design of the buildings has to be adjusted. The urban designer can not act without affecting the designs of the architect.

The relation, therefore, is asymmetrical. Change on the level of the building does not affect the higher level of the urban design, but change in the urban design affects the lower level of the buildings.

All this is in accordance with our everyday experience. People who own houses know they can change their houses, even tear them down to replace them with new buildings, without affecting the street layout of the neighborhood they live in. But when the street layout would be changed and the municipality would decide to cut a new street or to widen a existing one, or to rearrange a street's location, inevitably adjustments must be made on the lower level.

Apparently the distinction that is made here is independent of the parties involved. We may talk about architects designing buildings and urban designers designing street patterns, or we may talk about home owners owning buildings and the municipality maintaining the public streets; in both cases we make the same distinction in the physical world between those parts that belong to one level (the streets) and other parts belonging to a lower level (the buildings). This distinction is so natural that its implications are understood by everybody.

Thus it seems that the built environment is organized in levels and if we look further we will find more of them. For instance we talk about urban infrastructures like highways and railroads and we understand them to be of a higher level than the streets of the neighborhood. Here again the same relationship holds. When a major traffic artery has to be cut in a existing neighborhood network the lower level of local streets must adjust. But within the given structure of highways we can change the pattern of local streets without affecting the higher level traffic pattern.

This hierarchical organization of the built environment also extends downwards. We find in many buildings how the inner partitioning can be changed without affecting the basic building structure or its shape. This we see in office buildings but also in many residential building types. Apparently we can distinguish 'infill elements' - like partition walls, but also kitchen and bathroom equipment - operating on a lower level in the built environment relative to the building. (fig.2) The same relationship as we found between buildings and local streets is found here. We can remodel the building and change the distribution of partitioning and equipment without changing the larger building structure or its external shape. But when we begin to change parts of the building and tear down load bearing walls or extend a facade to get more room inside, we expect adjustments in the infill.

( A matter of terminology comes up here. It can be argued that what we call a 'building' includes the infill as much as the load bearing structure, facades and roof. Therefore a new term must be coined for what is left when the infill is taken out. This is called 'support'. In this way we can say that a building is comprised of two levels: the support level and the infill level. In this paper I will use both the terms 'building' and 'support' for the same level.)

Once we see the concept of levels operating in the built environment we discover the same hierarchical relation in many places. So far we have been looking at environmental forms but within their technical systems we find the same subdivision in levels. Take, for instance, the window in the facade. We can replace it with another window of a different make or design but use the same opening in the facade made for the original window. In that case we do not have to change the facade wall. When we decide to change the facade wall, however, and make a different window opening, the window itself, obviously, must adjust.

In all conduit systems we find similar hierarchical organizations. (Fig.3) In the example of buildings and streets given above, the sewage system follows levels too: there is the system in the house and there is the sewage main running in the public street. On a still higher level there will be the collector system of the city.

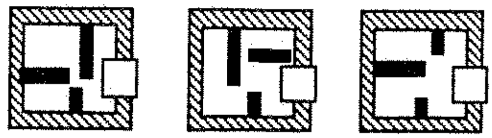


fig.2 two level organisation;
building with infil variations

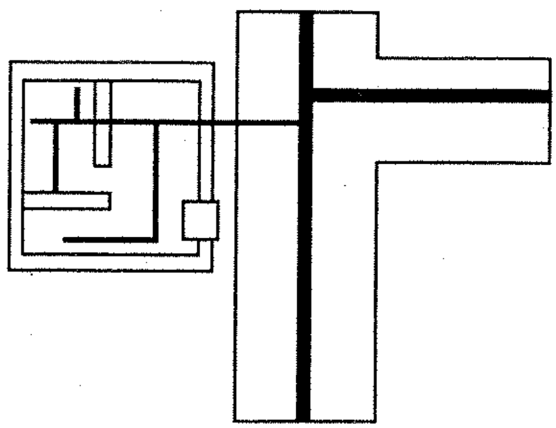


fig.3 Two level conduit organisiation

**Model.**

We have here a general principle of spatial organization that is actually operating in the built environment and we all understand it intuitively. Those who study this phenomenon believe that we can learn from it how to create and maintain complex environmental systems. I want to show you how the concept can describe things we do in practice. But to do so we must first make a more formal representation. Figure 4 shows a very simple model of five levels. The terminology may be familiar with exception, perhaps, of the word 'tissue'. The so called 'urban tissue' is the

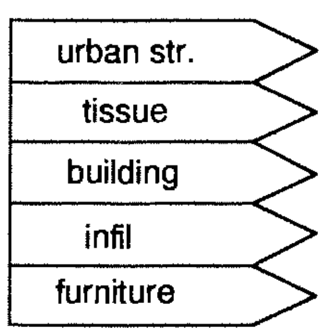



fig.4. a simple five level model

level of the streets and related urban elements on the scale of the neighborhood, most directly related to the building, The term is introduced to make a distinction with the 'urban structure' of major roads and other infrastructures of the city. Of course alternative terminology can be proposed, but the example of five levels will suffice to illustrate the uses of the concept.

The five levels identified here are actual physical systems. We talk about walls, roads, and other physical parts. These physical systems are what we put in place when we build. They must be distinguished from the more territorial concepts we also use in design, concepts like: 'room', 'dwelling', and 'neighborhood'. The relationship between these two hierarchies is given in figure 5. What we call a 'dwelling' can be seen as the juxtaposition of building and infill, whereas the neighborhood becomes a combination of the physical levels of building and tissue.

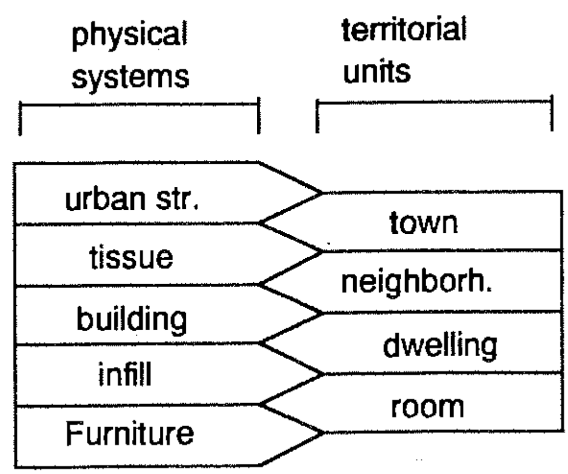



fig.5. The five level model of physical sytems related to a territorial hierarchy.

Territorial structure is an important subject in our modelling of the built environment, but will not be discussed further here. We will use the five levels of physical systems to look at various examples of real life projects to see how the different parties involved in these projects relate to the levels.

In our little model we can identify who is in control of a certain level by means of a screen pattern. Figure 6 shows the most common distribution of control in present day housing projects. Professional responsibility encompasses all levels except the furniture that is brought in by the user. But among the professionals further distinctions can be made, of course; for instance between those responsible for the design of the buildings and their infill on the one hand and those responsible for the urban design on the other.

When we make such a control pattern in the level model we must make a distinction between design control and actual control during use. If figure 6 gives us design control we can still have different control patterns for the uses of this environment. For instance, after completion the single user still may control the furniture level only but the apartment building may be under control of either a collective of users, or a extraneous housing management. For the development of housing projects both forms of control are important, and they will require separate diagrams.

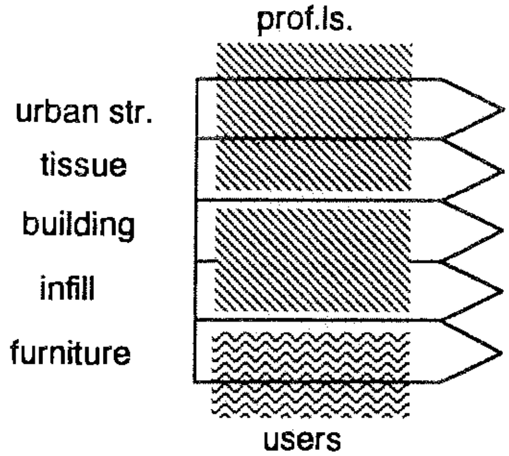



fig.6. control distribution

**Uses of the model.**

Sites and services.

In the last decade the so called 'sites and services' approach has been applied in many parts of the world to provide shelter to people who cannot afford to rent or buy a completed dwelling. This way of working has been supported by the World Bank and other authorities as a way to make limited resources help the largest possible number of people. The sites and services idea makes a distinction between what should be done by professionals and what people can do themselves. The professional operates mainly on the level of tissue and urban structure. The users are made responsible from the level of the dwelling downwards. (Fig.7)

The distribution of responsibilities is different from the 'normal' case given in fig.6. Of course the model does not tell us what strategy is the better one. But that is exactly the point. Today there is not a single good strategy but it depends on the circumstances of a case what control distribution can best be adopted. Comparing models in a systematic way is the first step towards a more sophisticated methodology in housing.

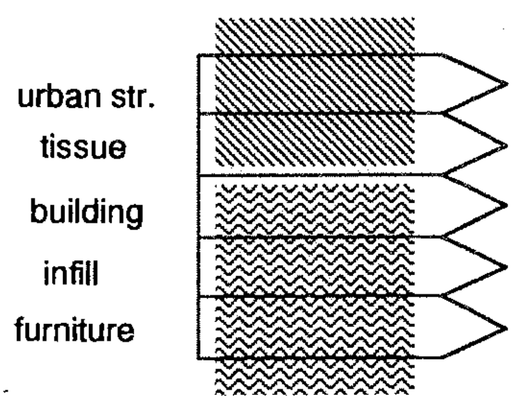



fig.7 sites and services

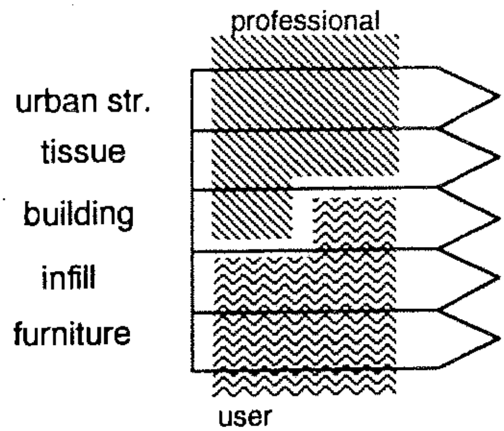



fig.8. core house

Core houses.

It has often been pointed out that the sites and services approach makes it too difficult for people to acquire shelter. Critics say it takes a long time and too much effort before dwellers have a decent roof over their head.

Therefore other projects offer some form of primitive shelter and let people fill in the rest over time. I am sure you are familiar with the idea of the 'core house'.

With the core house approach the building level is actually distributed among two parties. The professional makes the core house, while the user, later on, will expand the building. Thus in the sites and services scheme the whole of the building level is under the responsibility of the user, while in the core house the building level is only partially given to the user. (Fig.8)

A particular interpretation of the latter form of control distribution was proposed in a scheme I was involved with in Egypt. (Fig.9) Here we designed only the surrounding walls for the dwellings, proposing that the users make the roof and fill in the volume. The rationale behind this solution was to protect people in the beginning as much as possible from the harsh desert winds. The walls also gave a more 'finished' look and a clear expression of the territorial organization.

Let me stress again, at this point, that I do not advocate any particular solution, but want to give you examples of different strategies that all can be explained and compared by means of the concept of levels. In this way one can study alternative approaches to find the best possible solution in each case.

Systems and levels.

The last example is also interesting from a methodological point of view for another reason. We see that walls are also designed to protect and define the separate compounds in the neighborhood and that, finally, the whole neighborhood had its own wall with gates. Thus, in the first stage, walls were designed on three levels. Use-control will be distributed among two parties: the individual users will bear responsibility for walls on the building and infill levels, but the building walls they share with neighbors as well as the walls delineating the compounds are a collective responsibility. (Fig.10)

Here we see how a specific technical system - in this case the configurations of walls - can be operating across different levels and be controlled by different parties on each level. We already saw the distribution of a single technical system across levels in figure 3. In figure 10 we also find the distribution of the sewage system as it could be in the example of the Egyptian compound project. Again we see control by, respectively, the individual users, the collective of users, and the municipality. This distribution pattern is not the same as with the walls. Each system can have its

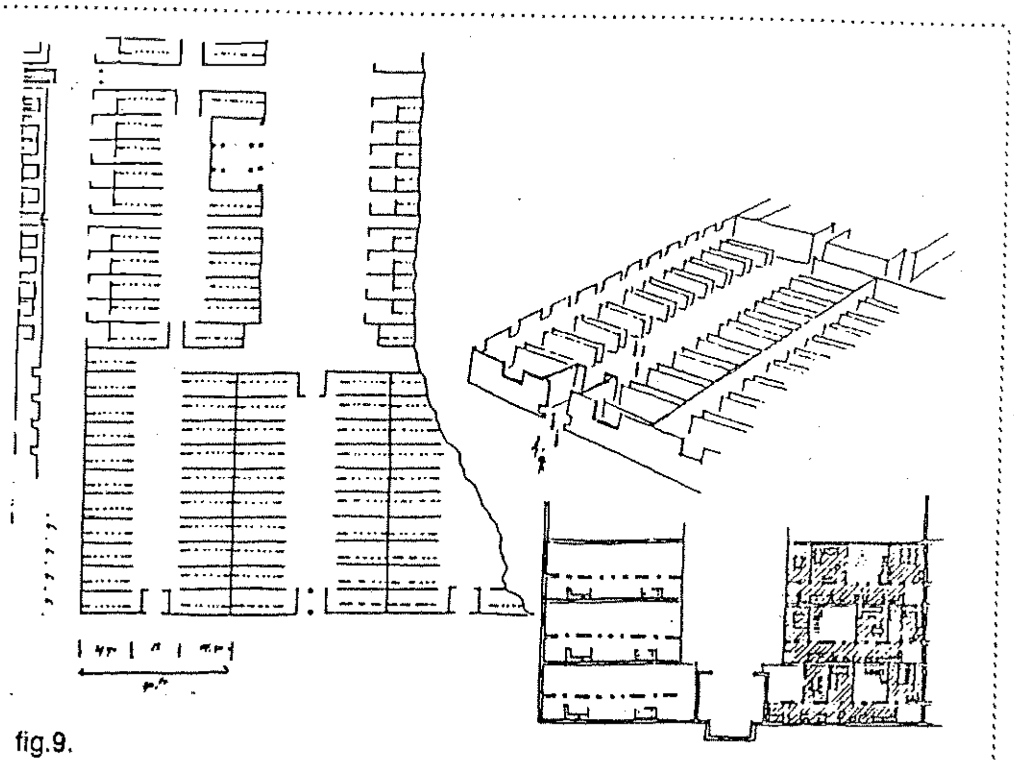


fig.9.

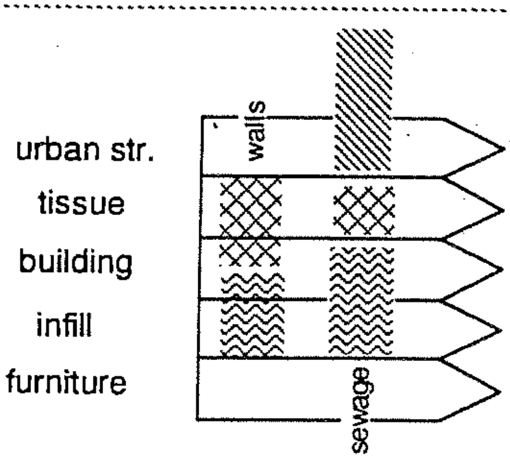



fig.10. walls and sewage in case of fig.9

own control distribution. It is of course possible to have different ways of assigning control to a system across the levels, using in the same design. For instance: in figure 10 the collective control of the sewage on the tissue level can be replaced by control from the municipality.

Support /infill approach

So far we have looked at examples of control distribution for projects for the lowest income groups. A very different case is taken from the European housing situation. As some of you may know, I have advocated for many years, the distinction between 'support' and 'infill'. This idea came from the necessity to build large apartment buildings for relatively high density situations.

The 'support' is what I have so far called 'building level' in the model. As observed before, we have here a question of terminology. Some people argue that infill is also part of 'building'. In that case the higher level needs a new name: hence 'support'. Infil comprises partitioning walls, kitchen and bathroom equipment and all the conduits for electricity, heating, water, and gas, needed to operate the equipment.

A clear distinction between support and infill was proposed to offer the users of the housing units the freedom to determine their own floor plan. The support could be built in rigorous repetition as a single project. But on the level of the infill each unit can be different. and the responsibility lies mainly by the user. Figure 11 gives a example of a floor plan of a support project that was built already ten years ago in the Netherlands. It was designed by architect Frans van der Werf. It is easy to see that all infill plans are different but that the support is fairly repetitive. The diagram of this way of working is given in figure 12. We see that the support level is under professional responsibility but that the user decides about the infill

I mentioned earlier that the control pattern can be about design control or about use control. If we switch to the latter in figure 12 we can see the management of the housing estate controlling the tissue and support level while the users remain in control of their infill level, being able at at any time to change and improve. But we can also think of a scenario where the collective of users manages the building as may be the case when it would be a condominium. In that situation fig. 13 would apply.

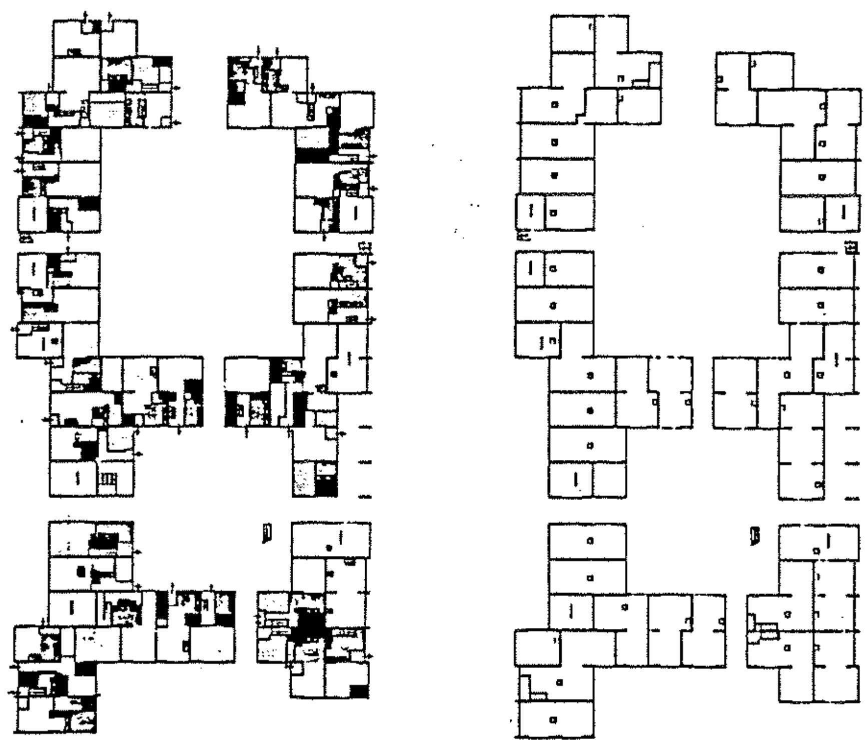


fig.11.

<u>Efficiency.</u>

For a long time it was argued that the support/infill distinction might perhaps be very desirable, but that it was not efficient. You may be interested to know that at this moment the opinion among many professionals in the Netherlands has changed. It was found that, if one studies the technology seriously, the separation of the infill level offers better efficiency. There is no time to go into this question in great detail but the major arguments are as follows:

- Clear separation of the infill level makes it possible to design and produce infill systems that are independent from individual projects. Their components can be produced industrially in large numbers.

-Installation of separate infill systems saves much time and labor on the site, therefore

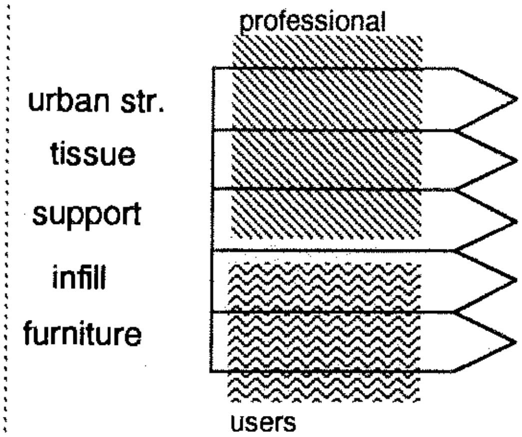


fig.12 . 'support/infill' approach

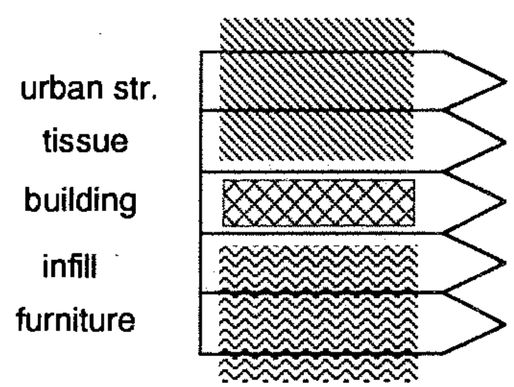


fig.13. support under collective control

reducing not only on-site labor but also overhead costs.

-Because the infill system is a separate industrial product it can be improved over time.

-Where several infill systems will be available clients can choose and competition will produce a variety in styles and price levels.

-Because infill systems are not dependent on a single project they can be applied in a wide area. This is particularly interesting with a more united Europe in 1992.

-Because the installation of a infill system goes per unit it is not important that floorplans are the same; they can all be different.

-Individual units can be changed and improved over time to meet individual users needs.

You see that in this case the initial motivation is technical and economical but that, at the same time, we can respond to several of the 'idealistic' points on the wish list I gave earlier.

At this moment in the Netherlands there is a organization called 'Open Building'. It has more than a hundred members among whom we find not only architects and engineers, but also contractors, manufacturers, and experts in public housing management. They are convinced that the clear distinction of levels in housing production and design is the way of the future. They are not necessarily all that interested in the freedom of the user to change his own infill system, but they regard the support/infill distinction as a good base for improved industrialization leading to a better product for less money.

It would be a mistake to believe that the support/infill distinction is only for rich countries like the Netherlands. The distinction of levels allows us to organize our work better and offers greater flexibility and efficiency independent of the available material resources. Professor Bao Jia Sheng from Nanjing university, who is present at this conference, has successfully applied the support/infill distinction in a housing project in Wuxi City, China, with a very different budget compared to that available to his colleagues in the Netherlands. I assume he will report on that project himself. A few weeks before this meeting I was informed that the support/infill approach is also applied in Egypt by the ministry of reconstruction. There professors Nasamat Abdelkader and Sayed Ettouney have developed a standard support system that can be applied in different sites around the country. The infill of the units will be left to the users who will apply traditional materials.

**Final remarks.**

To end my talk I would like to make a few final remarks.

I set out to propose a model that allows us to describe different control situations in different projects. But by now you will have discovered that this model actually implies a methodological principle. The distinction of levels, as they operate in the real world, allows us to organize our work in a more sophisticated way. We no longer need to seek a similar solution for all purposes, but we can find the best approach in each case. In each project we can ask ourselves how responsibility will be distributed across the various levels to get the best results in the most efficient way.

The concept of levels therefore provides a planning tool that we can use to deal with the growing complexity of our task.

When we organize our work in this more sophisticated way important methodological questions arise. For instance, how will the distinction between the two levels be made clear? How do we decide exactly what belongs to one level and what to another? How do we define the subsystems to be found on a single level? How do parties, operating on different levels, coordinate their work?. You will agree that such questions are not particularly new. Issues of control distribution and coordination between parties always have been very important in planning and design and engineering. In the course of time we have researched and developed numerous additional tools to help us organize the division of design control better.

Examples of such tools are for instance a better understanding of modular coordination: not for the standardization of components, but for the coordination of design among different parties. In the same way we have experience with the uses of formal zoning systems as design tools to coordinate work on different levels.

When we operate on a particular level we must, in this new way of working, be able to judge what freedom we offer to the party on the lower level. When, for instance, a urban designer makes streets and house lots, as we discussed in a earlier example, he wants to make sure that the house lots can contain the kind of houses he has in mind. He will analyze the size and shape of the lots to make sure the houses he has in mind will fit. This kind of investigation to check what can be done on a lower level, can be formalized in what we call a 'capacity analysis'. Such a analysis can be done on all levels of the built environment. For instance , when we design a support system we want to understand its capacity to hold the right kind of infill plans. Or when we make a core house we want to find out in what ways the user can expand and improve it.

I mention these few examples of formal operations to show that a specific methodology is involved than cannot be explained here. Much remains to be done but we know enough to be confident that the levels approach for open building is very promising. To use this new approach, however, new skills and methods must be applied.

Let me return briefly to a topic we discussed earlier: the issue of variety versus uniformity. You may have noticed that I stressed method and the distribution of responsibility in a scientific and flexible way. In each example we found, however, that the result is greater variety and flexibility. In the sites and services example we can be sure that each house will be different and that houses will adapt over time to the needs of their users. The same is true in the support infill examples. Here again the result can be that each unit is different and can be adapted over time.

But you will have noticed that this rich variety was not the goal but the result of a more efficient and sophisticated approach. The idea that variety can be the result of efficiency is hard to accept for many among us. Even among the members of the Open Building organization in the Netherlands I found that people said: I know now that variety and efficiency are not in conflict with each other, but I still find it difficult to believe. This is understandable because we have been trained for generations with the idea that rigid standardization of floorplans is necessary to be efficient. In the next decade this old fashioned idea will disappear.

I assumed, in my models, that the user can be regarded as a responsible party as much as the professional. Some of you may have their doubts about this assumption. But you will also have noted that the models of control distribution are different from what is usually called 'participatory design'. I firmly believe that those who want to participate must be willing to carry responsibility. Moreover, responsibility must be clearly defined. Only when these conditions are met, the users role can be helpful.

I do not share the concern of some of my colleagues who fear that when the user participates, the professional role is somehow discounted or degraded. I believe the opposite is true. To organize and steer the processes we have seen in the various models, professional skill is more needed than ever before. As experts we are responsible for the management of the process and our expertise must lie in our understanding of the control distribution patterns and the skillful organization of the different parties involved.

This new expertise must be developed. As I have said before, I believe much can be done here. A new level of sophistication can be reached. When the concept of levels is not properly understood, or when the control distribution is not properly studied and when the coordination between the parties on different levels is not skillfully organized, problems will arise, no matter how much or how little money is available for your project. Those who want to take full advantage of the understanding of levels and control distribution must study it carefully and be aware of the methodological requirements to be met. To deal with the more complex world that we live in, and to replace our outmoded methods for better ones will take much effort. In the field of architecture we tend to look for the quick fix: another style, a new type to copy. This will not work when we are serious about the housing problem. To change our methods is hard work.

To end this paper we now may come back to the seven points I brought up in the beginning of my talk. Let us see what levels mean to them.

1) The levels concept allows us to choose the right process: we consider the different parties involved and can decide what their responsibilities must be. We also see how different projects can be structured differently with their own control distribution pattern. As such it is a planning tool.

2) In this model both professionals and non professional can have a place. The need to arrive at the most effective solution with the best possible use of resources will determine the control distribution. In some cases users can do the job better, in others professionals must do it. The most important point is that on each level, for each subsystem, the responsible party is identified.

3) Change over time can be related to levels. Change on a lower level is easier and can have a faster frequency than change on a higher level. Clearly defined levels with systems assigned to each level, make change over time easier to be organized.

4) Uniformity can be efficient when one party has to do many things. To build a support, for instance, repetition of the same bays is more efficient. But when systems operate on their own level, different parties can use the same system simultaneously and work parallel. We see this with the infill systems in the support project or with the building of the individual houses in the sites and services project. In those cases variety is not the purpose but the natural result.

5) Separation of the lower level systems allows for their change without disturbing the higher level. If that condition is offered, adaptation to individual needs on the lower level is easy and efficient.

6) The building level can be designed to respond to local lifestyles and cultural values. This is what determines the quality of the urban environment. This level can also respond to specific housing types that people prefer.

The lower infill level provides the modern amenities that have become international preferences: good bathrooms and kitchens, electricity, telephone and television. Adaptation to a higher standard is possible over time.

7) To fit the housing project in the local urban context is always the responsibility of the professional urban designers and architects. Their expertise should particularly be occupied with this question, leaving the lower level decisions to those who live in the projects.

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Some further reading:

For a theory of the built environment based on physical levels and territorial hierarchies see: N. John Habraken: Transformations of he Site, Cambridge, Awater Press, 1983, distributed at the Department of Architecture, MIT.

For a discussion of levels and territorial hierarchies from the point of view of design see: N.John Habraken: The Appearance of the Form, Cambridge, Awater Press, 1985, Distributed at the Department of Architecture, MIT.

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On the issue of control distribution as a explanation of the traditional Muslim City see: Jamel Akbar: Crisis in the Built Environment, a Mimar Book, distributed by E.J. Brill Leiden , the Netherlands and New York, USA.

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# SHELL/INFILL: A TECHNICAL STUDY OF A NEW STRATEGY FOR 2X4 HOUSEBUILDING

Author: Stephen Kendall, PhD, AIA
(published in Open House International, 1988)


## ABSTRACT

A typical '2x4' house is used as a case study for the SHELL/INFILL concept. This is a new logic structure in which design methods, building hardware, and construction phasing are examined as an alternative to the conventional paradigm. No difficulties are found in using current building assembly hardware. Changes are required in design methods, construction phasing and contracting. New commodity products would enable the concept to be applied with more efficiency and quality.


KEY WORDS: SHELL/INFILL; "2x4" construction; construction phasing; variety/efficiency; commodity products.

## INTRODUCTION

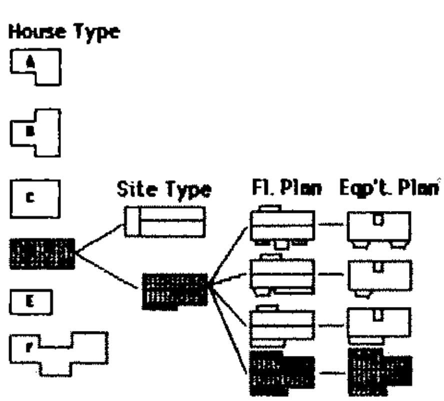



Figure 1: House Types

In a residential development of single family houses in the U.S., market driven variation is ordinarily achieved by the application of a widely available repertoire of design and construction methods. We see the same house type built on different sites, with different orientations to the street, with variations in the facade, window positions, and porch design. The roof may vary on the same house type, in roofing material and fascia detailing.

Inside these houses of the same type, the living room may be larger in one, there may be a small 1/2 bath beside the front door, and the kitchen may be smaller, and in a different position, than in another house. Resource distribution systems may likewise vary in houses of the same type.

In the same development project, we can also find different house types. They may, however, all have the same resource distribution systems, the same kitchen locations, the same exterior cladding, and the same balcony details and window types. In addition, we can find in different house types, exactly the same construction stratgey and a common repertoire of materials, colors, and configurations of many sorts.

These are normal things. It is also normal to return to the same development years later, to find that some of the things that were the same are now different. In all we see that certain physical systems and configurations remain as before (that is they are fixed) relative to those elements, and relations among parts, which have changed. There remains a certain conformity, which comes because the houses share a context, regulations, a building process and a repertoire of materials. The principle of fixed and variable is at work. This principle is familiar to most casual observers. In complex systems such as the 2x4 system, however, we are not familiar with longitudinal observations taken from this point of view. It is a relative concept based on the proposition that those parts which change do so not necessarily because of simply technical and economic causes, but because different people want different things, and because a particular party had power to change a configuration and did so.

By observing such instances of adaptation over time and in many instances, we begin to see certain ordered patterns of change. This ordered pattern of change was examined, and is reported here in a research activity examining the logic structure of design and construction practices.

A demonstration project is called for to further examine the concepts studied here on paper, but in actual design and construction logistics.

THE RESEARCH PROJECT

**The study reported on here was undertaken to see if the practices of adaptation and variety which are so much taken for granted, could be organized more efficiently, without inhibiting the wide distribution of control that the 2x4 system currently offers. (1)**

The '2x4 system' which has matured over the past 150 years in North America has developed in the presence of an interesting synergy between forces of production and forces of use. A particular equilibrium has come to exist between these two spheres of control and initiative. The pattern of the force of use has been highly disaggregated - to the level of each and every household and homeowner, many other actors, and numerous political jurisdictions. This has given rise to the variety that

This is a concept which we think is worth further study, as a way to give added potential to the continuity and stability of the 2x4 system.

We hypothesize that by untangling building elements and "unlocking" some subset of parts from the whole, based on life cycle needs and patterns of control, 2x4 buildings can be built faster with higher quality, and can more easily adapt over time with reduced waste in scarce resources and time. Given the increased complexity of homebuilding with a rapid increase in consumer electronics, mechanical systems, and rapid style shifts, more money is now spent of what is here called Infill than heretofore. Disentangling these parts of houses can make economic sense, and also enables households to choose to invest money on their dwellings as a viable alternative to spending money on vacations, or other consumer purchases.

We suggest a linked process/product distinction, as in office building development, between a SHELL (base building) and INFILL (tenant work), made on the basis of responsibility and control, as well as a distinction in building hardware and processes according to life cycle analysis. An INFILL element is one that can change without requiring the SHELL to change; a SHELL is a configuration of elements which, when it changes, automatically requires a change of INFILL. Generally, a Shell lasts longer than Infill.

This approach sees a house as composed of many subsystems that relate to each other in an hierarchical way - we rank the subsystems in such a way that each can be deployed after the systems higher in the order have been deployed first. Each subsystem in turn is a context for the deployment of the next subsystem. Thus, a SHELL is a context for INFILL. In the same SHELL, many INFILL Plans can be made. In the same way, in a given INFILL plan, many furniture layouts are possible.

<u>The Research Questions</u>

1. Would it be possible, as well as efficient, to build a SHELL (with strategic positioning of certain subsystems) in such a way that several kitchen or bathroom locations and equipment decisions can be made independantly, after the SHELL is built? Kitchen and bathrooms are selected for study because they are most prone to deterioration and also to adaptation before other parts of houses and because they involve a great deal of the subsystems most difficult to untangle: the piping and wiring systems.

2. Would it be possible to organize INFILL PACKAGES from the market of basic commodity products, comprising physical parts needed for these more frequently adapted parts of a house, and to bring them into SHELLS providing different layouts, and varied equipment?

we experience. Centralized control has not been a hallmark of the system's evolution. This finding has been a hallmark of virtualy every study of the light frame convention of the US homebuilding industry.

At the same time, the 2x4 system has matured because of the massive involvement of commodity producers, who take initiative to produce a huge and generally inexpensive stock of very general elements, which everyone (site builders, panelizers, modular producers, and homeowners) can use in their own way. They have thrived on the highly disaggregated forces of use. The "2x4 system" (as this technical practice is called in Japan, but in which is forgotten the concept of distributed control) has become the standard of reference, enabling the construciton of millions of houses and buildings each year, and the renovation of other millions of buildings, by specialists and non-specialists alike.

This investigations took the point of view that a threshold seems to have been reached today in this equilibrium, at least in the United States. The pressures for increased efficiency - along with cost and quality control - are clashing with the pressures for variety. Forces of production seem to feel justified in tring to increase their share of the control in the operation of the 2x4 system, but are facing resistence from the still lively (but hard-pressed) forces of use. Data indicate that costs are rising rapidly while quality is decreasing, while industry introduces new products each year. The margin of advantage in each incremental adjustment for improving quality or reducing cost at various points of the production stream <u>as it is now understood</u>, has now diminished almost to zero. Introducing new hardware and adjusting regulations seems no longer to be efficacious in maintaining a healthy equilibrium between production and use <u>in the current design and construction paradigm</u>.

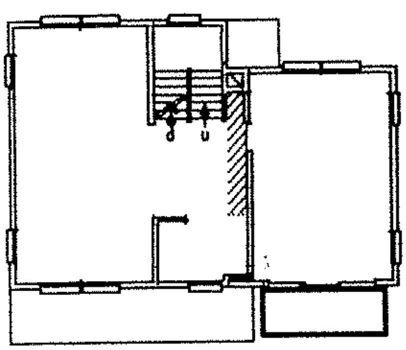
<u>The Shell/Infill Distinction</u>

This research introduces the SHELL/INFILL concept to the industrial vernacular 2x4 system. This concept is well established in the US commercial office market, where a parallel distinction is named "base building/tenant work". Most large construction firms such as Turner, Tishman, Beacon, and others organize themselves this way. Most large architectural and A/E firms are familiar with this practice and organize design work accordingly. Product manufacturers make parts to match this convention, and investment and depreciation tax credits are aligned with this way of working. Recent trends in investment in equipment as opposed to buildings is indicative of an increase in parts of buildings being identified as equipment as part of tenant work packages. **(2)** Building owners such as the World Bank, IBM and others as well as smaller owners take this approach for granted, to accommodate the almost constant change in their building stock as needs and standards adjust.

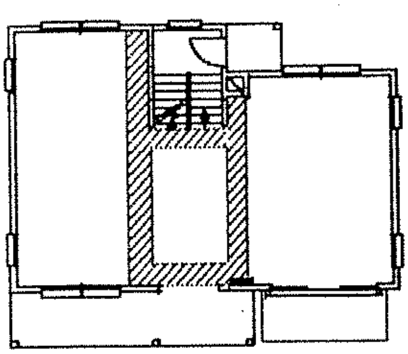
## DISTINCTION BETWEEN SHELL AND INFILL

### The SHELL

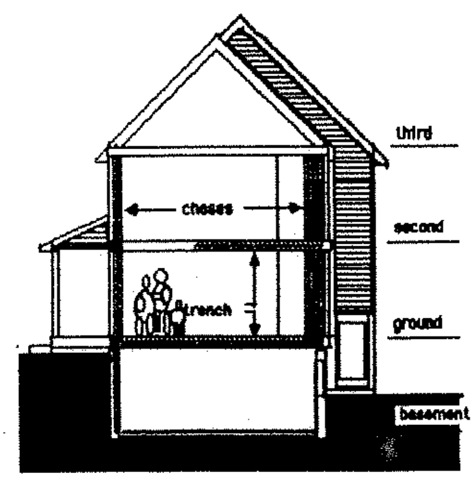
We used the author's former house in Boulder, Colorado for the study. It is one house type in a small homeowners association development of 32 dwellings. (fig.1) We redesigned the house to make a SHELL. The two main floors of the SHELL are shown here. (fig 2) The process of arriving at the SHELL involved a capacity study, in which a fixed SHELL was examined as to its capacity to hold various plans. This is an iterative process and can be done with any house design. Normal design reasoning is brought to bear on this. Emerging computer software will be of assistance in this process. (3)



Ground Floor



Second Floor




Cross Section

**Figure 2: SHELL Plans and Section**

## Basic INFILL Plans

Several spatial/functional areas (kitchen and small bathroom) were 'unlocked' from the 'whole house' configuration. We know from observation of many house plans in journals and in place, that when they can, people will choose to put kitchens in different places, some on the sunny side, some to the backyard, even in the same house type. We also know that people may decide to have a small washroom/WC on the ground floor, but may place it differently according to how they use the house. We also know that a family may choose to have more smaller bedrooms or fewer large rooms when the choice is available. Figures 3 and 4 show some possible INFILL layouts in the SHELL. We also know that such choices reveal themselves over time as houses are adapted to changing household needs.

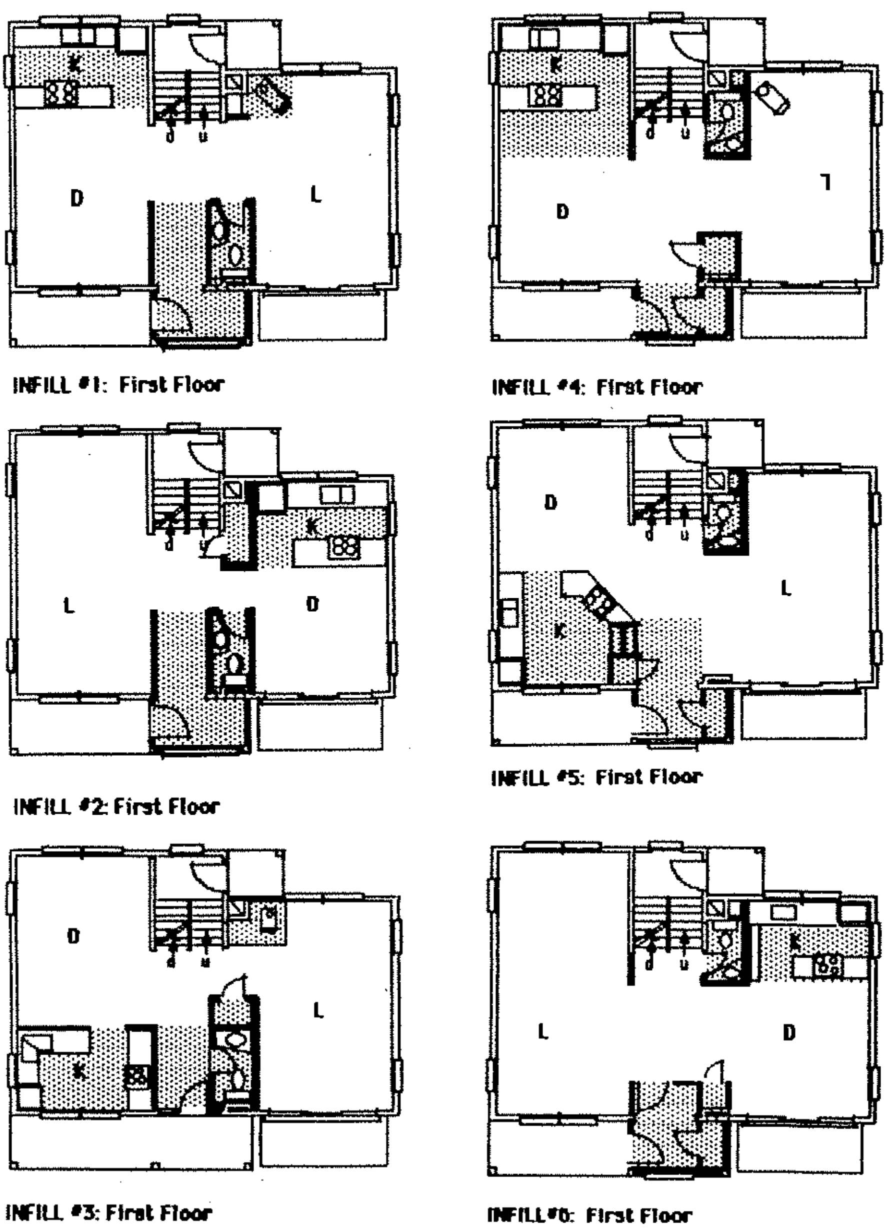
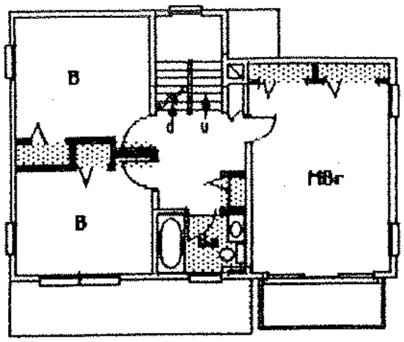
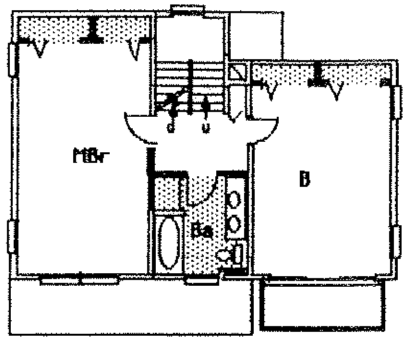


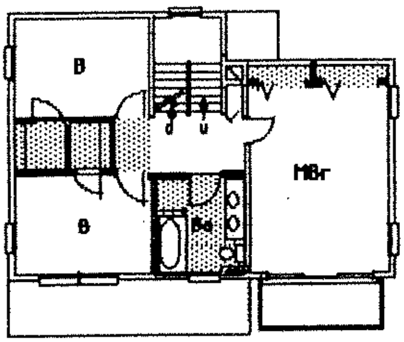

Figure 3:




INFILL #1: Second Floor




INFILL #3: Second Floor



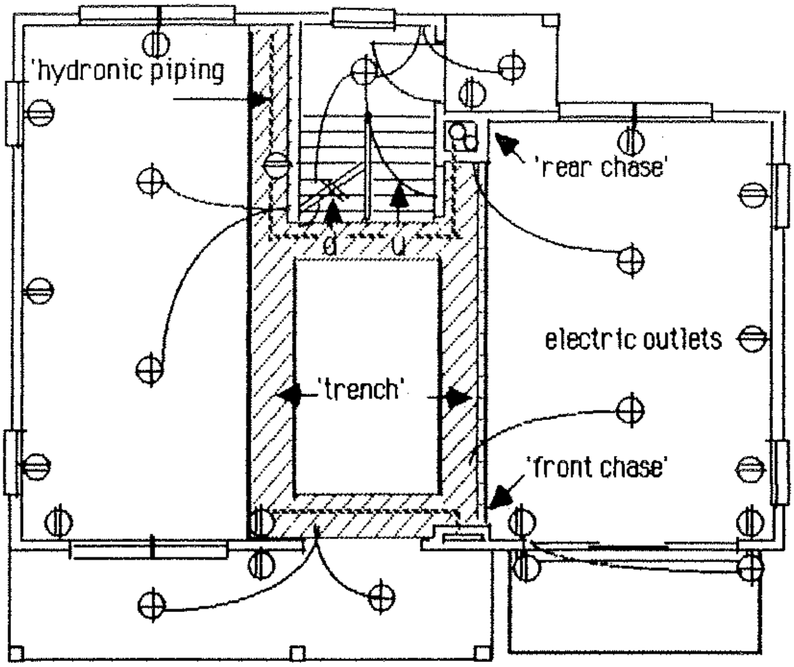

INFILL #2: Second Floor

Figure 4

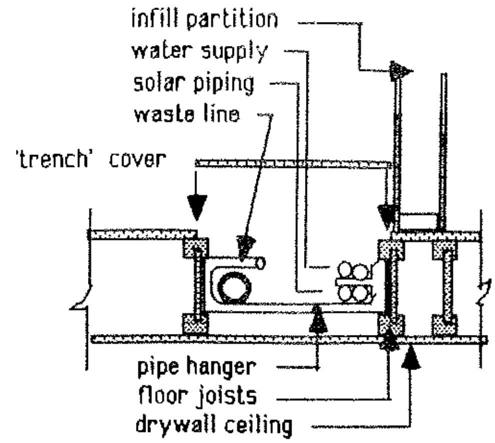
SHELL SYSTEMS

The SHELL is a completed stage of construction, but does not yet make a dwelling. It will have the 'fixed' portion of the resource distribution systems in it, the floors, roof, bearing walls, and in most cases a tight envelope. Decisions must still made on plan layout, finishes, equipment, and so on: these decisions constitute the INFILL LEVEL. (Furniture constitutes another set of decisions on a 'lower level', constrained by INFILL decisions). Figure 5 shows a partial plan of SHELL systems.

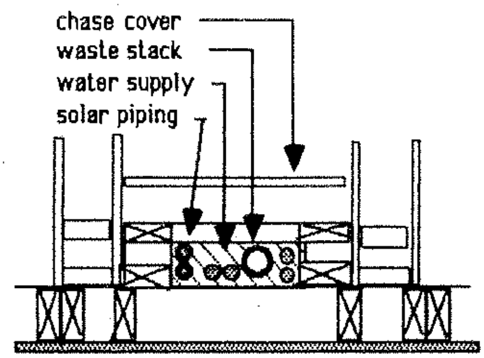
The SHELL in this study is fixed in most respects on the exterior, except around the front door, where the INFILL 'comes to the outside'. We did not investigate the thermal properties of the envelope, colors, exterior siding material, window style, or a large number of other specifications. Nor do we specify how the SHELL is to be built. It could be 'stick-built' on-site, panelized, modularized, etc. The SHELL has gypsum board taped and ready for paint or wall paper, on all SHELL walls and all ceilings. Rough stairs are part of SHELL. The position (not size) of the second floor bathroom is fixed.



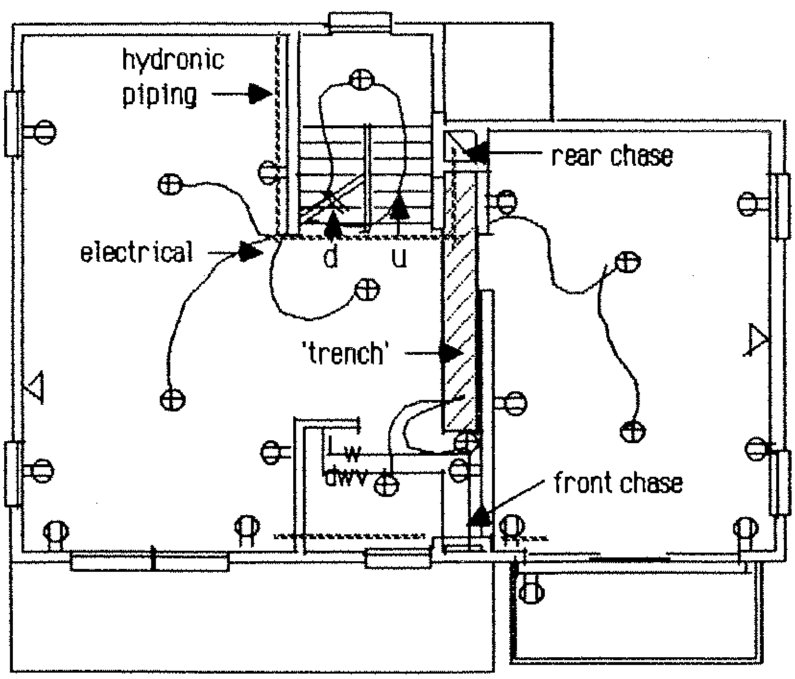

## Ground Floor Shell Plan



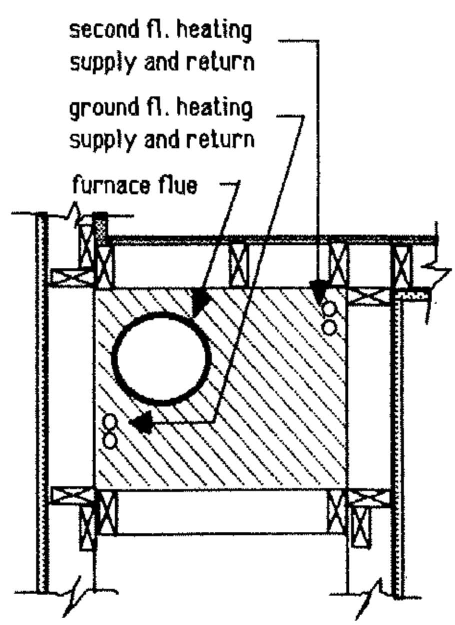

## 'Trench' (in section)




## 'Front Chase' (in plan)




## Second Floor Shell Plan




## 'Rear Chase' (in plan)

# Figure 5: SHELL Systems

Fixing these subsystems of the SHELL does not mean that the SHELL cannot be varied during design, construction or later. These would simply be 'customizing' changes, depending on the willingness of the parties involved to organize and pay for them. These could be such decisions as change of a window position or size, upgrading of insulation rating of the envelope, enlarging the SHELL in a particular direction, and so on.

INFILL SYSTEMS

INFILL system parts should be installed without 'undoing' something done in the SHELL stage of construction. For example, installing INFILL wiring should not involve cutting or boring holes in SHELL elements. In general, Infill contractors should be able to work in such a way that disruption or distruction of the Shell contractor's work is not called for.

INFILL subsystems are independant of the SHELL, but follow them in construction sequence and connect to them: INFILL wiring must connect to SHELL wiring, as with other resource distribution systems. INFILL walls must attach to SHELL floors and walls; and so on. But INFILL can change without changing the SHELL.

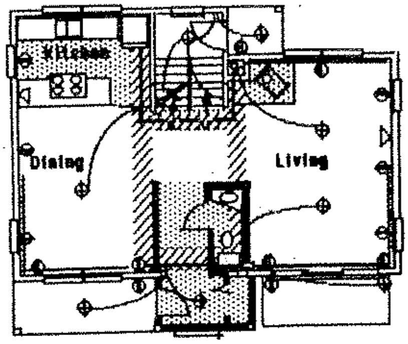
Within an INFILL system, many operations are performed, impacting many interfaces between subsystems. If studs are used, they may be drilled for wiring for a particular layout, or special openings cut in standard panels, etc. These operations, their sequence and coordination, are those decided upon by the INFILL designer and contractor.

The same applies to subsystems in the SHELL design and construction.

In order for these two operations to come together, principles of coordination will be of assistance in two respects: 1) position coordination agreements (where things are placed relative to each other so that Shell elements will not be in the way of Infill elements), and 2) dimensional agreements, so that things fit.

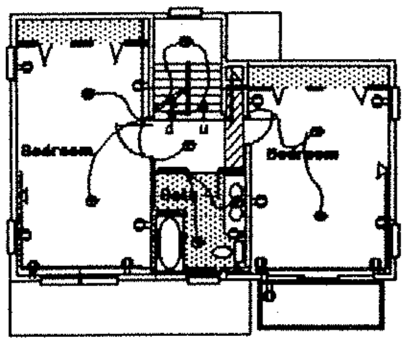
Composite of INFILL Systems in the SHELL

A drawing of all the INFILL parts together shows the parts making an INFILL Package. Each of the INFILL subsystems interfaces with the SHELL subsystem of the same kind.




Ground Floor Shell Plan w/ INFILL

Figure 6: Composite of Ground Floor




Second Floor Shell Plan w/INFILL

Figure 7: Composite of Second Floor

Partitions

We used conventional construction, but this need not be the case. New parts would help. INFILL partitions meet a SHELL trench at least once, enabling wiring and piping in a partition to connect to their sources in SHELL. Most but not all INFILL partitions are interior walls.

Drainage, Waste, Venting (DWV)

INFILL DWV serves the kitchen and 1/2 bath, but not the second floor bathroom, whose plumbing (but not fixtures) are in SHELL. DWV routing occurs in the 'chases'

Water Supply

Resource supply lines follow the trenches from their sources in SHELL pipes to their INFILL destinations.

Heating System

The heating system specified for this research was a conventional hydronic base - board system, with a gas-fired boiler. The boiler and main piping is in SHELL, but the baseboard fintube radiation is in INFILL.

Electrical, Data and Communications Systems

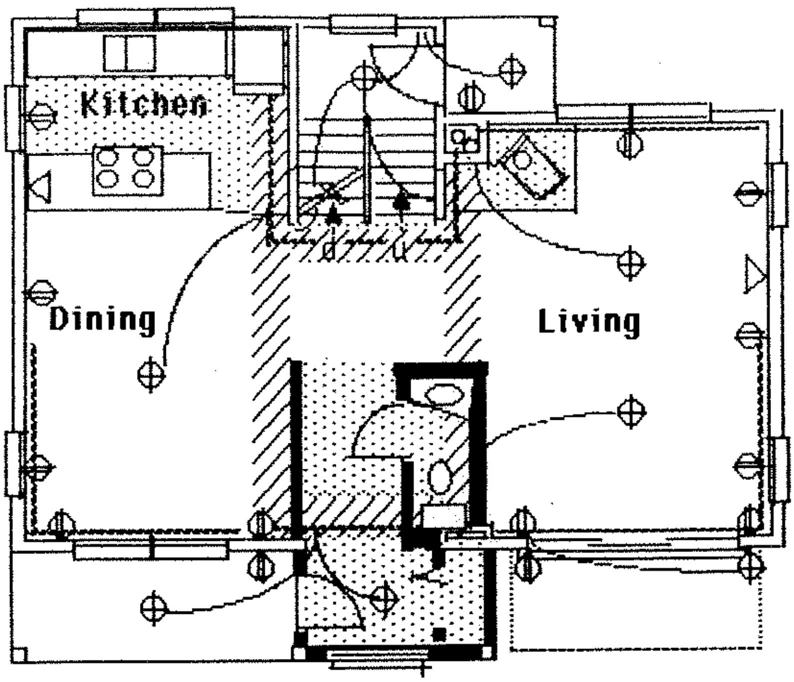
We assume a conventional electrical load pattern, and standard communication needs: telephone, computer, and stereo and video display. INFILL systems operate on their own circuits, wired directly to the main SHELL electric panel of the house. There are also interfaces between INFILL controls and switches, and the SHELL power source.

Equipment, Fixtures, and Cabinets

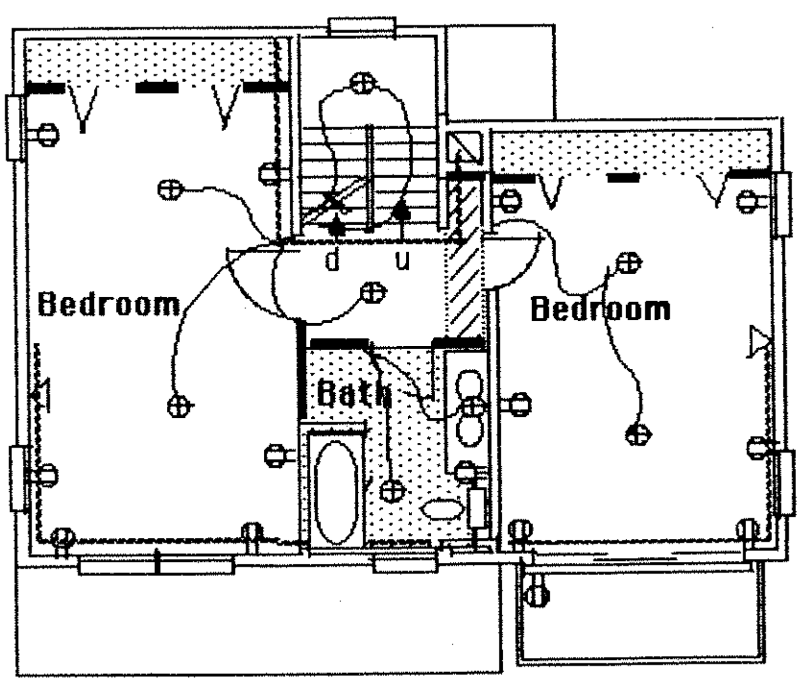
These include kitchen cabinets, appliances, plumbing fixtures, lighting fixtures, miscellaneous hardware, shelving, mirrors, and so on.

Wall, Floor, Ceiling Finishes

All finishes are INFILL. Finish stair treads are INFILL, set on a rough stair (SHELL). Putting stairs in SHELL is simply an aid to construction operations. One would rather defer stair design and installation to the INFILL phase, because of the closely linked decisions of floor finish and thickness to stair materials and dimensions.




Ground Floor Shell Plan w/ INFILL




Second Floor Shell Plan w/INFILL

SUMMARY

The approach we have investigated makes for a variety of plans that can be designed and produced efficiently. But this reorganized way of working also makes future adaptation easier to achieve, providing benefits to habitability performance in keeping with household life. Introducing the SHELL/INFILL concept will make some subsystems - such as interior walls, the resource distribution systems that serve kitchen and baths, and interior finishes - more adaptable. This can be done by distinguishing them from the subsystems of the more permanent SHELL.

We think that one of the advantages of this, were it to be practiced in the production of houses in the 2x4 system, would be more rapid construction of both SHELL and INFILL. We also think that this strategy can make the work of building many houses easier, more coherent, and more managable to designers (as in puzzle solving), builders and subcontractors. We also think that it can cost less, and lead to higher quality. The money saved in reduced time on the site - thru simplified SHELL construction, and more rapid INFILL installation - can be channeled back into higher quality SHELL and INFILL elements and construction.

Many advantages of the SHELL/INFILL approach are already available with current materials and hardware assemblies in the 2x4 system. But changes in logistics and organization are required, both in designing, contracting, and in marketing.

To go further with the cultivation of the 2x4 system, we would like to see this concept used to stimulate the development and production - as commodity, value added products - of higher quality SHELL and INFILL subsystems for use in the context of the 2x4 system. Many different companies could produce these parts, and many different contractors could assemble them for diverse applications. If financing and contracting processes are reoriented, it may be that mortgages and rents might shift into congruence with this distinction of building processes (as has gradually occurred in the office building market), and new kinds of design and contracting organizations might grow up to compete in housing markets (as we have seen Special Project Groups emerge in general contracting firms in office building construction, specializing in tenant work only).

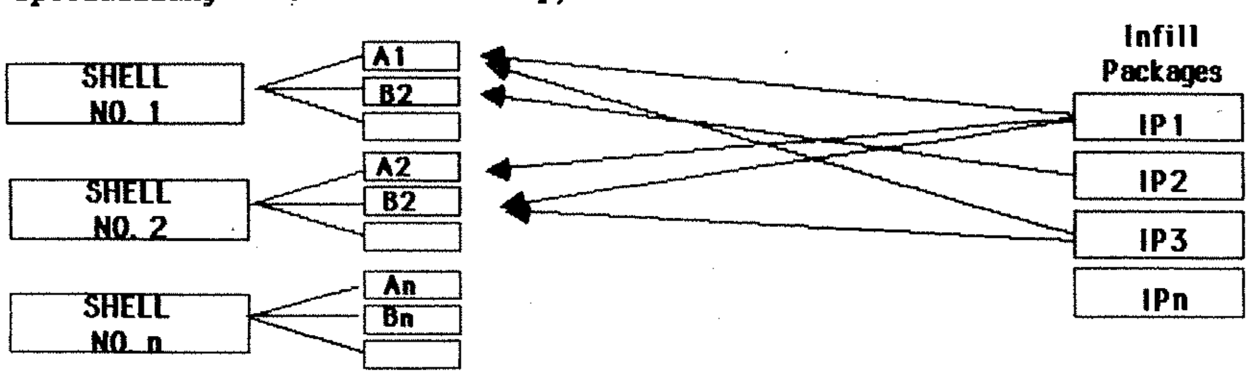



Figure 8: SHELLS and INFILL Packages in the Housing Market

## Footnotes:

1. Kendall, Stephen, and Chalmers, Thomas, SHELL/INFILL: A Technical Study of a New Strategy for 2x4 Housebuilding, MIT Dept. of Architecture, Design and Housing Program Working Paper Series, Cambridge, Mass., 1986.
2. Ventre, Francis T., "Buildings in Eclipse, Architecture in Secession", Progressive Architecture, December, 1982.
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5. Habraken, N. John, Transformations of the Site, Awater Press, Cambridge, Mass., 1983.