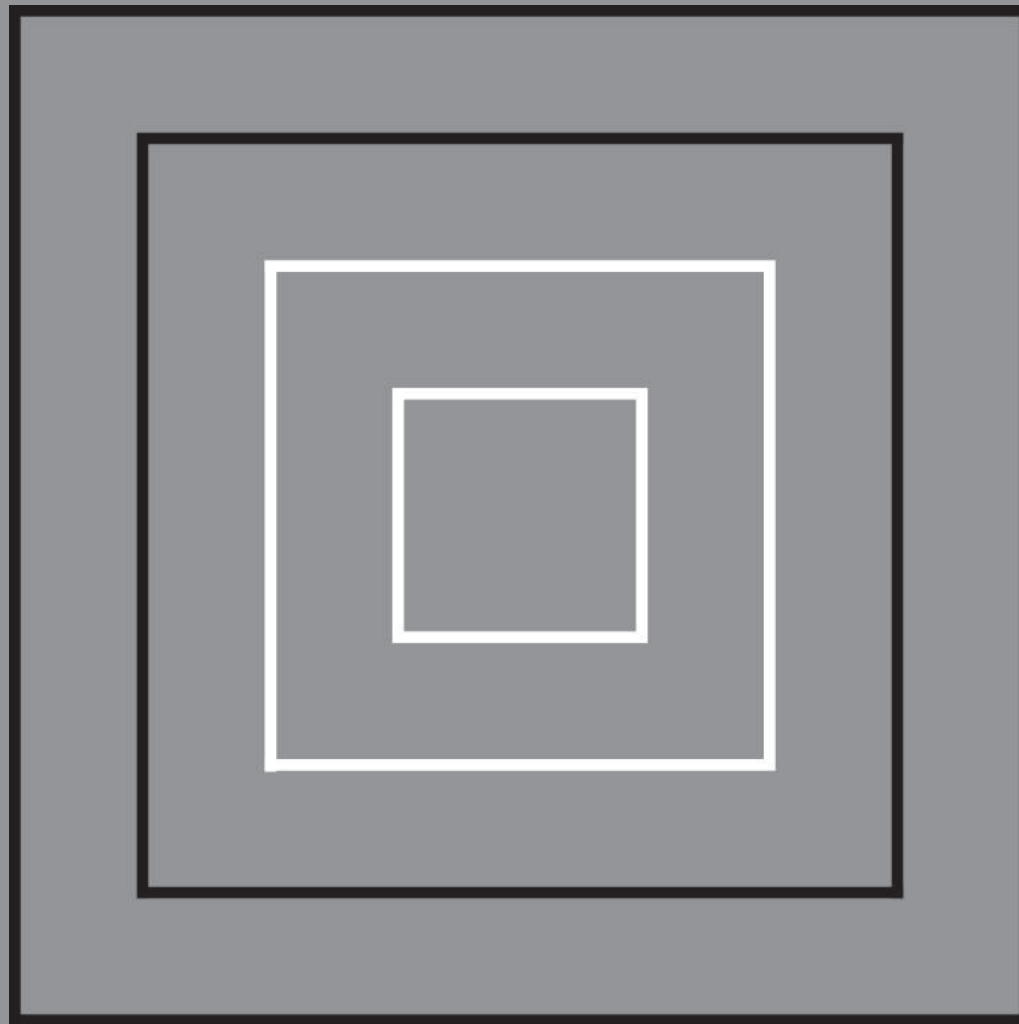# DESIGN RESEARCH AND TYPOLOGY

B DESIGN RESEARCH AND TYPOLOGY

In empirical study the hypothesis functions as an object of verification in an existing reality. Establishing a hypothesis itself scarcely figures as an object of methodological thought. Usually the hypothesis of a study is considered to be 'free'. With the design as a hypothesis this would also be the case, if that would not result most of the time from the designers study.

The architectural design is nevertheless in all its stages a fact ('factum', 'artefact') in so far as it has been made with considerable effort; before it even functioned realistically enough to be checked. In its several stages of development an architectural design is not a real and working object. That enrichment is achieved 'ex post', when it is executed and put into a context of use; or when, 'ex ante', a mathematical or material model of it has been made for evaluative assessment. At that time the design has produced two things:

- the hypothesis "This design will work", and:
- a reality or model to test this hypothesis.

Only if a design can be realised is it a model. The type entails the comparison of models. There are types of models, not models of types. Following the criterion of Quatremère de Quincy, quoted by Leupen (page 113), the type is not yet a model. It can not be copied in reality. Like an intuition it can not act as a model for that reality. By the same token a processing by design is needed. That applies also, although less, for the architectural notion 'concept' in the sense of 'conception', e.g. aiming at communication and consensus between designers and members of the construction team before a design or model exists.

Therefore not every content of experience is a model. If the notion of a model would be that encompassing, it would lose its meaning and crucial applicability in sciences. What is a model then? In the present section different definitions are used. Not only spatial relations (form, composition) and connections (structure) may be read from a model. A model allows for effect analyses and critical evaluations before execution. If a hypothesis on existing reality – or a design for a possible one – is to be tested inter-subjectively, it is a model.

Design research
Van Duin and De Jong give a classification of possible studies when a context is determined.

Designerly enquiry
Breen explores what kind of study is needed before the design is ready for design research. How could we study design before it is a model to be realised and tested?

Typological research
A type is a tool, not yet a model. To elaborate a type into a design we still need a concept as Leupen will explain. Engel and De Jong give a classification of types. The design with a certain function satisfactory on this spot may be a failure elsewhere. How could we extract more context-independent types out of design research?

Concept and type
A concept summarises crucial elements of context and the object to be designed. Leupen explains the relation of concept and type in making designs. This making requires a 'technique' in the connotation of Ancient Greece (*teknè*, art, capability; *poèsis*, making). People who never designed will not be able to conceive of it while it is hard to transfer it verbally, in terms of mathematics, or even as straight pictures. This technique is increasingly supported by sketching and tutoring during designing, by specific computers programs, individually.

Analysis of buildings and plan analysis

Molema and Meyer give examples of analysing existing architectural and urban designs. There are more design methods than designers. The emphasis on design methods in the study of design of the sixties has shifted from process diagrams with stages and arrows to more spatial components: the toolbox of the designer, his means of design and the classification of design interventions.

Design driven research

Breen examines the potential for design driven research in academic environments. Making a design as such is part of the academic education in design; by the same token partial to design research. If the making of a design would not be the object of scientific study, a design education at the academic level would lack justification.

Conclusion

What may be studied in a design before a model of it exists? It is the model itself that should be made. Predecessors of the model do require attention here: the types, concepts, and other means of design. They are the main subject of this section; the next one will deal with the forming of the model following design.

10 DESIGN RESEARCH

TAEKE DE JONG
LEEN VAN DUIN

Design research - when it comes down to it, is the comparison of designs even though they are often implicit. Even if only one design (n = 1) is researched (casuistic-study), then this is carried out at the background of the design profession, its concept formation and terminology and, therefore, carried out on the basis of experience with other designs. One must be conscious of these implicit-references when describing a design and give notification of these or even present images if necessary. At least one design object and its context are explicitly described during design research. The analysis begins once the description has taken place.

For example, Lefaivre and Tzonis[a] compared in the floor plan of Van Eyck's Burgerweeshuis, its classic architectural canons with those from 'De Stijl'. They describe how Van Eyck combines these with new design means wherein both can be recognised. They enumerate a number of compositional means, not only the well-known classical and modern ones, but also their new synthesis in Van Eyck's work.

Can one selectively search for similarities using earlier experiences when carrying out design research using a definition of a problem with pre-determined-concepts and stated hypotheses therein? Can these new characteristics be discovered (which cannot be named) by means of design research (exploratory-research, heuristic-research), or does one come to a dead-end in the concept-constriction, which is imposed upon us by the convention of the use of words?

Can everything be said using words or does the drawing have to assist with this? How scientific then is the conclusion?

Are words and drawings sufficient to make the experience (and up to a point not verbally expressible, intuition) of the designer, his or her 'design-means (choice of materials, providing structure, providing form, providing function, providing intention, the integration of their conflicts or incomparability) communicable using examples? If the attempt continually gets bogged down in mysticism and only succeeds in demonstrating, then the ambition of the university design research can no longer be defended. All that remains is the traditional practice of the 'master-pupil apprentice' relationship.
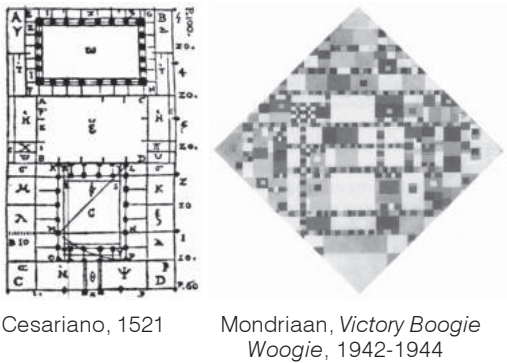
10.1 OBJECTS AND CONTEXTS

Architectural context entails everything that falls outside the frame (or within the grain) that could have bearing upon the spatial object being considered (such as the form of the location and the layout preceding the design) or vice versa (see page 38). The situation, the site and the programme of requirements belong to the context.

Therefore, strictly speaking, context is not situated *beside* or *opposite* to form.[b] After all, the (historical or prospective) context also has form, which is different at every scale level. In the table below, an overview, as a variant of Frielings' schema[c] is shown of research forms wherein the design plays a rôle.

Design study (upper right in the diagram) is a daily practice in each and every architect's office that does not exclusively work in an instinctively untraceable manner. An object must be designed for a specific context (spatial, ecological, technical, economic, cultural, and administrative). New possibilities are sought for this determined context usually using a programme of demands (part of the context). This form of research will be discussed on page 387.

10.1

10.1   Objects and contexts   89
10.2   Context dependency   90
10.3   Grounds for comparison   91
10.4   Operationalisation   92
10.5   Aims or means orientated approach   93
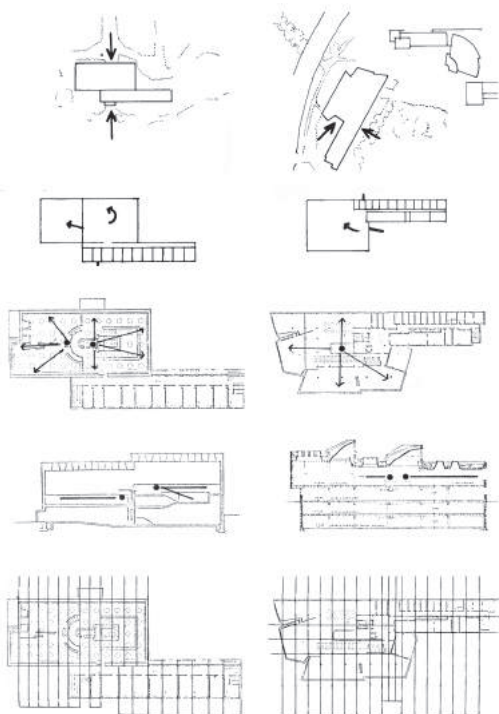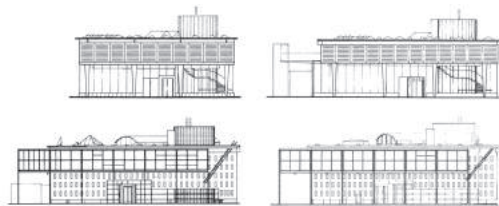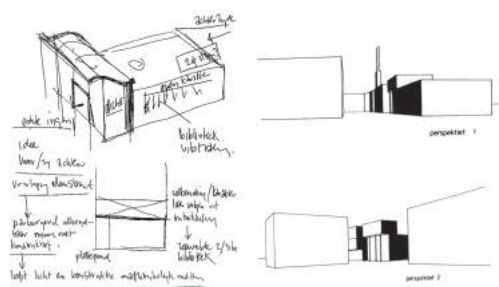10.6   Legend, form, structure, function,
          process   93

Cesariano, 1521   Mondriaan, *Victory Boogie Woogie*, 1942-1944

Aldo van Eyck, *Burgerweeshuis*, 1960

42   See similarities in design means, Lefaivre and Tzonis (1999)

	OBJECT Determined	Variable
CONTEXT Determined	Design research	Design study
Variable	Typological research	Study by design

43   Types of design-related study

a   Lefaivre, L. and A. Tzonis (1999) *Aldo van Eyck: humanist rebel*.
b   Alexander, C. (1964) *Notes on the synthesis of form*.
c   Frieling, D.H. (1999) *Deltametropool: vorm krijgen en vorm geven*.

DESIGN RESEARCH   8 9

44   K. van Velsen, 1988, design study for the library of Zeewolde

45   Design study of the design process of the library in Zeewolde

46   Typological research of libraries

47   Study by design graduation Van der Voort

a   Duin, L. van (1985-1991) *Architectonische studies 1-7*.
b   Clark, R.H. and M. Pause (1985) *Precedents in architecture*.
c   Duin, L. van and H. van Wegen (1999) *Hybrides*.

In the figure alongside K. van Velsen studies, for instance, the possibilities of a programme and a site for his library.[a] Study of that type comprises a formal analysis and a functional analysis of the existing material and the social (programmatical) context. Apart from this, a limited number of relevant precedents[b] is studied in search of possible means of design; either implicitly, from memory, or explicitly, with the support of documentation. Strictly speaking, this is design research as discussed in the present Chapter.

Design research hones the insight into possible directions of solutions of a design problem; by the same token it contributes to development of a reasoned concept of the designing.[c] As soon as a design has been completed (and consequently, the object determined), it may be studied empirically as to its external (contextual) effects; but also as to the means of design applied within the design, together with their inter-change during the emergence of a design.

After a number of design researches in varying contexts have been carried out, one discovers a complex of characteristic properties, typical for a class of buildings, independent of context; the parlance is then of typological similarities. A type may be rendered schematically. It is possible to verify whether form or structure return under different conditions (architecturally, or in terms of urban planning) and whether it maintains the same effectiveness, such as functional properties (typology).

The type is then context independent. This does not mean that the context is of *no importance* for the typology. The context is *variable,* and this variability is, therefore, the object of typological research: object(context). For each (relative) context independent type, variants of this type are subsequently described, from which the appearance may well be context dependent. The point of discussion is the level at which the spatial-functional constellation of the design is dependent on the context and, therefore, the generalisability. This research is highly concept defining for the design practice and the communication between designers, as much in the naming of the type as the context. This form of research will be discussed on page 103.

An inter-action exists between object and context. If this can be perceived during the design process, due to the fact that alternatively the object and the context are subject to scale changing design, then this is known as study by design. This form of research will be discussed on page 453.

10.2   CONTEXT DEPENDENCY

If a design features a location, it has a material (spatial, ecological, technical) and a social (economical, cultural, political) context. That context will change. The designer anticipates on future contexts (perspective) in so far as they are probable during the period of the designing process. Each design differing from any other design in space and/ or time, differs in context and perspective. This evokes questions concerning the possibilities of comparison, although these are often neglected during the study (*ceteris paribus*). However, the same design has in each material and social context a different effect on the various levels of scale. In a strict sense, one can not identify effects on the base of effects identified previously, if the

context differs. As an example the spatial environment can be a built one; or un-built. In a more general sense, one may call this concentration and de-concentration of building within a radius of circa 30, 100, 300 metres; etc. Along these lines the Schröder House of Rietveld has been perceived, once upon a time, as the outer built-up area of Utrecht city.

Nowadays it is faced by a main traffic road; with new buildings at the other side. Within a radius of 300 metres the building concentration has increased. The usage of the house has changed, as have costs of maintenance, ownership, utilisation. Is the effect still the same? Does the building still have the same characteristics in this context? To what extent is the concept, the type, the model (that means three different things!) still applicable in different contexts? This is already a subject of typological study. The design study itself is restricted to detailed description of the object, its context and the analysis of effects therein.

There are more contexts and perspectives than the spatial one. As an example, the ecological context may vary between small and considerable diversity in terms of soil, plants, growth and use: homogeneous/ heterogeneous characteristics within a radius of 30, 100, 300 metres; etc.(see page 38) On its turn the same applies to each scale level around the architectural design *vis-à-vis* technical, economical, cultural and political contexts. In the case of the technical context one should think of function segregation versus function integration within constructions[a], between constructions, but within buildings[b], between buildings, but within the ensemble[c], within neighbourhoods[d], within areas[e], within cities[f], within landscapes[g]. The economical context is determined by shrinkage versus expansion for the user, care-taker, municipality, province, national government. Culturally there may be huge difference in orientation on the traditional versus the experimental with consumers, producers, third parties and passers-by. Politically, one should ask oneself the question which agency acts in a leading versus a following rôle: user, entrepreneur, municipal, provincial or national authorities?

10.3 GROUNDS FOR COMPARISON

Red and round can not be compared. Something can not be redder than round; a particular design can not be redder than the degree to which the other design is round. Only in a poetical sense is it possible to say that a design is more useful than firm, or more firm than beautiful (alluding to Vitruvius'[h] categories). The comparison has only a scholarly character if an underlying common ground of comparison has been made explicitly.

While comparing designs or their parts, known and identified from other designs, the question whether they can be compared and, if so, in what sense, can not be avoided. In other words: which ground of comparison is chosen? In the case of red and round the two properties each have a set examples of red and round objects (extension). In order to compare them, a third set that may be counted is needed; for instance the set of recognisable objects that might be arranged as to colour and/ or shape more or less conclusively, so that one could say: "this object is more readily recognised by its colour than by its shape."[i] In that case recognisibility is the ground of comparison for red and round, colour and shape.

48   Rietveld Schröder House[j]

49   Which ground of comparison?[k]

a   For instance composite materials, stretch < > pressure.
b   For instance carry < > separate
c   For instance separate or shared walls, roofs, ducts, heating, parking facilities.
d   For instance specialisation or integration of living, working, facilities.
e   For instance combination or separation of types of traffic
f   For instance compartmentalised or rather connected dehydration.
g   For instance combination of agriculture, environment protection and recreation or rather separation.
h   Vitruvius and M. Morgan (1960) *Vitruvius: The ten books on Architecture.*
i   Key-word: recognisibility: colour and shape as cause for this.
j   Source: media-centre, Fac. of Arch. DUT.
k   Source: media-centre, Fac. of Arch. DUT.

	(Legend)	(Form)	(Structure)	(Function)	(Intention)
Independent variable					
Dependent variable					
Intention				Intention (function)	Ideology
Function	Semantics	Function (form)	Function (structure)	Human sciences	
Structure	Syntax	Structure (form)	Construction	Structure (function)	Structure (aim)
Form	Naming	Formalism	Functionalism	Structuralism	Symbolism
Legend	Logic				

50 Actions between legend, form, structure, function and intention

When comparing designs or design phases the inevitable question arises: are they comparable or not, and, if so, in which respect? In other words: which basis for comparability is to be chosen? Is it useful to compare designs with a specific magnitude, material application or colour, with specified form principles, technical, functional or intentional purposes? Can these principles be formulated beforehand or must one be surprised by the design, in order to discover essentially new, not yet formulated principles? Legend (material)[a], form[b], structure[c], function[d] and intention are, in this order, pre-supposing bases for comparison.[e]

One of these aspects, (for example, function), can be altered, within stated boundaries, (the independent variable) in order to enable the effect of the variation (the dependent variable) upon itself or upon other aspects to be reported. The function can, within a stated boundary, (for example railway stations) be varied with different design examples. Subsequently, different buildings with more or less the same function are compared in order to see which effect this has on their structure (the implemented separations and connections).

This is one of the 25 theoretically possible forms of design research differentiated upon here: structure(function).[f] In this way the structure is regarded as an action of the function (functional analysis) or more specifically as an action of the aim(intention). Structure is a design means and this form of research is known as aim-orientated research because the function of the aim as an independent variable is achieved with specific design means as the result being: means(aim). This sort of research can be carried out in the form of evaluative research (see page 149). Also methods stated in the following Chapters (predictive, evaluative, optimising research) can be utilised.
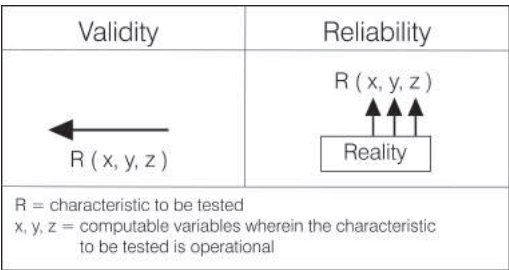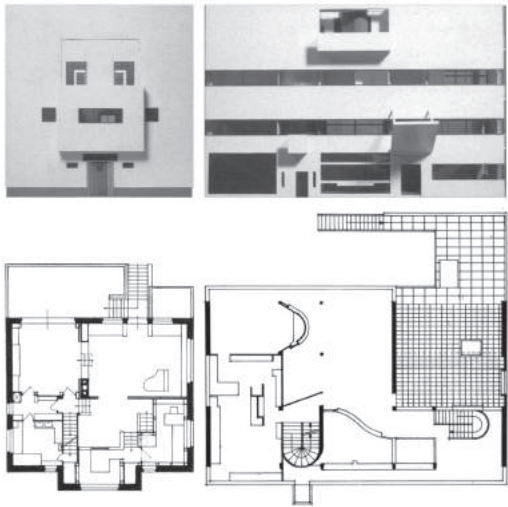
10.4 OPERATIONALISATION
Risselada placed two characteristics of architectural design opposite to one another: Raumplan <> Plan libre.[g] He presents a significant number of convincing examples of Loos and Le Corbusiers' work without being able to conclusively define the characteristics of both.

Supposing that the level wherein space boundaries and bearing constructions come together is a computable indicator 'x' from which the 'Raumplan character' R could then be measurable from a design. When x is high, the design is of type 'Raumplan', when x is low, the design is of type 'Plan libre'.

The search for such computable variables is called 'operationalising'. The level at which the characteristic to be researched is represented is called 'validity', the level at which the ranking or measuring approaches reality is called the 'reliability'

The aim of 'operationalising' is to make characteristic R that alone is an immeasurable characteristic, accessible for more quantitative research. The value of the named variable x is

a   The use of legend here refers not only to the explanatory drawing code of a drawing but also to the 'that which takes on form' in the drawing or in the proposed reality, for example 'concrete', 'brick', 'steel' or 'parking areas', 'roads', 'green areas', 'buildings'. A similar legend is normally a pre-condition in order to compare drawings, unless different legends are to be put to the test as design means, then something else has to remain constant. What would this brick building look like made of concrete?
b   The meaning of form here is the joining distribution layout of the material or of the space in or around the material. This bare concept of form has no sensation, as sensation is a function, an action of the form (distribution layout).
c   Structure, the manner in which composing parts remain as a whole is defined here as the compilation of separations and connections in a joined whole.
d   Function here is regarded as 'external action'
e   See also: Frankl, P. (1914) *Die Entwicklungsphasen der neueren Baukunst.*
f   This must be regarded as 'structure as an action of function'.
g   Risselada, M. (1988) *Raumplan versus Plan Libre: Adolf Loos and Le Corbusier 1919-1930.*

Validity	Reliability
← R (x, y, z)	R (x, y, z) ↑↑↑ Reality

R = characteristic to be tested
x, y, z = computable variables wherein the characteristic to be tested is operational

51   Raumplan and Plan libre

52   Validity and reliability

high for the Raumplan, low for the Plan libre, therefore both previously named extremes are an action of x: Raumplan<>Plan libre(x). However, does characteristic x cover the whole range of the difference, or is that only a 'half truth'? Should additional indicators be found, for example y and z: Raumplan<>Plan libre(x,y,z.)? What is the connection between x, y, and z? If they overlap, these aspects are measured twice; if there are missing factors, then short-comings in the validity exist. Are they of the same significance or should each factor be weighed up?

10.5 AIMS OR MEANS ORIENTATED APPROACH

If the design, contexts and perspectives wherein the design has been made are sufficiently described, various aspects can be analysed. The methodical, most developed analysis con-firms if the design has achieved its goal within the given context: (aim-orientated research): means(aim). The method of the aim-orientated research is discussed in more detail in the section regarding evaluation (see page 149). There are, in fact, numerous architectural solu-tions in order to achieve the same aim, from which the variation cannot be explained measur-ing efficiency. The potential to accommodate *numerous* or unexpected (non-programmed) functions (multi-functionality, robustness) is a researchable quality as well.

The question can also be inverted: if these means are utilised in the design, which aims do these serve: aim(means)? This is means-orientated research, because the design means like form and structure can be independently varied, in the relationship function(form) or function(structure), in order to determine their action on the function. Could a round building be used as a railway station?

Can a hall with a span of 50m function as a railway station? A design can have numer-ous functions that are verbally indescribable like specific forms of image qualities or non-described 'functional potentials', which have never been included in a programme. Is it pos-sible to feel at home in a round building, be able to orientate oneself? More comprehensive actions occur at this point, which are more difficult to operationalise empirically, such as 'hospitality' or 'transparency'.

The effect to be reported upon can also concern the structure or form of the design, such as the relation between structure(form) or form(form) (composition). In this case the total focus is on the formal design means, the designer's toolbox. Can a round shape com-bine itself with a rectangular form? Once these questions have been asked the structural ac-tion of such combinations can be looked at on a higher level: structure(form(form)). What are the technical consequences of a combination of rectangular and round forms?

10.6 LEGEND, FORM, STRUCTURE, FUNCTION, PROCESS

The study into the means of design is a study into the instruments that could bring us beyond the probability of empirical reality in the field of what is possible. In this the relation between form and function in the design and in the designing process is crucial. Form has perceptible (visual, tactile, motor) and conceptual functions, but does not equal it, in spite of the sugges-tion of the dictionary ("form is outward shape"). People do experience form, but form is not the same as that experiencing value. It determines, for instance, also functional and construc-tional possibilities. Form (and format!), seen separated from a possible causation, is the situ-ation of spreading of adjacent material, so that it, for instance, may be recorded, recollected and represented in co-ordinates.

Concentrated situation of spreading can be described with an outline. If a regularity is found within a spreading situation a pattern results. A pattern with an increasing density is a gradient. This gradient may be a central, bi-modal, or tri-modal one.
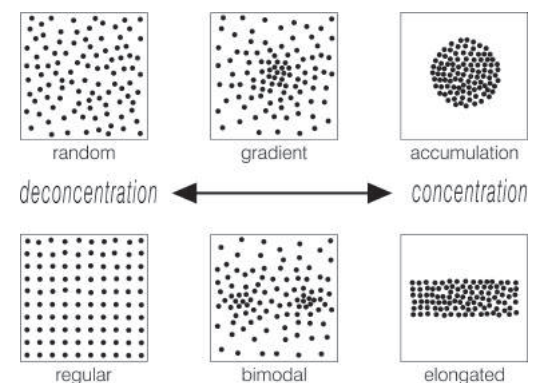
Form pre-supposes that something takes on form (material, space), expressible in a legend. The units of the legend emerge in the drawing as a situation of spreading, propor-tional to those of the material or space in reality. This form is perceived by different people from different standpoints and is associated with meaning. By the same token form does not
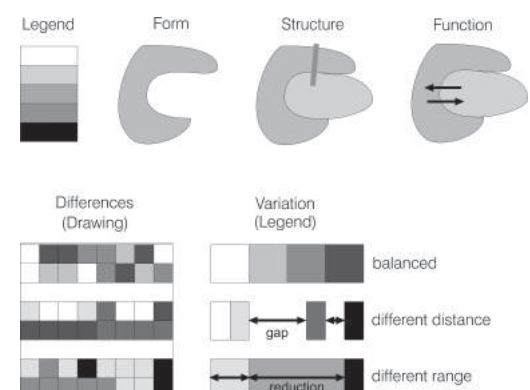

53 Difference not to be explained by the purpose [a]

$$M=f(A) \qquad A=f(M)$$

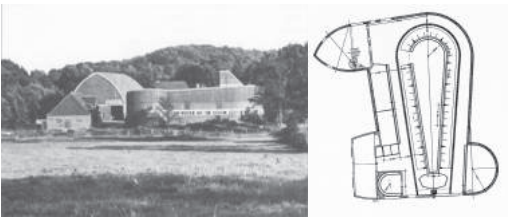54 Means resulting from Aim or vice versa?

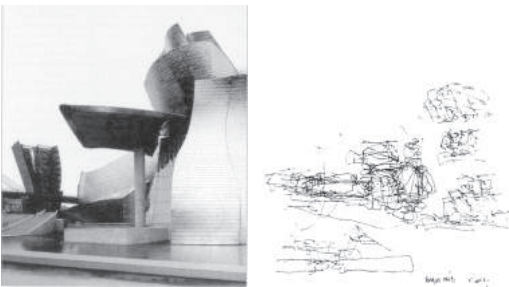55 Situations of spreading

56 Legend (material or space)

a Photograph: Theo Uytenhaak, Amsterdam

	matter	*space*	*image*
form (state of dispersion)	mass	divison	appearance
structure (separations and connections)	construction	articulation	composition
function (external action)	physics	use	meaning

57   Domains of terminology

58   Functionalism (Häring, *Cow Stable Holstein*, 1922)

59   Formalism (Gehry, *Museum Bilbao,* 1998)

equal experiencing. Experiencing is an external working (function) of the form. However, the image of the form is, in its turn, something else than the experiencing of a form: for an image may precede the form; something experiencing cannot do. Each architectural drawing features legend units in material and spatial terms which might be getting, or aiming at, structure and function. This also applies for the image or the visualisation of both.[a]
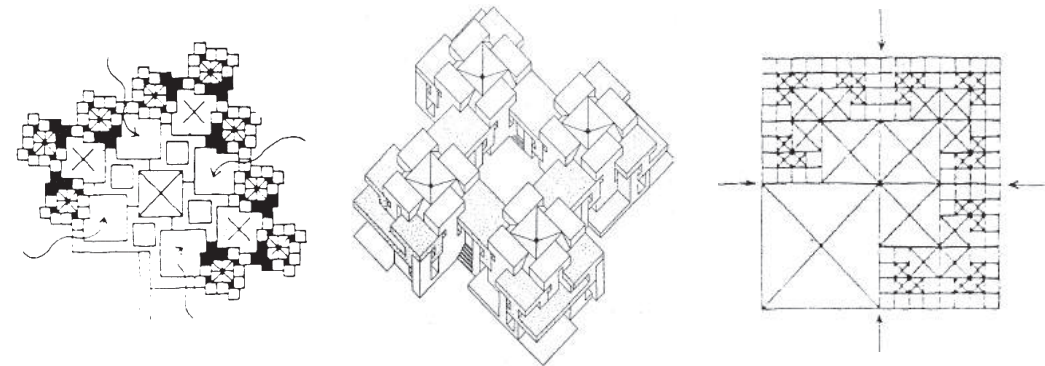
It is possible to compare individual stages of the same location or of the same design. In that case the design study concerns a design process in which the supplement or change of the drawing is evaluated.

When should the designer translate the usage function desired to form (functionalism[b]), and when is it allowed to give a form concept pride of first place (formalism[c])? 'Programme' (literally 'pre-writing') is seen in this Chapter as the working of a (prescribed) function. In the end it results in prescribed formats and separations or connections in between, with a view on the function. The question is then: should one always design from a programme, or is it possible to generate functions from a design study, for instance of the potential of the location?

   Between function and form the concept 'structure' may be placed; many regard it as one that is too ambiguous. Structure is the set connections and separations with which the constituent parts form a more than incidental whole. This is implying more than the way in which com-ponents have been put together (com-position) or a regularity therein (pattern). Is it possible to determine form and function also from the structure (structuralism)?

If the designing process is selected as foundation for comparison, a first classification may be made in terms of the multi-functionality of the product (the function aimed at). Mono-functional products, as there are an tea-pot, a road, an air-plane, feature a designing process, fundamentally differing from those applying to a building or a city. It is a much more optimising designing process than the other one, in which the large number of aims intended makes for a rather more means-orientated approach. Within the urban architectural design process a distinction may be made as to function: the Board of a School is a different kind of commissioner than a building co-operation, or a rail-road executive board. In its turn, within each function the degree of the multi-functionality aimed at is determining the degree to which the designing process is taking function as a point of departure (functional analysis as a vanguard, functionalism), or form (morphological analysis heading, formalism), or structure (structuralism), as its intention. Here study by design is catching its connecting flight to the methodology of designing itself; and so to the design study.

60   Structuralism (Blom, *Prix de Rome*, 1962)

a   Duin, L. van (1995) *Vorm en functie*; Durand, J.N.L. (1975) *Precis des lecons d'architecture (1819)*.
b   Key-word: form(function), i.e. form as a working of function.
c   Key-word: function(form), i.e. function as a working of form.

B   DESIGN RESEARCH AND TYPOLOGY

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Only if a design can be realised is it a model. The type entails the comparison of models. There are types of models, not models of types. Following the criterion of Quatremère de Quincy, quoted by Leupen (page 113), the type is not yet a model. It can not be copied in reality. Like an intuition it can not act as a model for that reality. By the same token a processing by design is needed. That applies also, although less, for the architectural notion 'concept' in the sense of 'conception', e.g. aiming at communication and consensus between designers and members of the construction team before a design or model exists.

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Design research
Van Duin and De Jong give a classification of possible studies when a context is determined.

Designerly enquiry
Breen explores what kind of study is needed before the design is ready for design research. How could we study design before it is a model to be realised and tested?

Typological research
A type is a tool, not yet a model. To elaborate a type into a design we still need a concept as Leupen will explain. Engel and De Jong give a classification of types. The design with a certain function satisfactory on this spot may be a failure elsewhere. How could we extract more context-independent types out of design research?

Concept and type
A concept summarises crucial elements of context and the object to be designed. Leupen explains the relation of concept and type in making designs. This making requires a 'technique' in the connotation of Ancient Greece (*teknè*, art, capability; *poèsis*, making). People who never designed will not be able to conceive of it while it is hard to transfer it verbally, in terms of mathematics, or even as straight pictures. This technique is increasingly supported by sketching and tutoring during designing, by specific computers programs, individually.

Analysis of buildings and plan analysis

Molema and Meyer give examples of analysing existing architectural and urban designs. There are more design methods than designers. The emphasis on design methods in the study of design of the sixties has shifted from process diagrams with stages and arrows to more spatial components: the toolbox of the designer, his means of design and the classification of design interventions.

Design driven research

Breen examines the potential for design driven research in academic environments. Making a design as such is part of the academic education in design; by the same token partial to design research. If the making of a design would not be the object of scientific study, a design education at the academic level would lack justification.

Conclusion

What may be studied in a design before a model of it exists? It is the model itself that should be made. Predecessors of the model do require attention here: the types, concepts, and other means of design. They are the main subject of this section; the next one will deal with the forming of the model following design.

10 DESIGN RESEARCH

TAEKE DE JONG
LEEN VAN DUIN

Design research - when it comes down to it, is the comparison of designs even though they are often implicit. Even if only one design (n = 1) is researched (casuistic-study), then this is carried out at the background of the design profession, its concept formation and terminology and, therefore, carried out on the basis of experience with other designs. One must be conscious of these implicit-references when describing a design and give notification of these or even present images if necessary. At least one design object and its context are explicitly described during design research. The analysis begins once the description has taken place.

For example, Lefaivre and Tzonis[a] compared in the floor plan of Van Eyck's Burgerweeshuis, its classic architectural canons with those from 'De Stijl'. They describe how Van Eyck combines these with new design means wherein both can be recognised. They enumerate a number of compositional means, not only the well-known classical and modern ones, but also their new synthesis in Van Eyck's work.

Can one selectively search for similarities using earlier experiences when carrying out design research using a definition of a problem with pre-determined-concepts and stated hypotheses therein? Can these new characteristics be discovered (which cannot be named) by means of design research (exploratory-research, heuristic-research), or does one come to a dead-end in the concept-constriction, which is imposed upon us by the convention of the use of words?

Can everything be said using words or does the drawing have to assist with this? How scientific then is the conclusion?

Are words and drawings sufficient to make the experience (and up to a point not verbally expressible, intuition) of the designer, his or her 'design-means (choice of materials, providing structure, providing form, providing function, providing intention, the integration of their conflicts or incomparability) communicable using examples? If the attempt continually gets bogged down in mysticism and only succeeds in demonstrating, then the ambition of the university design research can no longer be defended. All that remains is the traditional practice of the 'master-pupil apprentice' relationship.
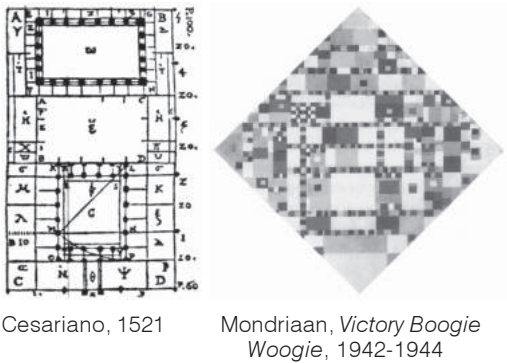
10.1 OBJECTS AND CONTEXTS

Architectural context entails everything that falls outside the frame (or within the grain) that could have bearing upon the spatial object being considered (such as the form of the location and the layout preceding the design) or vice versa (see page 38). The situation, the site and the programme of requirements belong to the context.

Therefore, strictly speaking, context is not situated *beside* or *opposite* to form.[b] After all, the (historical or prospective) context also has form, which is different at every scale level. In the table below, an overview, as a variant of Frielings' schema[c] is shown of research forms wherein the design plays a rôle.

Design study (upper right in the diagram) is a daily practice in each and every architect's office that does not exclusively work in an instinctively untraceable manner. An object must be designed for a specific context (spatial, ecological, technical, economic, cultural, and administrative). New possibilities are sought for this determined context usually using a programme of demands (part of the context). This form of research will be discussed on page 387.

TOC on right

Cesariano, 1521   Mondriaan, *Victory Boogie Woogie*, 1942-1944

Aldo van Eyck, *Burgerweeshuis*, 1960

42   See similarities in design means, Lefaivre and Tzonis (1999)

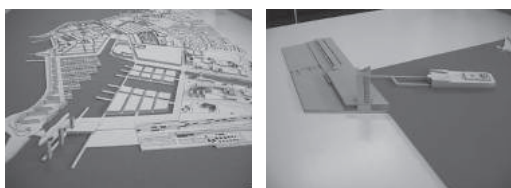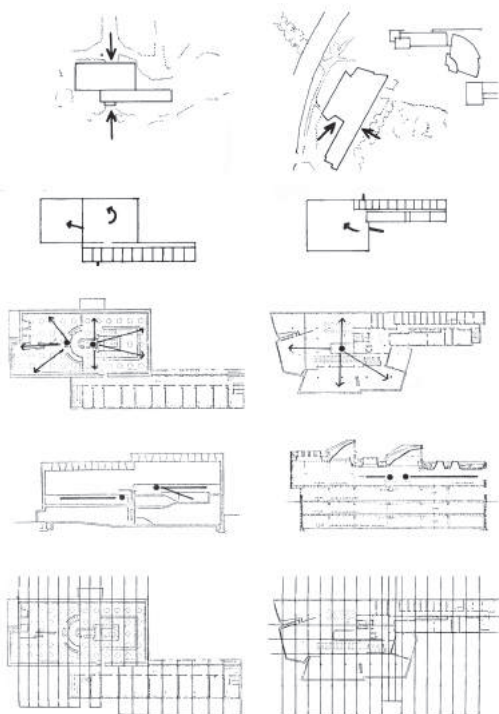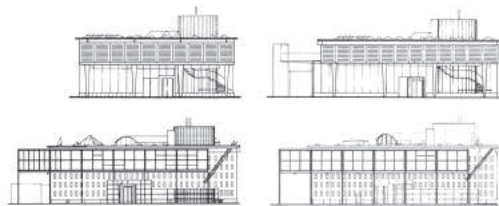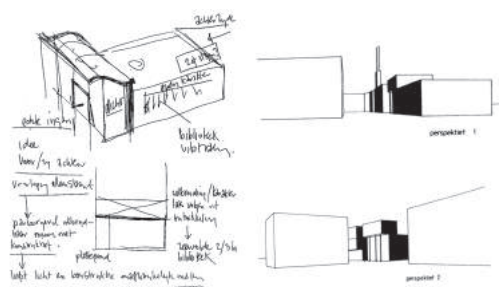| | OBJECT | |
	Determined	*Variable*
CONTEXT *Determined*	Design research	Design study
Variable	Typological research	Study by design

43   Types of design-related study

a   Lefaivre, L. and A. Tzonis (1999) *Aldo van Eyck: humanist rebel*.
b   Alexander, C. (1964) *Notes on the synthesis of form*.
c   Frieling, D.H. (1999) *Deltametropool: vorm krijgen en vorm geven*.

44 K. van Velsen, 1988, design study for the library of Zeewolde

45 Design study of the design process of the library in Zeewolde

46 Typological research of libraries

47 Study by design graduation Van der Voort

a   Duin, L. van (1985-1991) *Architectonische studies 1-7*.
b   Clark, R.H. and M. Pause (1985) *Precedents in architecture*.
c   Duin, L. van and H. van Wegen (1999) *Hybrides*.

In the figure alongside K. van Velsen studies, for instance, the possibilities of a programme and a site for his library.[a] Study of that type comprises a formal analysis and a functional analysis of the existing material and the social (programmatical) context. Apart from this, a limited number of relevant precedents[b] is studied in search of possible means of design; either implicitly, from memory, or explicitly, with the support of documentation. Strictly speaking, this is design research as discussed in the present Chapter.

Design research hones the insight into possible directions of solutions of a design problem; by the same token it contributes to development of a reasoned concept of the designing.[c] As soon as a design has been completed (and consequently, the object determined), it may be studied empirically as to its external (contextual) effects; but also as to the means of design applied within the design, together with their inter-change during the emergence of a design.

After a number of design researches in varying contexts have been carried out, one discovers a complex of characteristic properties, typical for a class of buildings, independent of context; the parlance is then of typological similarities. A type may be rendered schematically. It is possible to verify whether form or structure return under different conditions (architecturally, or in terms of urban planning) and whether it maintains the same effectiveness, such as functional properties (typology).

The type is then context independent. This does not mean that the context is of *no importance* for the typology. The context is *variable,* and this variability is, therefore, the object of typological research: object(context). For each (relative) context independent type, variants of this type are subsequently described, from which the appearance may well be context dependent. The point of discussion is the level at which the spatial-functional constellation of the design is dependent on the context and, therefore, the generalisability. This research is highly concept defining for the design practice and the communication between designers, as much in the naming of the type as the context. This form of research will be discussed on page 103.

An inter-action exists between object and context. If this can be perceived during the design process, due to the fact that alternatively the object and the context are subject to scale changing design, then this is known as study by design. This form of research will be discussed on page 453.

10.2 CONTEXT DEPENDENCY

If a design features a location, it has a material (spatial, ecological, technical) and a social (economical, cultural, political) context. That context will change. The designer anticipates on future contexts (perspective) in so far as they are probable during the period of the designing process. Each design differing from any other design in space and/ or time, differs in context and perspective. This evokes questions concerning the possibilities of comparison, although these are often neglected during the study (*ceteris paribus*). However, the same design has in each material and social context a different effect on the various levels of scale. In a strict sense, one can not identify effects on the base of effects identified previously, if the

context differs. As an example the spatial environment can be a built one; or un-built. In a more general sense, one may call this concentration and de-concentration of building within a radius of circa 30, 100, 300 metres; etc. Along these lines the Schröder House of Rietveld has been perceived, once upon a time, as the outer built-up area of Utrecht city.

Nowadays it is faced by a main traffic road; with new buildings at the other side. Within a radius of 300 metres the building concentration has increased. The usage of the house has changed, as have costs of maintenance, ownership, utilisation. Is the effect still the same? Does the building still have the same characteristics in this context? To what extent is the concept, the type, the model (that means three different things!) still applicable in different contexts? This is already a subject of typological study. The design study itself is restricted to detailed description of the object, its context and the analysis of effects therein.

There are more contexts and perspectives than the spatial one. As an example, the ecological context may vary between small and considerable diversity in terms of soil, plants, growth and use: homogeneous/ heterogeneous characteristics within a radius of 30, 100, 300 metres; etc.(see page 38) On its turn the same applies to each scale level around the architectural design *vis-à-vis* technical, economical, cultural and political contexts. In the case of the technical context one should think of function segregation versus function integration within constructions[a], between constructions, but within buildings[b], between buildings, but within the ensemble[c], within neighbourhoods[d], within areas[e], within cities[f], within landscapes[g]. The economical context is determined by shrinkage versus expansion for the user, care-taker, municipality, province, national government. Culturally there may be huge difference in orientation on the traditional versus the experimental with consumers, producers, third parties and passers-by. Politically, one should ask oneself the question which agency acts in a leading versus a following rôle: user, entrepreneur, municipal, provincial or national authorities?

48   Rietveld Schröder House[j]

10.3   GROUNDS FOR COMPARISON

Red and round can not be compared. Something can not be redder than round; a particular design can not be redder than the degree to which the other design is round. Only in a poetical sense is it possible to say that a design is more useful than firm, or more firm than beautiful (alluding to Vitruvius'[h] categories). The comparison has only a scholarly character if an underlying common ground of comparison has been made explicitly.

While comparing designs or their parts, known and identified from other designs, the question whether they can be compared and, if so, in what sense, can not be avoided. In other words: which ground of comparison is chosen? In the case of red and round the two properties each have a set examples of red and round objects (extension). In order to compare them, a third set that may be counted is needed; for instance the set of recognisable objects that might be arranged as to colour and/ or shape more or less conclusively, so that one could say: "this object is more readily recognised by its colour than by its shape."[i] In that case recognisibility is the ground of comparison for red and round, colour and shape.

49   Which ground of comparison?[k]

a   For instance composite materials, stretch < > pressure.
b   For instance carry < > separate
c   For instance separate or shared walls, roofs, ducts, heating, parking facilities.
d   For instance specialisation or integration of living, working, facilities.
e   For instance combination or separation of types of traffic
f   For instance compartmentalised or rather connected dehydration.
g   For instance combination of agriculture, environment protection and recreation or rather separation.
h   Vitruvius and M. Morgan (1960) *Vitruvius: The ten books on Architecture*.
i   Key-word: recognisibility: colour and shape as cause for this.
j   Source: media-centre, Fac. of Arch. DUT.
k   Source: media-centre, Fac. of Arch. DUT.

Independent variable	(Legend)	(Form)	(Structure)	(Function)	(Intention)
Dependent variable					
Intention				Intention (function)	Ideology
Function	Semantics	Function (form)	Function (structure)	Human sciences	
Structure	Syntax	Structure (form)	Construction	Structure (function)	Structure (aim)
Form	Naming	Formalism	Functionalism	Structuralism	Symbolism
Legend	Logic				

50 Actions between legend, form, structure, function and intention

When comparing designs or design phases the inevitable question arises: are they comparable or not, and, if so, in which respect? In other words: which basis for comparability is to be chosen? Is it useful to compare designs with a specific magnitude, material application or colour, with specified form principles, technical, functional or intentional purposes? Can these principles be formulated beforehand or must one be surprised by the design, in order to discover essentially new, not yet formulated principles? Legend (material)[a], form[b], structure[c], function[d] and intention are, in this order, pre-supposing bases for comparison.[e]

One of these aspects, (for example, function), can be altered, within stated boundaries, (the independent variable) in order to enable the effect of the variation (the dependent variable) upon itself or upon other aspects to be reported. The function can, within a stated boundary, (for example railway stations) be varied with different design examples. Subsequently, different buildings with more or less the same function are compared in order to see which effect this has on their structure (the implemented separations and connections).

This is one of the 25 theoretically possible forms of design research differentiated upon here: structure(function).[f] In this way the structure is regarded as an action of the function (functional analysis) or more specifically as an action of the aim(intention). Structure is a design means and this form of research is known as aim-orientated research because the function of the aim as an independent variable is achieved with specific design means as the result being: means(aim). This sort of research can be carried out in the form of evaluative research (see page 149). Also methods stated in the following Chapters (predictive, evaluative, optimising research) can be utilised.
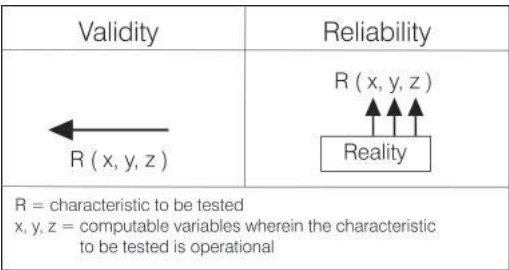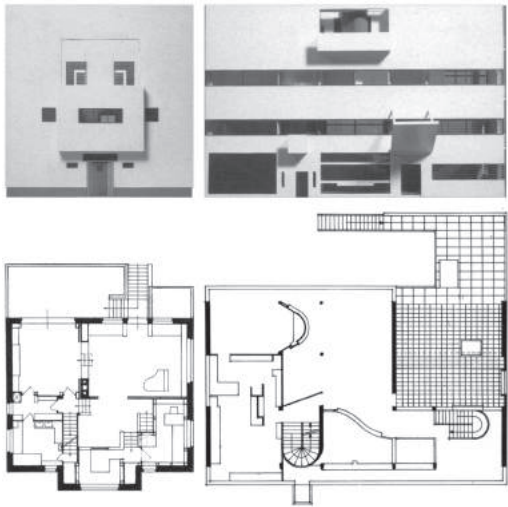
10.4 OPERATIONALISATION

Risselada placed two characteristics of architectural design opposite to one another: Raumplan <> Plan libre.[g] He presents a significant number of convincing examples of Loos and Le Corbusiers' work without being able to conclusively define the characteristics of both.

Supposing that the level wherein space boundaries and bearing constructions come together is a computable indicator 'x' from which the 'Raumplan character' R could then be measurable from a design. When x is high, the design is of type 'Raumplan', when x is low, the design is of type 'Plan libre'.

The search for such computable variables is called 'operationalising'. The level at which the characteristic to be researched is represented is called 'validity', the level at which the ranking or measuring approaches reality is called the 'reliability'

The aim of 'operationalising' is to make characteristic R that alone is an immeasurable characteristic, accessible for more quantitative research. The value of the named variable x is

a   The use of legend here refers not only to the explanatory drawing code of a drawing but also the 'that which takes on form' in the drawing or in the proposed reality, for example 'concrete', 'brick', 'steel' or 'parking areas', 'roads', 'green areas', 'buildings'. A similar legend is normally a pre-condition in order to compare drawings, unless different legends are to be put to the test as design means, then something else has to remain constant. What would this brick building look like made of concrete?
b   The meaning of form here is the joining distribution layout of the material or of the space in or around the material. This bare concept of form has no sensation, as sensation is a function, an action of the form (distribution layout).
c   Structure, the manner in which composing parts remain as a whole is defined here as the compilation of separations and connections in a joined whole.
d   Function here is regarded as 'external action'
e   See also: Frankl, P. (1914) *Die Entwicklungsphasen der neueren Baukunst*.
f   This must be regarded as 'structure as an action of function'.
g   Risselada, M. (1988) *Raumplan versus Plan Libre: Adolf Loos and Le Corbusier 1919-1930*.

Validity	Reliability
	R (x, y, z)
← R (x, y, z)	↑↑↑ Reality

R = characteristic to be tested
x, y, z = computable variables wherein the characteristic to be tested is operational

51 Raumplan and Plan libre

52 Validity and reliability

high for the Raumplan, low for the Plan libre, therefore both previously named extremes are an action of x: Raumplan<>Plan libre(x). However, does characteristic x cover the whole range of the difference, or is that only a 'half truth'? Should additional indicators be found, for example y and z: Raumplan<>Plan libre(x,y,z.)? What is the connection between x, y, and z? If they overlap, these aspects are measured twice; if there are missing factors, then short-comings in the validity exist. Are they of the same significance or should each factor be weighed up?

10.5 AIMS OR MEANS ORIENTATED APPROACH

If the design, contexts and perspectives wherein the design has been made are sufficiently described, various aspects can be analysed. The methodical, most developed analysis con-firms if the design has achieved its goal within the given context: (aim-orientated research): means(aim). The method of the aim-orientated research is discussed in more detail in the section regarding evaluation (see page 149). There are, in fact, numerous architectural solu-tions in order to achieve the same aim, from which the variation cannot be explained measur-ing efficiency. The potential to accommodate *numerous* or unexpected (non-programmed) functions (multi-functionality, robustness) is a researchable quality as well.

The question can also be inverted: if these means are utilised in the design, which aims do these serve: aim(means)? This is means-orientated research, because the design means like form and structure can be independently varied, in the relationship function(form) or function(structure), in order to determine their action on the function. Could a round building be used as a railway station?

Can a hall with a span of 50m function as a railway station? A design can have numer-ous functions that are verbally indescribable like specific forms of image qualities or non-described 'functional potentials', which have never been included in a programme. Is it pos-sible to feel at home in a round building, be able to orientate oneself? More comprehensive actions occur at this point, which are more difficult to operationalise empirically, such as 'hospitality' or 'transparency'.

The effect to be reported upon can also concern the structure or form of the design, such as the relation between structure(form) or form(form) (composition). In this case the total focus is on the formal design means, the designer's toolbox. Can a round shape com-bine itself with a rectangular form? Once these questions have been asked the structural ac-tion of such combinations can be looked at on a higher level: structure(form(form)). What are the technical consequences of a combination of rectangular and round forms?

10.6 LEGEND, FORM, STRUCTURE, FUNCTION, PROCESS

The study into the means of design is a study into the instruments that could bring us beyond the probability of empirical reality in the field of what is possible. In this the relation between form and function in the design and in the designing process is crucial. Form has perceptible (visual, tactile, motor) and conceptual functions, but does not equal it, in spite of the sugges-tion of the dictionary ("form is outward shape"). People do experience form, but form is not the same as that experiencing value. It determines, for instance, also functional and construc-tional possibilities. Form (and format!), seen separated from a possible causation, is the situ-ation of spreading of adjacent material, so that it, for instance, may be recorded, recollected and represented in co-ordinates.

Concentrated situation of spreading can be described with an outline. If a regularity is found within a spreading situation a pattern results. A pattern with an increasing density is a gradient. This gradient may be a central, bi-modal, or tri-modal one.
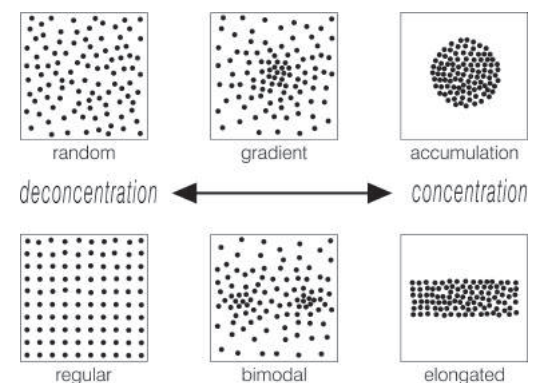
Form pre-supposes that something takes on form (material, space), expressible in a legend. The units of the legend emerge in the drawing as a situation of spreading, propor-tional to those of the material or space in reality. This form is perceived by different people from different standpoints and is associated with meaning. By the same token form does not
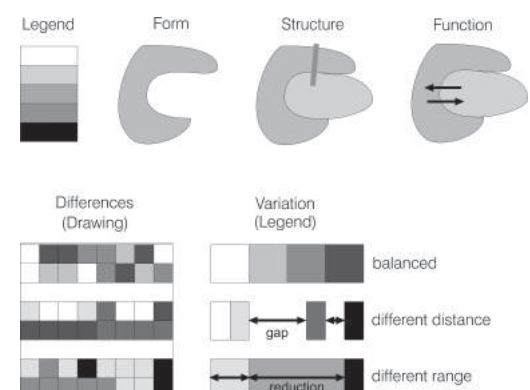

53 Difference not to be explained by the purpose [a]

$$M=f(A) \qquad A=f(M)$$

54 Means resulting from Aim or vice versa?
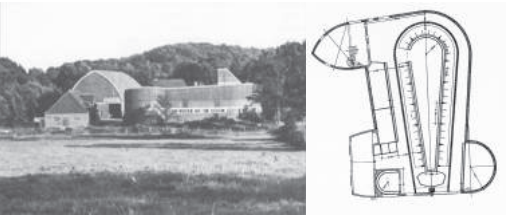

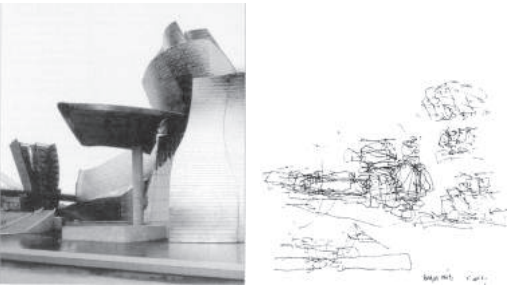55 Situations of spreading

56 Legend (material or space)

a Photograph: Theo Uytenhaak, Amsterdam

	matter	*space*	*image*
form (state of dispersion)	mass	divison	appearance
structure (separations and connections)	construction	articulation	composition
function (external action)	physics	use	meaning

57 Domains of terminology

58 Functionalism (Häring, *Cow Stable Holstein*, 1922)

59 Formalism (Gehry, *Museum Bilbao,* 1998)

equal experiencing. Experiencing is an external working (function) of the form. However, the image of the form is, in its turn, something else than the experiencing of a form: for an image may precede the form; something experiencing cannot do. Each architectural drawing features legend units in material and spatial terms which might be getting, or aiming at, structure and function. This also applies for the image or the visualisation of both.[a]
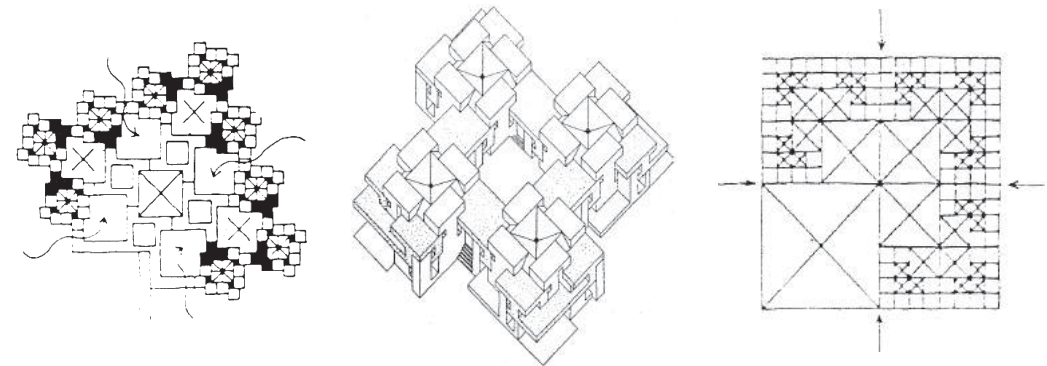
It is possible to compare individual stages of the same location or of the same design. In that case the design study concerns a design process in which the supplement or change of the drawing is evaluated.

When should the designer translate the usage function desired to form (functionalism[b]), and when is it allowed to give a form concept pride of first place (formalism[c])? 'Programme' (literally 'pre-writing') is seen in this Chapter as the working of a (prescribed) function. In the end it results in prescribed formats and separations or connections in between, with a view on the function. The question is then: should one always design from a programme, or is it possible to generate functions from a design study, for instance of the potential of the location?

Between function and form the concept 'structure' may be placed; many regard it as one that is too ambiguous. Structure is the set connections and separations with which the constituent parts form a more than incidental whole. This is implying more than the way in which com-ponents have been put together (com-position) or a regularity therein (pattern). Is it possible to determine form and function also from the structure (structuralism)?

If the designing process is selected as foundation for comparison, a first classification may be made in terms of the multi-functionality of the product (the function aimed at). Mono-functional products, as there are an tea-pot, a road, an air-plane, feature a designing process, fundamentally differing from those applying to a building or a city. It is a much more optimising designing process than the other one, in which the large number of aims intended makes for a rather more means-orientated approach. Within the urban architectural design process a distinction may be made as to function: the Board of a School is a different kind of commissioner than a building co-operation, or a rail-road executive board. In its turn, within each function the degree of the multi-functionality aimed at is determining the degree to which the designing process is taking function as a point of departure (functional analysis as a vanguard, functionalism), or form (morphological analysis heading, formalism), or structure (structuralism), as its intention. Here study by design is catching its connecting flight to the methodology of designing itself; and so to the design study.

60 Structuralism (Blom, *Prix de Rome*, 1962)

a   Duin, L. van (1995) *Vorm en functie*; Durand, J.N.L. (1975) *Precis des lecons d'architecture (1819)*.
b   Key-word: form(function), i.e. form as a working of function.
c   Key-word: function(form), i.e. function as a working of form.

11 DESIGNERLY ENQUIRY

JACK BREEN

This contribution explores the opportunities for *design driven* approaches to architectural research. Starting with an investigation into the broad domain of architectural design and its working methods, the relationships between design and scientific methods of research are explored. The discourse focuses on instruments and procedures that are suitable in order to approach design products and design thinking within a research context. It is argued that *designerly* modes of *enquiry* can offer opportunities for the benefit of innovative design driven research.

11.1 DESIGN

How should architectural design be considered in a (scientific) research perspective? What are the aims of design activity? Can characteristic methods of design be identified?

The primary aim of architectural design (in the broadest sense) is the creation of shelters and surroundings which should be functionally and structurally sound and create a sense of 'place'. The result should ideally be visually pleasing and contribute to a sense of emotional well-being, creating room for human activity and experience. The classic pre-requisites formulated by Vitruvius: *firmitas, utilitas, venustas* (durability, utility and beauty), are generally still considered pertinent today.[a]

The act of designing is a form of creative *organisation*, which takes place on different 'levels' within an overall design *concept* (often simultaneously). A design is 'work in progress' which is gradually developed and refined from an initial idea to a built environment. In the course of the design process a designer will generate design propositions which are judged on functional, structural, material and aesthetic levels, to name but a few.

During a design trajectory intermediate (sub-)solutions are constantly being generated and evaluated in relation to the composition *as a whole*. This interactive approach - focusing on the overall composition as well as on its constituting components and details (and vice versa) - is characteristic of architectural design activity.

Designers work towards proposals which offer a fitting 'answer' to a specific context, a given programme and sets of economic constraints. At the same time they endeavour to create *authentic,* even *novel* solutions: end products which are experienced as more than a sum of separate solutions: as a *synthesis* of form, material and space (Kurokawa even suggests that design elements may be considered to co-exist in a state of *symbiosis*).[b]

In their work, designers address a variety of formal themes, such as: order and contrast; size and proportion; rhythm and (inter)space; symmetry and asymmetry; symbol and ornamentation; exploiting the expressive qualities of materials and the effects of light and colour, in order to shape new architectural objects and environments. On a compositional level this may involve creating visual *tension* between different, constituting parts, but the design ought not to be perceived as 'falling apart'. In a kind of 'balancing act' between order and chaos, the designer tries to achieve a form of *harmony* throughout the composition as a whole.

Alberti, paraphrasing Vitruvius: *"Beauty consists of a rational integration of proportion of all the parts of a building, in such a way that every part has its fixed size and shape, and nothing could be added or taken away without destroying the harmony of the whole."*[c]

P.F. Smith: *"The most successful buildings are those which clearly express their elements, but which, at the same time, come across as wholes which are much greater than the sum of their parts. This is the primary aesthetic 'dialectic' in architecture. Aesthetic success demands that orderliness wins, but not too easily. There has to be sufficient complexity to make the perception of unity a worthwhile mental achievement."*[d]

a   Vitruvius *De architectura libri decem*. (from the English translation: Vitruvius and M. Morgan (1960) *Vitruvius: The ten books on Architecture*.

b   Kurokawa, K. (1991) *Intercultural architecture, the philosophy of symbiosis*.

c   Wittkower, R. (1952) *Architectural principles in the age of humanism*. p. 6.

d   P.F. Smith in: Canter, D., M. Krampen et al. (1988) *Environmental perspectives*: *"The most successful buildings are those which clearly express their elements but which, at the same time, come across as wholes which are much greater than the sum of their parts. This is the primary aesthetic "dialectic" in architecture. Aesthetic success demands that orderliness wins, but not too easily. There has to be sufficient complexity to make the perception of unity a worthwhile mental achievement"*.

Fundamental to creative composition is *knowledge* and *understanding*. One needs to acquire cultural and technical knowledge and acquire *insights* into relevant design options and the effects of design *decisions*. Designing is a process of *searching* for a 'correct' result. This quest can be considered 'empirical' only in so far as that it tends to follow a path of *trial and error*. In a design process there is not one 'correct' outcome. The designer can come up with a *variety* of potential solutions, each of which would lead to considerably different environmental qualities and spatial experiences, if built.

Although the design process itself is clearly not 'scientific' in nature, the designer does make use of many sources of knowledge and information, which contribute to shaping the end product. In education, a proven method of acquiring knowledge and insight is the study of *precedents*, to be analysed systematically. Recurring formal themes and characteristic forms of variety make it possible to identify specific *types* of design artefacts. These can be organised systematically in design *typologies* which may in turn contribute to understanding and appreciation of *specific* design artefacts.

One of the most effective compositional structuring devices was traditionally the architectural *style*. In the Renaissance, the renewed orientation on 'classical' architecture of Romans and Greeks led to a set of stylistic rules which would not necessarily lead to the same result, but could be applied with a certain amount of freedom and inventiveness by different designers. After the emergence of the modern movement in the early twentieth century, the classical rules were declared obsolete. No generally accepted stylistic framework has taken their place. Although designers frequently refer to their knowledge of historical examples, and may at times *re-interpret* previous themes or even borrow directly from design examples, designers frequently attempt to cross - or at least to 'stretch' – existing boundaries. Design practitioners are constantly 're-inventing' what was conceived before, within the shifting cultural (and technological) climate of the moment.

The cultural climate of the twentieth century *fin-de-siècle* seems to have given rise to a tendency amongst leading designers to keep surprising their audience with 'original' solutions in order to stay in the limelight. In contemporary architecture there is a tendency not to adhere to any pre-determined, binding themes – or indeed *methods* - of design, but rather to make choices within a framework of plan-specific design rules developed *per project*. The contemporary architectural 'landscape' offers both the familiar and the innovative. We bear witness to a constantly shifting 'parade' of architectural forms and themes. There is no generally accepted architectural style, no standard set of *rules*.

Architectural and urban plans are not created directly 'in situ', but are conceived, notated and communicated via specialised design *media*. Drawings and *models* are generated to explore and create insights into the 'workings' of the design. By learning to 'read' visual information design students develop the ability to translate ideas into form. Images are used to lay down ideas, this information can then be shared and communicated to others.

Design processes tend to be *iterative*, following a series of successive 'loops'. At any given point, the 'state' of the design is evaluated in relation to previous steps and successively developed further. It is essentially a process of creative *imaging,* as Zeisel indicated.[a] Imaging is a form of communication with oneself (or with other partners in a design team), a way of questioning or verifying the merits of intermediate design ideas and developing new options and strategies. As such, the imaging process is a way of 'channelling' inspiration; the designer thinking while *doing* and reacting directly to ideas as they are being visualised, reflecting, eliminating and refining, subsequently making decisions and documenting the results. By determining *criteria* (frequently on the basis of 'taste') judgements are made concerning the *qualities* and *potentials* of different ideas.

a   Zeisel, J. (1985) *Inquiry by design: tools for environment-behavior research.*

The working *methods* of designers may have been changed to a certain extent by the recent influx of computer aided techniques, but design *composition* remains a way of getting to the *heart* of the matter: a process of simultaneous development and testing of ideas, involving reflection, selection, reduction and perfection. There is no such thing as a 'standard' approach to designing. Although all sorts of themes are constantly (re)surfacing within design processes, design itineraries and working styles vary considerably, from one designer to another and frequently even *per* designer, depending on the kind of project at hand.[a] Viewed in this light, the *imaging* process, involving the active use of various design media, should perhaps be regarded as the most enduring *method* of design.[b]

11.2   DESIGN AND RESEARCH

What is the relationship between design and research? To what extent might design products be considered as research output? What are the characteristic aims and methods of design orientated research?

It may be clear that design is a broad field of enterprise that cannot easily be 'tied down'. Working methods and formal composition tend to be determined by personal preferences and dynamic – cultural, technological, economic and ecological – developments (including fashions). The design process is not orderly and linear, but unpredictable and may – to an outsider – seem haphazard and erratic, even chaotic. Projecting scientific models of thought onto such a complex, varied and layered domain can easily lead to gross reductionism or simplification, in which case the – so called – 'research' findings will not be taken seriously by design practitioners or academics.
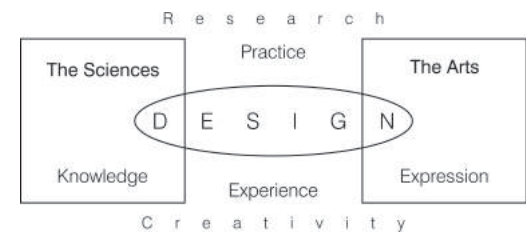
It is important to realise that *design practice* and *design research* are activities which, as it were, move in *different directions*, back and forth between (historical and contemporary) *culture* and (technical and applied) *science.* Architectural design is a development process which is both *creative* and *rational*, drawing from a wide range of knowledge and experience, concerning technical, practical and cultural aspects. An 'in-between' realm: broad and multi disciplinary; traditional as well as innovative; stretching into the domains of the Technical Sciences on the one hand and those of the Arts on the other.

61 Scheme 1: The in-between realm of design

De Jong:*"Some futures can be predicted, others must be designed"*[c]

Designing is essentially an activity of conceiving futures. Instead of looking back, designers are inclined to look towards 'what might be', they seldom look back in order to understand what has come to be and why. They apply their knowledge in a pragmatic way, but they are also inclined to 'bend the rules' for aesthetic effect whenever they consider it necessary. Such 'poetic licence' may be at the root of persistent objections to architectural design and research activity by conventionally inclined academics. However, it is precisely this tension between logical and aesthetic considerations that makes architectural compositions so *complex* - and therefore so challenging.

A design remains a mental 'construction' up to the moment it is actually built and begins to function within surroundings that have been altered by its introduction. In the unpredictable and iterative design process, various options are developed and 'tested'; a process which is rational as well as intuitive. Designers base their conceptions on experience and knowledge but are often able to take 'shortcuts' and 'bypasses', using *intuition* fed by knowledge and experience. As such a design product is clearly not the same as research output. A designer is primarily involved in a creative process aimed at reaching a solution which is – in principle – 'buildable', whereas a researcher is involved with the evolvement of *knowledge* .

To put it another way: the ambition of *archi*-tects (the traditional 'masters' of the combined building disciplines - in present-day conditions often 'creative directors' of complex planning

a   Bakel, A.P.M. van (1995) *Styles of architectural designing: empirical research on working styles and personality dispositions*.

b   Breen, J.L.H. (2000) *The medium is the method: media approaches to the designerly enquiry of architectural compositions*.

c   Jong, T.M. de (1992) *When is designing also research*?

processes) is to create *architecture*; to achieve the 'highest' form of building production. Architectural *researchers* attempt to *understand* architectural thought and expression. Their ambition is to uncover the 'origins' and the 'workings' of architectural artefacts and as such they might be considered as '*arche*-tects'.

Architectural researchers have to ask 'how and why' questions. This involves fact-finding, systematic analysis and documentation in an orderly manner. However, it might also require thinking - and possibly even *acting* - along the lines of designers.

Inventive, innovative design research may call for the *re-searcher* to get 'behind' the architectural *search* and its results. A kind of 'detective' approach involving logical thought and systematic (comparative) analysis as well as less 'stable' forms of (designerly) enquiry, in an attempt to get behind the 'event'.

Press: *"Research is the systematic investigation towards increasing the sum of knowledge which is reported in a form which renders both methods and outcomes accessible to others."*[a]

De Jong and van der Voordt: *"Study is a collective term to denote the furthering of knowledge through profound thought, by carrying out experiments and by identifying and collecting subject matter which is processed and analysed systematically."*[b]

Design research might aim at quite different areas of design efforts, like *product development* (devising new or better building components and technical solutions) or *practical applications* (aiming at the development of methods and new design tools), but a great deal of design driven research is aimed at *understanding* the workings and backgrounds of designs and design thinking. This is essentially *fundamental* research, even if the subject of study is by definition not 'pure', but *applied*.

Scholars find themselves confronted with an enormous *quantity* and *variety* of architectural artefacts - each with its own specific *context* and characteristic *synthesis* of space, form, material and detail. How should researchers set about exploring this extensive field of enquiry?

Architectural compositions are not necessarily 'technically' complicated. What really makes designs complex is the *inter-play* of different *sorts* of aspects within a relatively coherent 'whole'. Whereas common scientific principles usually require the researcher to focus on specific, narrowly defined issues - which may be studied *intensively* – it often proves to be difficult for researchers to 'unravel' designs to such an extent that an unambiguous field of study, with clear boundaries, can be determined. For this reason, design research output is often viewed with scepticism by professionals from other disciplines, who may consider the outcomes too broad, longwinded and 'fuzzy'.

For the sake of clarity, architectural researchers need to 'narrow down' their subject matter considerably. On the other hand, this should not lead to disproportionate *simplification* or abstraction. Without sufficient 'context', design research can easily become totally irrelevant in the eyes of design experts.

Henket: *"Designing is working across the width of a broad domain, science should attempt to investigate the connections within this realm of design."*[c]

Jansen: *"Intensive study of a tiny bit of some item with a thousand facets, that leads to output!"*[d]

Duffy:*"Architectural knowledge does not 'sit well' in academic structures."*[e]

It is not terribly difficult to paint a negativistic picture of the opportunities for design research in an academic environment[f], but the challenge should be to *develop* forms of research which do justice to the kinds of mental activities and procedures that are fundamental to design.

a   Press, M. (1995) *It's Research Jim.*
b   Jong, T.M. de and D.J.M. van der Voordt (2000) *Criteria for scientific research and design.*
c   Architect Prof. ir. H.A.J. Henket, speaking at the Architecture faculty, TU Delft, April 2000.
d   Information Technologist Professor dr.ir. F.W. Jansen, speaking at the faculty of Architecture, TU Delft, May 2000.
e   Francis Duffy: "The kind of architectural research I value most fits uncomfortably with academic models of what research ought to be." Duffy, F. (1996) *The Value of a Doctorate in Architectural Practice.*
f   Architect Professor Carel Weeber: "... at this university of technology people are mainly taken with empirical-technical research and the diffuse situation of architectural culture ensures that each research proposal is immediately branded as wrong by other architects. Thus, there seems to be no room at Dutch universities for design studies, and we may be relinquishing control of the development of the profession to journalism and the theorising of the art-historical sciences." In: Weeber, C. (1992) *Dutch architecture today.*

Designers make use of their own arsenal of knowledge, insights and skills. These should not be ignored, but made operational in relevant, innovative forms of study. Designing – as an activity - can potentially be made instrumental in research, as long as the aim of such an application is the furthering of knowledge and understanding.

Matthews:*"There is a need to reclaim design research for designers. Too much design research has been conducted by technologists, systems practitioners, historians, psychologists, sociologists, anthropologists, organisation and management theorists. Too much design research has been research into design. Too little design research has been research conducted by designers doing what they do best - designing."*[a]

An important requirement of an architectural *research* project - as opposed to a design process - is that it must be methodically *transparent*, as well as *systematic* in the way insights are gathered and subsequently communicated. The characteristically wide range of design endeavours should not be denied, but should somehow be 'tamed' for the benefit of research.

Most contemporary architectural research tends to be *descriptive*, often focusing on the oeuvres of individual architects or groups and their underlying ideological motivations. However, design research might involve *applying* design knowledge and experience in order to get behind the kinds of *considerations* and *choices* which determine the end product and to understand how such an object or environment is *conceived* and *perceived*. This has to include the characteristic *interplay* of compositional aspects. At the same time it means introducing certain *constraints*, which may narrow down the field of study, without this leading to reductionism or simplification. This must involve an attempt at identifying themes, defining meanings, establishing relationships and unravelling the complex patterns on the level of design composition.

Matthews: *"Design is not only a great orchestrator of knowledge, it constructs its own peculiarly polyvalent knowledge which makes visible and realisable the possibility of change."*[b]

Duffy:*"It is absolutely necessary for architects to re-define architectural knowledge in a way which commands public respect. ... We architects need to invent our own models, our own future, in our own way"*[c]

Design clearly does not fit comfortably the kinds of empirical conceptions characteristic for scientific research. Design activity is not the same as research activity, but it can certainly *lead* to research. This implies that something must be *done* with the design product or process in an orderly way.

In this respect researchers should not simply try to *imitate* the working methods of other research disciplines. Design driven research projects require methods - or combinations of methods - which *do justice* to the nature of design, while at the same time learning from proven scientific methods, by adapting these or by finding suitable models and methods for design driven research. This means *designing* and *initiating* new forms of research.

11.3 DESIGNERLY ENQUIRY

What sorts of enquiry might be considered to be characteristic of design? What are the potentials for approaches involving controlled design activity in design education and design driven research?

Architects have a reputation of being far more interested in design(ing) than in research.Architectural practitioners are primarily concerned with the conception and realisation of built environments, inclined to move on swiftly to the next project, generally spending little time evaluating precise effects of their creations after they have been built.

However, the designer's search for the right solution(s) is a venture driven by an *inquisitive* nature and a *creative* approach. To a certain extent the kinds of study carried out by a designer in the course of such a process might be considered a form of research, but the designer's way of working and thinking is also quite different from familiar scientific research.

a Matthews, G. (1996) *Doctorates in Design? Why we need a research culture in design.*
b Idem.
c Duffy, F. (1996) *The Value of a Doctorate in Architectural Practice.*

The designer is involved in *problem solving*, using his or her imagination to develop - and indeed to predict - a *successful* final solution. However, design solutions are expressed not so much as conceptions, but as (proposed) *form.* The designer's thinking process is essentially a process of *transformation.*This 'search' involves a specific kind of active *exploration*, for which Bruce Archer has introduced the term *designerly enquiry.*

Archer: *"The idea of Design as a broad area of man's concerns, comparable with Science and Humanities, seems to be defensible in pedagogic terms. The idea that there exists a designerly mode of enquiry, comparable with but distinct from, the scientific and scholarly modes of enquiry seems to be defensible by the design methods literature"*.[a]

Such a *designerly* way of thinking is typical of design. It is a kind of problem solving which transforms a relatively complex problem into a workable solution, which may be tested, judged and effectuated afterwards. Other activities requiring such *foresight*, like setting up a workable planning, developing an educational curriculum or organising a sound research experiment, could also be considered as forms of designerly enquiry…

The intellectual aptitude – usually denoted with *talent* – required for such *visionary* reasoning is not universal. Some people can be said to 'have' more designerly abilities than others. Design students are expected to have such talents, although it is not easy to recognise whether first-year students have the necessary capabilities. Designerly modes of enquiry deserve to be recognised as *intelligent* forms of enquiry, that it works and can be used in projects requiring problem solving directed towards creating a workable product.

What is of interest is if the *direction* of such enquiry can, as it were, be 'turned around': if designerly enquiry can be directed towards a better *understanding* of a product and the *sort* of 'solving' that went into it…

If so, it can be argued that this aptitude is not only necessary for designers in order to make designs, but also important for researchers involved in design driven research. If – as might be conceivable – this is not the researcher's 'greatest talent', it would be worthwhile to get others – more expert in designerly working methods – involved in research projects. In this context, term designer*ly* enquiry seems appropriate, precisely because it has a certain, elegant *ambiguity*. It is a concept which can denote practical designing activities, but also suggests an *'as if'* designing approach, which may be particularly relevant in design education as well as in research *experiments*.

Design work needs to be carried out rigorously and conscientiously, if one is not to be confronted with 'unpleasant' surprises at the end. In this respect there is not that much difference between design and research. Designerly enquiry calls for (and to a certain extent is even *dependent* upon) *imaginative* insights. At the same it should be recognised that the working processes of design are relatively methodical and transparent, even predictable. On a 'creative' level, a design process requires both artistic and logical consideration, involving what David Bohm would regard as *imaginative* and *rational* insight and fancy.[b]

Hertzberger: *"Designing is a complex thinking process with its own possibilities and limitations, within which ideas are developed fairly systematically."*[c]

Which characteristics of designerly enquiry might be considered pertinent for other forms of study, like education and research? In the following overview four significant attributes of designerly enquiry are identified and discussed briefly.

11.4   DESIGNERLY CATEGORIES OF ENQUIRY:

a.   *Designerly decomposition*

As it is impossible for a designer to constantly address a design project as a whole, regarding all its facets with equal attention, there is a tendency to 'decompose' the design. The project

a   Archer, B. (1981) *A view of the nature of design research.*
b   Bohm, D. and L. Nichol (1998) *On creativity.*
c   Hertzberger, H. (1999) *De ruimte van de architect: lessen in architectuur 2*, p. 28. English translation: (2000) *Space and the architect: lessons in architecture 2.*

is as it where 'taken apart' (and subsequently re-assembled), so that items of importance can be isolated and developed further in detail. The designer should be able to focus on specific *parts* of the composition and on *combinations* of parts in relation to the concept as a *whole*. In this way it becomes possible to recognise levels of priority and room for variation. By organising such information, decisions can be made relatively objectively. Essentially this attitude involves loops of successive decomposing – and *re-composing* – the project at hand.

b.   Designerly variation
An important part of designing a project is developing forms of systematic organisation. Such project specific *structuring* devices set the tone for the types of compositional *variation* which are opportune on different levels. Finding the right dimensions, rhythms, proportions, sub-divisions, connections, materials and colours (to name but a few) requires relatively system-atic study. For this reason different variations (often on the basis of some identifiable theme or *motif*) are worked out, compared and evaluated. One of these 'solutions' may consequently be chosen, to form the basis for further designerly developments.

c.   Designerly visualisation
Possible design solutions need to be *made visible*, not only for the benefit of the designer or the development team, but also for other 'actors' involved. Such visualisation, using design media is essential for design *communication*. Drawings and models can in a way be considered the primary 'language' of the designer. At the same time they form a kind of 'laboratory' involving (de)composition, selection and variation. The designer uses this visualisation ability to create impressions of the *effects* of potential design decisions, which makes choices *accessible*.

d.   Designerly reference study
If an architect receives a commission for a particular kind of building - a museum, hospital, bank or housing complex - this usually involves extra 'homework', in order to get acquainted with specific demands, regulations and considerations. Designers often refer to *precedents* - usually more or less comparable, previously realised projects - which may be arranged in a kind of temporary 'project library'. Such references allow for comparison with similar *types* of projects and solutions. Findings are not translated literally into the design at hand, but pri-marily allow for *reflection* concerning the merits of intermediate design solutions.

In a design process, activities such as those mentioned above help to keep the 'thought experi-ments' constantly carried out relatively orderly and transparent not only to the designer, but also to others. By determining *criteria* and *values* of certain design attributes, an objective judge-ment might be made concerning the relative *qualities* of different ideas. The *data* generated in such designerly study activities and evaluations can offer valuable insights into the underlying design process and benefit the *interpretation* of design results in education and research.

Whereas traditional design activities are primarily involved with development of design *products* and design studies with *knowledge*, in design driven education the processes are characterised by *reciprocity*. In the academic environment an *'as if'* design setting is the norm, whereby design and research activities are primarily targeted at the generation of *knowledge, insights and skills*. Thus, the aim of designerly exercises, integrated into educational curricula, is one of *learning by doing*.

A traditional approach to teaching design involves requiring students - as 'apprentices' - to repeatedly carry out *integral* design tasks under the critical supervision of a 'master'. With such an organisation, there is the risk of a 'black box' situation, with relatively little transpar-ency on the level of the objective exchange of ideas or evaluation of results. A pedagogical alternative is to set up clearly structured courses which incorporate designerly activity, aimed at the *discovery* of architectural design themes. An effective way of 'channelling' student
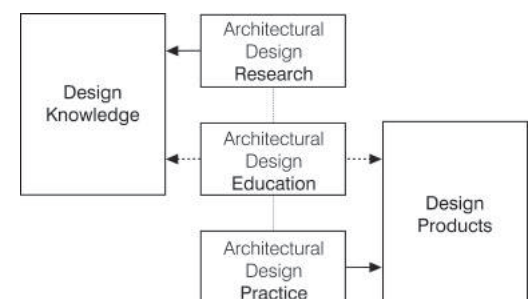
62   Scheme 2: A comparison of aims in research, education and practice

activities towards research is by creating a kind of 'game' situation. Such a method has, amongst others, been promoted by Donald Schön and colleagues, who carried out explorative design exercises with considerable success at MIT.[a] The more clearly such tasks and objectives are defined, the more profoundly the students may be made aware of the constraints on one hand and the creative freedom on the other. An advantage of such a structured approach is that, in principle, results can be compared and the qualities of specific design solutions recognised and discussed. Examples of such a thematic, designerly approach in an educational setting can be found in the Delft Form Studies programme.[b]

The four designerly categories of enquiry mentioned earlier, common in design practice, can be used as - integral - parts of the didactic set-up of *educational* exercises (either with a design or a research emphasis), but potentially also in experimental design research:

a. *Designerly decomposition:*

The kind of decomposition which designers practice can be used most effectively in education by making such decomposition a part of the set *task*. This can come down to consciously not setting a complex, integral design task, but instead offering a more compact, clearly defined 'problem', to be studied in depth. An alternative is to make students aware of this approach as part of the *tutoring* method, or of a research approach and protocol.

b. *Designerly variation*

Designerly variation can be used in education as a part of the design *counselling* method. Such an approach can involve pointing out relevant themes or options, without necessarily suggesting an outcome. Such "could (also) be" scenarios can purposefully be developed as design variants, to be tested and discussed. Apart from using such an approach in design tutoring, designerly variation may be introduced as part of a research *task* and the accompanying procedures.

c. *Designerly visualisation:*

Active application of design visualisation techniques does not only constitute an important part of design activity, it is an essential component of education – and consequently can be made operational in design driven research. Essentially this approach involves creating *models* of (aspects of) the project which is being scrutinised. These may vary from physical models (from conceptual to detailed scale models), digital models (computer visualisations and simulations) to two dimensional representations (sketches, drawings, schemes, collages).

d. *Designerly reference study:*

In education and research, reference study can be introduced to shed new light on the project at hand. A process involving targeted *juxtaposition* of the subject of study and one or more projects or specific design aspects, allowing for insightful *comparison* and evaluation. This approach may include the use of precedents, but also of metaphors and even conscious development and systematic comparison with designerly variations.

Well organised – designerly - projects can help to create a kind of 'laboratory' atmosphere, in which procedures and results can be considered more or less empirically. Of course, the disadvantage of projects involving groups of students is their relative lack of *experience*. However, this is often compensated generously by their *candour* and lack of 'hang-ups', which can lead to refreshing viewpoints and surprising insights. Such educational projects may be considered promising in the context of design driven research.

a   Schön, D. (1992) *The theory of inquiry, Dewey's legacy to education*. Habraken, N. and M. Gross (1988) *Concept Design Games*.
b   Breen, J.L.H. (2001) *Designerly Approaches to Architectural Research*.

12 TYPOLOGICAL RESEARCH

TAEKE DE JONG
HENK ENGEL

Architectural typology pre-supposes design research, but not all design research pre-supposes typology. What appears to be a legend unit in a specific structure, (for example 'split-level houses') can be a type in a smaller structure. Typological research searches for object constancy in a variable context.

An architectural type is a summary (concept) of architectural designs with common characteristics, conveyed in a 'schema'.[a] It may possibly be a forerunner of a model, a design. A type is, therefore, not yet a model which can be imitated actually in reality (Argan, 1991) in order to interpret the effects in a specific context. For example, a design, a realisable proposal with a scale factor, is actually a model whereas a type is not. Conversely, a model is more concrete with regard to specific selected components, more clear-cut than a type, and, therefore, not a type.

	OBJECT Determined	Variable
CONTEXT Determined	Design research	Design study
Variable	Typological research	Study by design

An ideal-type[b] for example, may have more characteristics than all the examples. The ideal type complements its examples in specific aspects, whereby they become more conceivable. A model or representation may be made of such an ideal type, which can serve as an ideal model in education for example, but it will always lack characteristics because they can never be simultaneously realised. The other (realised, therefore, incomplete) representations of the ideal type have characteristics (for example details which are neglected in the type) that in a specific context can make it usable and possibly unique.

If one historical original example, (possibly irrevocable) is available from one type, then a model can be made based on this. Such a model has, in order to be able to reproduce it in other aspects, also more (practical) characteristics than the type (for example a material specification and a form). Even if it can be made using this, it does not necessarily have to be useable[c] in a specific context.

A system also pre-supposes analysing components (elements) and well-defined system boundaries in which system and context are clearly independent. The boundaries remain intentionally vague regarding type and sometimes with the model (if parts of the context herein have, or have not, been suggestively incorporated). For example a study can make use of types and models, but they do not necessarily have to form a system with removable elements. An archetype[d], for example the Trinity is a type that precedes the form and is filled with old connotations and form associations. The labyrinth for example is an archetype based upon the myth of Theseus and Ariadne's thread, which originates from King Minos of Knossos' palace in Crete.

Every example of a type is a variant with other incidental characteristics (for example the location), as in music; the variations are categorised according to theme. A type can be a stereotype if it can secure itself in an unquestioning repetitious application without variants. Typological criticism (Argan, Tafuri) is the removal and addition of characteristics in well-known types. According to Levaivre and Tzonis, Van Eyck used classic types, (see page 89) in this way and exchanged a few characteristics with those from De Stijl.

Some design students consider it an honour to create a design, which complies with no individual type and therefore represents a 'new type', to be used by others. Types like these are prototypes. Very often such a type turns out to be a variant of an already existing type. Sometimes a variant is so diverse, that it is regarded as an individual type and remembered this way. The number of types is so immense, that nobody can imagine each and every plausible type. Typological research compares and classifies types and determines their variants in various contexts. When the classification adopts a structure of inter-related types in the form of a genealogical tree, it is known as 'taxonomy'.

a   The word 'schema' is Ancient Greek for posture, gesture, external appearance, as well as condition, viewpoint, place relating to something. This can be summed up with the word 'pose'. With 'schema' the English word 'shape' is also related to the suffix '-scape' in landscape.

b   The German term Idealtype was introduced by the sociologist Weber. The platonic notion of idea is the foundation for a reality conception in which every true object looks upon this as a reflection of an idea from a supreme reality.
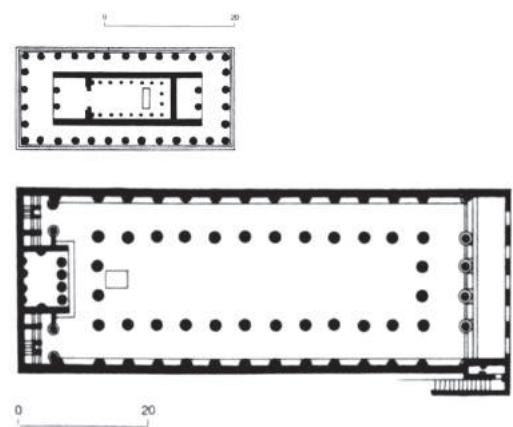
c   When considering the word 'use' the term 'experience' is also included.

d   The term 'archetype' was introduced by the psychiatrist Jung, who claimed to recognise inherited images from dreams, which were inexplicable from the individual's experience.

Primitive forms   Sum(add)

Difference (substract)   Intersection (intersect)
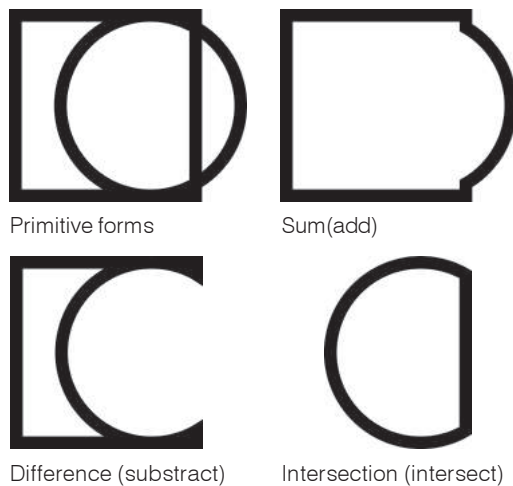
63   Primitive forms and their combinations

64   Hephaiston-tempel 440 BC Athene agora
      (above) and Basilica, ca. 80 BC Pompeï [c]

a   This line of reasoning is derived from the French geographer George, P. (1964) *Précis de géographie urbaine* (Dutch translation: (1966) *Geografie van de grootstad, het probleem van de moderne urbanisatie*). This can be found in the theoretical form with the American sociologist Parsons, T. (1966) *Societies: evolutionary and comparative perspectives*; Parsons, T. and J. Toby (1977) *The evolution of societies,* and by the Marxist orientated, with the Frankfurter Schule associated Jakubowski, F. (1936, 1974) *Der ideologische Ueberbau in der materialistischen Geschichtsauffassung* (English translation: (1990) *Ideology and superstructure in historical materialism*, Dutch translation: (1975) *Basis en bovenbouw*).
b   Montesquieu, C. de (1748) *De l'esprit des lois*. English translation: Montesquieu, C. de, Anne M. Cohler et al. (1989) *The spirit of the laws*.
c   Source: Koch (1988) *De Europese bouwstijlen*.

12.1   FORM, STRUCTURE AND FUNCTION TYPES

If the characteristics of a type are only related to the form (the layout distribution or the contour of this), it is known as a 'form type'. There are organic types (tree, stem, flower, umbel) and geometric types. A pyramid for example is a geometric form type. Round (spherical, dome shaped), square (cubic) or triangular (tetrahedral or pyramidal) construction elements, constructions, urban ensembles, neighbourhoods etc. are therefore form types. Geometric differences like these can be elaborated upon using their sum, difference or intersection. Computer drawing programs provide such primary form processes (add, subtract, intersect). Such combinatoric transformations can yield taxonomy.

If one includes a collection of separations and connections (structure) such as typified openings, dividing and bearing constructions in the characteristics of the type then this is known as a structure type. The peripteros and the basilica are structure types because the columns and dividing wall structures are indispensable in their constellation. The function does not need to be considered at this stage.

If the external working (function) is included in the characteristics of the type, then this is known as a function type. In this way a railway station is a function type. The function concept always pre-supposes, albeit mostly implicitly, an elaborate external structure wherein the function concerned is a specialism. In this way a railway station is inconceivable without railway tracks and usually directly next to it an entrance and an exit (unless this is the 'terminus' type for commuters with an origin (a home for example) and a destination (work for example).

This material or social structure, pre-supposed with the function type, is, not as yet, a well-defined context. This type of context must be discussed when carrying out design research and design study. An external structure is variable in typological research, however it is decisive for a structural distinction such as 'front', 'back', and 'side' in the constellation of the type. Since a type is less restrictive than a system, external structure characteristics can also form part of a structure type. The entrance in particular is an important characteristic of the structure type. The direct surroundings of the entrance or the other openings leading outside can be involved in the structure type. For example, the archetype, the Villa Rotonda (Palladio) is inconceivable without the lines this type draws in the surrounding landscape, whichever landscape this may be. This elementary context-sensitivity takes you to the brink of the concept of type.

12.2   A FUNCTIONAL TAXONOMY

The function concept is most suitable in typological research for the classification in taxa, families and types. The function of the developed or undeveloped surroundings consists of different values like short-term sensation value, medium-term utilisation value, long-term prospective value and extremely long-term sustainability value. The 'form' is sufficient for the sensation value; structure other than the sensory connection with the observer is not necessary.

For other values a notion of structure is a pre-condition in increasing measures. Utility values can be sub-divided into economy, culture and management.[a] Values less directly related to human utilisation or human sensation, like technical, ecological and environmental functions are not taken into consideration here. In the medieval town (see the market square in Delft) this trias is recognisable as a type.

Pierre George's categorisation could be denoted as trias urbanica. Further sub-division as a result of social differentiation and function divisions is known as a *trias politica*[b], a *trias cultura* and a *trias economica*, using the systematics of Jakubowski and Parsons.

Of course, function entails more than the above stated taxonomy based upon social differentiation at an urban level. Besides this top-down approach, the bottom-up approach is also possible, whereby pre-suppositions regarding individual activities (wherein the individual sensation is understood) play a rôle. This leads to another function typology more difficult to capture in a taxonomy.

12.3 FORM AND STRUCTURE PRE-SUPPOSED IN FUNCTIONS

Urban functions can be spatially concentrated or de-concentrated. This leads to various types. In this way institutions of higher, secondary and primary schools can be concentrated in one building or scattered over many buildings of different types. Deconcentration normally means implicit inter-weaving with other forms of land utilisation. Dispersed living often means inter-weaving with agrarian functions in a radius of one kilometre. Concentration means segregation.

Relatively unrelated to this, functions can also be centralised or de-centralised in a hierarchic organisational classification. Spatial concentration must not, therefore, be confused with the *organisational* notion of centralisation. In this way local shops can be an organisational element of a national chain, of which the distribution points are spatially spread. Implicit pre-suppositions regarding the layout form of one social function may have bearing upon the typology at varying scale levels (in a different frame).

Inter-weaving, for example, leaves intact the fact that juxtapositioned functions can have no connection due to local physical factors, economic, cultural or governmental barriers, (segregation). Examples of divisions like these are watercourses, unaffordable factors or due to unfamiliarity for specific population groups in the area or differing management responsibilities. For example, an office of a specific size in the vicinity of a restaurant, may have its own canteen. This in turn gives rise to a different type of office or restaurant.

On the other hand, segregation leaves the fact intact that functions are, in spite of distance, connected with each other by means of infrastructure, (function binding). This is the reason why long-term parking provisions, situated at a reasonable distance from the airport, are often linked to the airport using a system of shuttle bus services. Such possibilities have bearing upon the type of airport. Taxonomy therefore does not only have implicit form pre-suppositions but also implicit structure pre-suppositions, related to the analogy and divisions between functions.

12.4 SCALE SENSITIVITY OF TYPE CHARACTERISTICS

The type characteristics, distinguished in the schedule below, are scale sensitive. Something considered segregation in one specified framework can be considered inter-weaving within a larger framework (scale paradox, compare the apparently contradictory concept of 'heterogeneous mixture' from materials science).

These concepts, therefore, cannot be used during a scale switch in an argument. Similarities at different scale levels between drawings, which are in themselves fixed-scale drawings, or arguments which can contain these scale sensitive concepts without a change in interpretation, can be compared once more at a higher level of abstraction than comparing the argument itself once again.

Based upon these comparisons a type may be chosen which is recognisable at different scale levels. For example Lefaivre and Tzonis (see page 89) recognised the same type of form in a building, a painting and an urban construction design. When designing with a scale-free type, one again comes across the scale dependency of its characteristics. An office building situated adjacent to a restaurant, able to have its own canteen, is within the framework of the urban ensemble an example of segregation$_{100m}$, however within the building it is a form of integration$_{30m}$.[a]

This reversal of conclusions due to scale change also takes place at other scale levels and can be typified at higher abstraction levels. Function separation is used in the trade jargon in the case of both separation and segregation. The well-known CIAM-doctrine argues separation at urban level of housing, working, recreation and traffic on functional and environmental protection grounds. The question is, however, whether this must also lead to segregation. Structural means like sound barriers for example, separate the traffic from the housing, in order that they can continue to co-exist spatially (function segregation$_{30m}$). If segregation should be required in that framework, (for example by zoning surrounding hazardous companies), the question is: on what scale: within the area (between neighbourhoods) or within the town (between the areas). These are different types of function separations: function separation$_{1km}$ is a different principle than function separation$_{3km}$.

a The dimension index must be seen as 'within 100m' and 'within 30m' Function segregation within 100m (ensembles) can therefore go hand in hand with function integration within 30m (buildings). As soon as this is externally considered, the same situation must be named at one scale lower: Function segregation between buildings (30m), related to function integration between building segments. In order to avoid systematically concept confusion, an internal consideration is used.

b CIAM, 1933, earlier formulated by Hercher, 1904.

The distinction between function separation and function combination (integration) is, severed from the function itself, on each scale level a structural design dilemma allowing solution by structural types. The Swiss Army pocket-knife is by way of an example a type with a function integration$_{10cm}$. However, if one is accompanied on a holiday by a knife, cork-screw, bottle opener, screw-driver etc., then a function segregation$_{10cm}$[a] applies. At the same level of functionality this yields very different types of tools. Who wants to develop photographic film in a living-room is working at a function integration$_{3m}$; when working in a separate dark-room it implies a function-segragation$_{3m}$. Kinds of traffic (pedestrians, cyclists and motor-cars) may be combined and segregated as well. It is striking, in all examples, that function integration costs time, but saves space. Function segregation, on the contrary, often has time saving as a motive, but costs space. However, this applies only if it is possible to continue reasoning in the same order of magnitude. For, if in the case of function segregation the partial functions resulting are spread out to such an extent that, for instance, finding, walking or travelling time start to play a rôle, one should allow in a wider context for loss of time. In principle characteristics like that do not depend on function. They are related to usage of time and space; but there is no need to be specific about which kind of use is applying. Structural types restrict themselves to characteristics like that.

12.5   IMAGE TYPES

In architecture an image type – like a gate, mountain or grotto – is a scale-less image of the archetype (nature, God's ordination) preceding the form. The image knows no scale. However, in landscape architecture the term is also used as a function type recognising just one function: the visual and / or tactile, moving impression that an artefact leaves in many people collectively.[b] A Dutch *'polder'* – together with its agricultural and recreational function throughout the ages – is a function or an image type.

This impression is a condition for effective use of the artefact. An impression is containing more and less than the spread of material (technical, operational, real 'form'), of which only the outer appearance (*'vorm'* in the leading Dutch dictionary) is landing through the senses in the remembrance of people. If the collective impression would cover a spread like that, it would be a form type. In this vein the characteristic pattern of Dutch waterways, dikes, sluices, ditches and many other things just passing translation into English establishes within a polder is a form type. When their technical (water) separating and connecting operation is also taken into account, a structure type is discussed. An impression seldom contains the actual three-dimensional form below and above the topsoil as it may be reconstructed from blue-prints and cross-sections, or from constructional surveys, with the co-ordinates recorded in the computers of design agencies. In this sense an image type is a more restricted notion than a form type. However, to this restricted impression collective historical (cultural) connotations are added that have found access to collective memory through different media than the individual's perceptual senses. Through this, the objects of that type are getting collective meaning and value (imagination).

Visual types correspond in a more direct way to active imagination of designing than the analytical types described earlier. This imagination is comprising more than what is termed imagination in development psychology. It also comprises imagination techniques to be learned as a creative capability (see page 389 and 399). This includes analysis of the image (for instance in the historical, partially overlapping 'layers'), their supplement and restriction in a renewed synthesis (transformation), mounting the images in a different context (transfer) and analysing the effects on that context.

Because of the lack of words indicating concepts in images often images from a very different context – such as 'paper-clip' or 'satellite' are used in designing. Such metaphors can be regarded as types of transference.

a   In order to avoid change in significance and scale, the order of magnitude of the function-combination is adhered to while comparing functional separation and combination. Even if the same function-separation is presented on a much greater distance, such as a knife in the picnic basket and a screwdriver in the luggage boot, keeping together within one container is already function-separation, in order of magnitude comparable to the integration in a pocket-knife.

b   Aben, R., P. van der Ree et al. (1994) *Metamorfosen, beeldtypen van architectuur en landschap;* Conijn, E. (1999) *Wonen op een buiten, spanning tussen het oneindige en de geborgenheid;* Kooij, E. van der (2000) *Het buiten voorbij.*

13 CONCEPT AND TYPE

BERNARD LEUPEN

13.1   HOW TO GIVE FORM TO A DESIGN

We have been told for a long time that form follows function. Functionalists, in particular, held this view. But, if function directly generates the form, why, then, are there often many different solutions for one assignment?[a] Even when functionalism was in its heyday, one single assignment would result in a series of multiform designs, as demonstrated, for instance, by the results of the competition for low-cost working class housing in 1936.[b] These differences may be partly due to difference in insight, or interpretation of the assignment. If the differences between the designs were solely due to a different interpretation of the assignment, then, with the same interpretation of the same programme, the resulting designs would have the same form. The question remains: how does the programme generate form or, more specifically, how does the form of a bedroom follow from the function sleeping?

A functionalist will explain that this form is the result of careful analysis of all the activities that are part of the function sleeping. The dimensions and areas that follow from this analysis should lead to the ideal form of the bedroom; this also applies to kitchen, living room, etc. The result is a number of rectangular boxes that, together, fit overall dimensions. A sort of minimal envelop, not yet an architectural solution. For instance, what is wrong with the bedroom that Goff, the architect, designed for a house in Aurora (Illinois)? Why would this bedroom, placed in a quarter segment of a sphere, not follow the function?

The reasoning that form automatically follows function disregards two phases in the design process.[c] First, there is the phase of interpreting the assignment, as was mentioned. Then, there is the phase in which form and spatial arrangements are determined. In both these phases the architect makes active choices.

The first essential choices are made at the interpretation stage of the assignment and when developing a view of the project requirements in relation to the location. In many cases, certainly in the past, interpretation of the assignment was self-evident. The approach was mainly conventional: a certain project at a certain location should be handled the established way. That is how it was taught at the academy, or the way it had been done for years in a certain region. However, increasing complexity of assignments and current construction methods require a personal interpretation, based on an underlying principle, vision or concept. The notion 'concept' is further discussed below.

a   The idea that the assignment generates the form has also kept a whole generation of CAAD specialists busy.
b   Ottenhof, F. (1981) *Goedkope arbeiderswoningen (1936)*.
c   Please note that Sullivan with his tenet that form follows function did not mean that the form automatically follows from the function. In his view, one should choose the form which best fits the function. Sullivan, L. (1956) *The autobiography of an idea (1924)*.
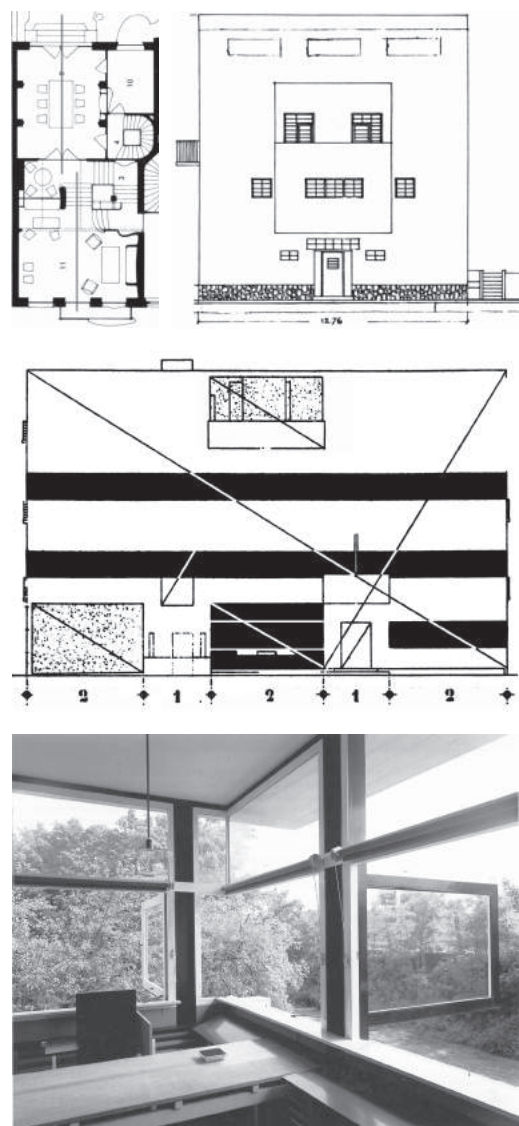d   Photograph: Jan Molema. Source: Archis (1996) nr.6 p.21.

68   Contest submissions for cheap labour housing Van den Broek (left) en Van Lochem (right)[b]

69   House in Aurora, designed by Goff. The bedroom is situated in the top half segment of the sphere[d]
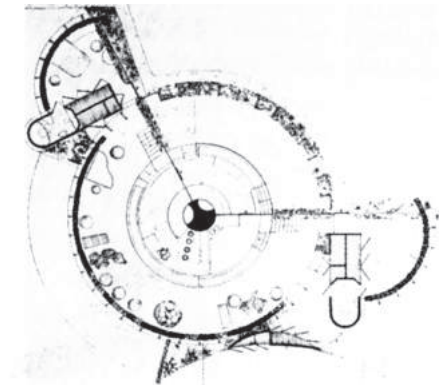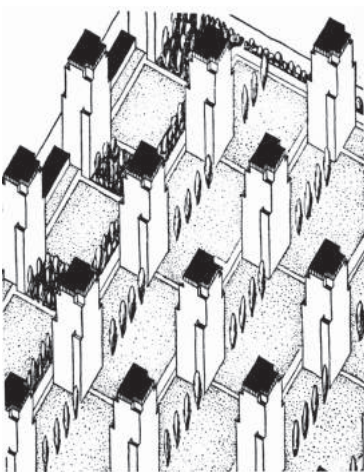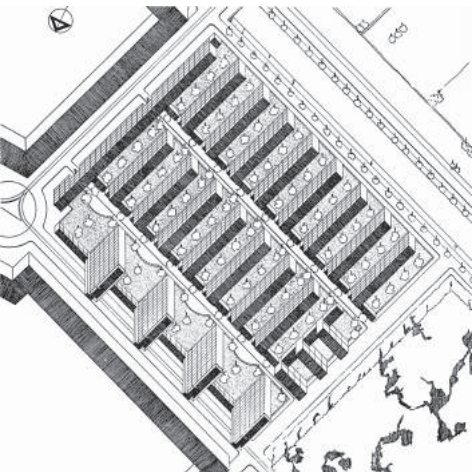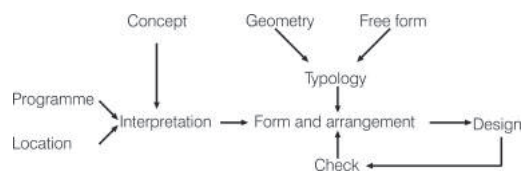
70 Schematic representation of the phases and influences in the design process

71 Horta, floorplan with shifted axes, private house.
Loos, front façade *Haus Möller*,
Le Corbusier, front façade *Villa Stein,*
Rietveld, *Schröderhuis*, open corner.[e]

a   Vitruvius and M. Morgan (1960) *Vitruvius: The ten books on Architecture*, p.17.
b   Leupen, B.A.J. and N. Bisscheroux (1984) *Interview met Rem Koolhaas*, p.51.
c   Zaera, A. (1994) *Incorporating: Interview with Jean Nouvel*, p.17.
d   Kaufmann, E. (1955) *Architecture in the age of reason*, p.75 a.f.
e   Sources respectively: Catalogue with the Horta Museum, Risselada, M. (1988), Rowe, C. (1982), Overy, P. *et. al.* (1992).

13.2 RECURRING PRINCIPLES OF SPATIAL ARRANGEMENTS CAN LEAD TO THE USE OF 'TYPE' SOLUTIONS

Once the interpretation has been made, the spatial arrangement and the decision on the form will, in broad outlines, be developed by a process of searching for solutions, making assumptions and testing results. Searching for a main principle for the spatial arrangements and for a form where it is assumed that there will be a fit to the assignment, and then testing the results as to how these work in practice. For centuries, the same criteria guided this process. Vitruvius spoke about 'durability, convenience and beauty'.[a]

The form can, in principle, be derived from geometry or from nature, in the last instance reduced again to geometrical form. If principles of spatial arrangements or form structures keep recurring, this may indicate use of a 'type' solution. From experience, we know that certain forms, schedules or models are more useful than others. In particular, when there is repetition, or when project requirements are very strictly defined (housing, theaters, prisons, etc.), the same principles recur regularly.

13.3 THE CONCEPT HAS NO FORM

In recent decades, the notion 'concept' came to achieve a prominent position in architectural theory. What does 'concept' mean in relation to architecture? Before addressing this question, I will first indicate why a concept plays such an important rôle in present-day architecture. In an interview Rem Koolhaas said this:

"I find the notion of 'concept' very difficult. When I, myself, was teaching, I found it difficult to explain what a concept is, and whether it is necessary. Today, I find it an absolute necessity. The concept is the theme on which the design is based. One can sum it up in one sentence. It can be very primitive, but it is still a test of your design"[b]

Nouvel states on the subject:

"I am always able to describe with enormous precision any of my projects in five written pages. It simply happens like that, and it is essential. But, at the same time, there is a moment in the process where the argument is there and I have no longer the need to keep talking about it, because the essential point is to fix the concept. This is the moment when, through a sort of miracle, other things will be produced. The work becomes more plastic; memory and attention take over."[c]

From Renaissance to the end of the nineteenth century, concepts, as we view them now, had no significant rôle. The discussion concerned primarily correct style. When discussing style, one usually thinks in the first place of appearance, the form of elements used and differences in decoration. However, a second, underlying system with regard to style can be discerned. The art historian Emil Kaufmann calls this system the 'architectural system'.[d] It delineates the structure of the designs attributed to a particular style, the way in which the elements are assembled and spatially arranged, and indicates which set of instruments has been applied. Spatial arrangement and composition of buildings were to a large extent determined by the prevailing architectural system. Until the beginning of the nineteenth century, the underlying system was hardly ever discussed.

13.4 THE CLASSIC SYSTEM PUT TO THE TEST

Around the 1900s, several architects began to work on fundamentals of the system. Horta queries symmetry, Loos attacks ornamentation, Le Corbusier redefines the classical rules for composition, Rietveld and Mies van der Rohe open up spatial arrangement.

Thus, slowly, but surely, a new form of architecture was developed, typified by absence of a coherent architectural system. Le Corbusier also, using the 'five points' and the 'Modulor', did not manage to create a new and generally accepted architectural system. Although elements of the classical architectural system can be found in many creations of modern

architects, the programme is now the basic issue. While transparency, apparent weightlessness and machine aesthetics form the basic idiom of the Modern Movement, each new design seems to be seeking its own identity, its own concept.

13.5 THE CONCEPT ORGANISES DESIGN CHOICES

When one common view still dominated the architectural system, the architect had a clear set of rules while making the numerous architectural choices with which a designer is confronted, choices about dimensions, proportions, rhythm, spatial arrangement, composition, structure, use of materials, etc.

That each design needs its own legitimacy or concept, is not only the result of the urge for innovation amongst architects, but also of the growing complexity of building specifications and materials and building techniques now available.

A concept does not have to be decisive about the form of the definitive design. It expresses in first instance the overall idea, the character and direction in which the solution is to be found. The concept expresses the basic thought behind the design, it gives direction to design choices and, at the same time, excludes alternatives: in a way, it organises the design choices.[a]

### 13.6 A CONCEPT MAY BE PRESENTED IN DIFFERENT WAYS

A concept may be presented in various ways: in a scheme, by visual images, in words. The procedure at the office of the French architect Jean Nouvel can serve as an example and illustration. Before the first line is drawn on paper, extensive discussions are organised between designers and specialists on sub-areas. Drawing is only allowed to commence when a description of the project – a concept – is clear to the mind's eye. This procedure pre-supposes wide knowledge of possibilities and great power of imagination.[b]

An example of such a verbal concept is the concept of the design of the Prize for an opera house in Tokyo (1988) designed by Nouvel. As the result of a series of discussions within the office a leading metaphor was chosen: a vast travel case of a musical instrument. On the outside the building should have a smooth black skin; on the location of the great hall it should have a slightly bulging surface. On the inside golden-hued auditoriums were placed in space, like instruments in a case.

The risk of a metaphoric concept lies in taking the metaphor too literally; for instance a hamburger joint in the shape of a hamburger. That may be funny briefly, but does not generate interesting buildings. While designing on the basis of metaphor the difficulty is to maintain a sufficient level of distance from the literal interpretation.

Le Corbusier condensed the *'Unité'* concepts – several concepts form the basis of the work – to two sketches, where points of departure like light, air and space, view, the pilotis and the roof-garden may be found back.

Along the same lines functionalism may be conceived of essentially as a concept: 'form follows function' is a discourse guiding the subsequent design decisions. Although an analysis of the programme of requirements does not result automatically in selection of a shape and certainly does not generate a shape – like functionalists pretend – functionalism obtained for itself via the metaphor of the machine-aesthetics a language of shapes.
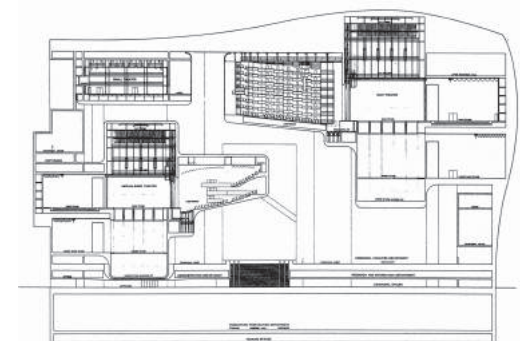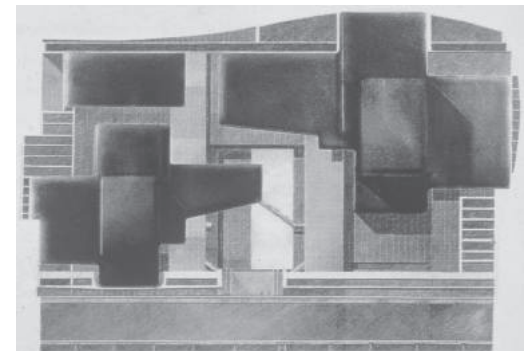

72 Nouvel in co-operation with Starck, design for an opera house in Tokyo, model and cross-section.[c]
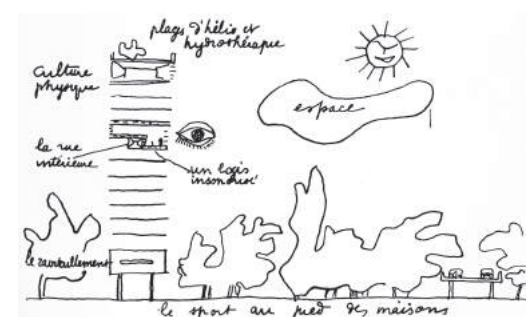
73 Le Corbusier, sketch of the concept of his 'Unité'.[d]

a   Leupen, B.A.J. and C. Grafe (1997) *Design and Analysis*. p. 13. Originally published in Dutch: Leupen, B.A.J., C. Grafe et al. (1993) *Ontwerp en Analyse*.
b   Leupen, B.A.J. (1989) *Een nouvel concept*, p. 85.
c   Source: Leupen, B.A.J. and C. Grafe (1997)
d   Source: Samonà, A. *et.al.* (1976)
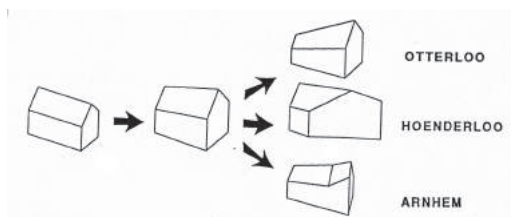
74   MVRDV, scheme of the concept for admission lodges on the 'Hoge Veluwe'.

13.7   A HOUSE OF STEEL, WOOD, OR STONE

An example may clarify how a concept guides design decisions. The Foundation *'Nationaal Park De Hoge Veluwe'* published in spring 1994 a controlled prize for the design of admission lodges. The existing ones were constructively but in sad shape and longing for successors; added to that, for safety and comfort of personnel, new requirements applied to the lodges.

The MVRDV office developed a concept for the admission lodges as simple as it is efficient. The shape of each small building may be reduced to the archetypal shape of a house with a pointed roof. By morfing, attenuating, and folding this main shape each lodge can boast its own shape. This way a playing with perspective emerges to the person observing the lodges.

13.8   A 'POWERFUL' CONCEPT PERVADES A DESIGN INTO THE DETAILS

The concept used by MVDRV is strongly similar to the concept used by the Italian visual artist Mario Merz for the igloos he created. Merz made a series of installations with a basic shape that may be carried back to the igloo archetype. However, in contrast to this frozen Eskimo abode Merz does not use ice, but a range of different materials like slate, glass, wax or asphalt. By realising the igloos in an unfamiliar material Merz obtains an alienating effect.

Inasmuch as MVDRV executes the main shape of the archetypal house each time in a different material, this office follows the same line of thought as Mario Merz. However, the MVDRV objective is not to create alienation, but distinction and contrast.

The selection of the material may be understood from the immediate context at first sight. The house made of brick may be regarded as an answer to the present brick home at the entrance Otterloo; while the wooden house is undoubtedly an answer to the forest and particularly the tree, almost the Siamese twin of the entrance pavilion at the Arnhem side. The selection of corten steel at the Hoenderloo entrance may be thought of as an allusion to the military training area that side of the Veluwe region.[a]

In a wider sense the context also influenced the selection of the material by the designers. In this vein the concurrence, or maybe on the contrary the conflict between conserving a bit of nature and culture, in a wider and more restricted sense influenced the concept. Culture in a wider sense relates to manipulating nature at the beck and call of hordes of visitors: the 'Hoge Veluwe' as a soft park of fun, culture. In a more narrow sense culture comprises the works of high arts stored in and around the Kröller Müller Museum. Likewise the corten steel may be regarded as a direct reference to visual artist Richard Serra, while the brick at the admission lodge near Otterloo evokes images of the work of Per Kirkeby.

75   Mario Merz, two installations of an igloo (photograps by author).

a   In a discussion with Winy Maas he mentioned that the choice of the corten steel was suggested by colour. The rusty colour is functioning in Autumn as a camouflage colour between the red beeches.
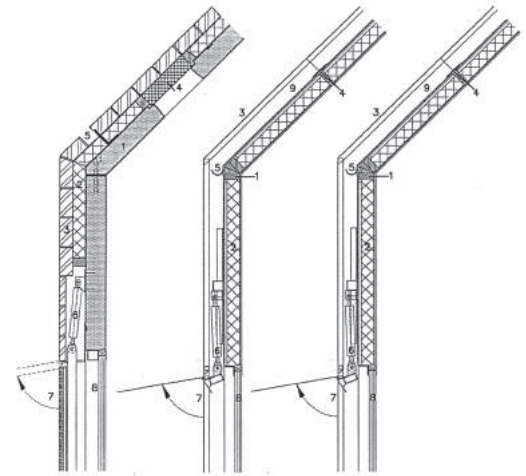
76   MVRDV, three admission lodges, in brick (left), steel (middle) and wood (right) (photographs by author).

The concept used by MVRDV is so powerful, that it determines the design decisions not excluding detailing. The selection of one material per lodge caused the designers a lot of trouble, particularly in the case of brick. The skin of brick has been stretched accordingly over the door and the shutters. This was realised by gluing brick strips on the structure.

In order to emphasise the idea that the outer material is just a skin, the designers have kept it loose of the soil. Particular attention went into the transition from roof to wall. Rainwater is disposed of by means of a hidden gutter. This reinforces the concept of the archetypal basic shape. In the case of the lodges of wood and brick a slit in the roof was made on that spot, while at the one executed in 'corten' steel circular holes were cut there in the steel sheets. These 'bullet holes' further strengthen the reference to the military training areas.

At night the shutters in front of the panes of glass of the admission lodges are closed. Then the continuity of the material is complete. The humble dwellings are thereby transfigured into rough crystal-like shapes of steel, brick and wood. The shutters of steel and brick are raised during daytime so that they may function as an eves. At the house of wood the shutters, built in a string of loose vertical slats, fold outward in elegantly pleated prisms.
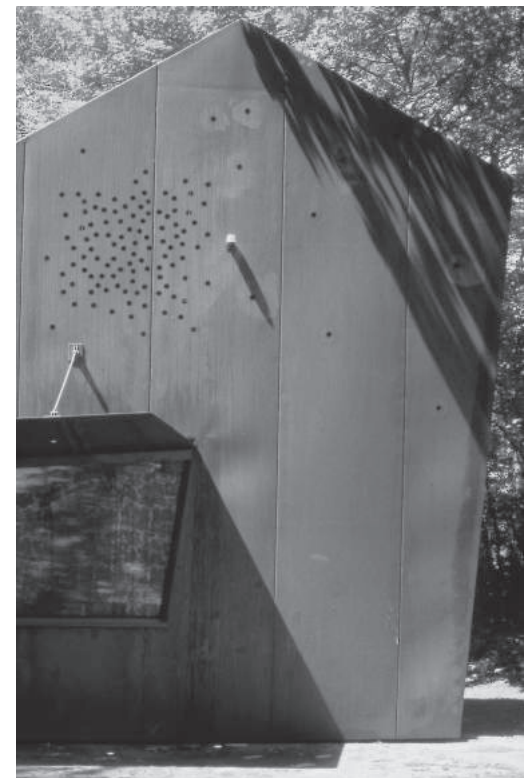

77 MVRDV, detailing of the admission lodges thrice: brick (left), steel (middle), and wood (right).

78 Richard Serra, composition of corten steel

79 Per Kirkeby, object in brick

80 MVRDV, detail admission lodge in 'corten' steel with holes for disposing of rainwater and ventilation (photographs 78-80 by author)

13.9 THE TYPE, THREE THEATRES AS EXAMPLE

As mentioned, we know from experience that certain forms, diagrams or models are more useful than others. In particular, in the case of repetition or precisely defined programmes (housing, theaters, prisons, etc.), one frequently sees that the same principles recur. With this sort of experience in mind, we now enter the domain of the typology. To illustrate the point, we show three theaters: the theatre in Genua by Aldo Rossi (19..), the *Stadtstheater* Essen by Alvar Aalto (1983-1988) and the *Danstheater* in The Hague by Rem Koolhaas / OMA (1980-1987). What do they have in common? The three architectures are so different that it can not be on the basis of the similarity. Closer study of the spatial arrangement of the three designs shows similarity in composition on two points. Firstly, in all three designs, there is a relationship between stage and auditorium via a 'proscenium'. From the auditorium one looks at the stage through a frame. A curtain can close the frame. In contrast to the classical Greek theatre, the spectator looks at the stage as at a show-box. A second similarity is the shape of the auditorium. Although the final form is different in each case, the three auditoriums have in common that the public is seated on a floor sloping upwards. The auditorium has a shell-shaped floor, allowing each spectator a good view of the stage.

13.10 THE IDEA OF TYPE SHIFTS BETWEEN WORD AND DIAGRAM

It might seem to be self-evident, but until Semper designed the *Festspielhaus*, Bayreuth, it went without saying that a large part of the public, and, in particular, those from the upper classes, were seated in the loges, boxes situated on horseshoe-shaped balconies around an auditorium with a flat floor. A number of these boxes were situated in such a way that occupants could more easily see each other than the actors on stage. Being seen was the primary reason for going to the theatre In the eighteenth and nineteenth centuries. What happened on stage was less important.

81   Aalto, Floorplan theatre in Essen.[a]

82   Rossi, Floorplan theatre in Genua.[b]

83   OMA, floor plan Danstheater, The Hague.[c]
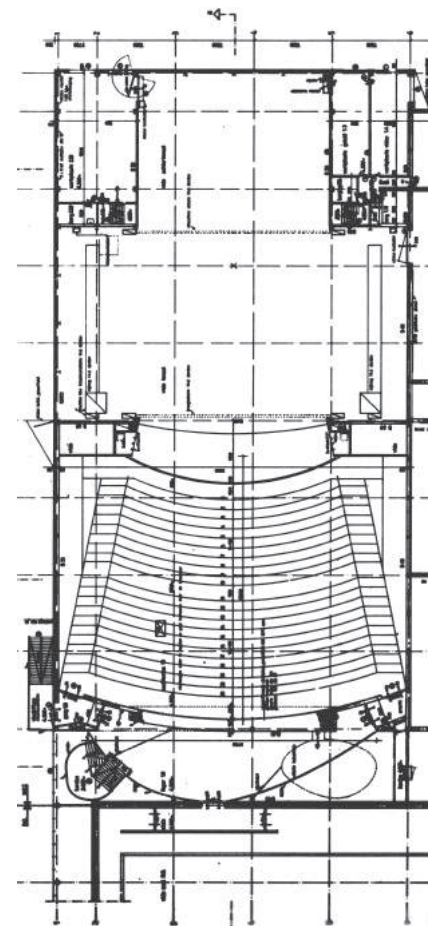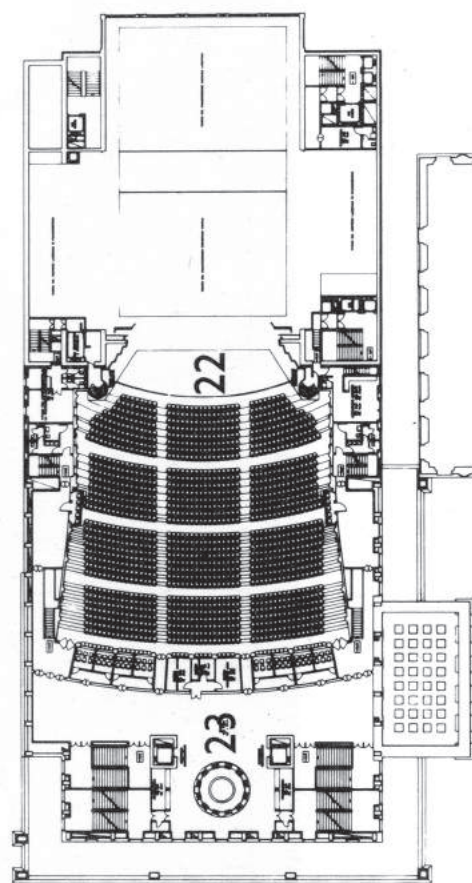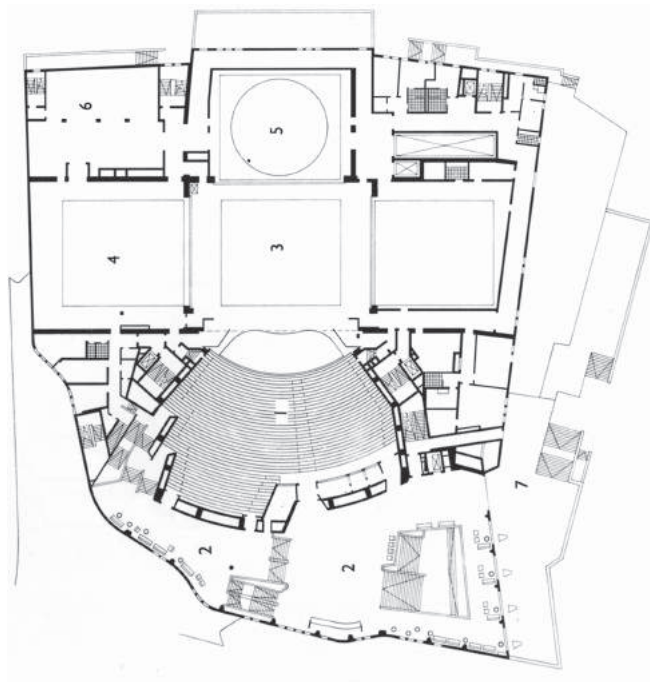
a   Source: Archis (1989) nr.1, p.24.
b   Source: Archis
c   Source: AMC (1987) nr. Décembre, p.9.

Wagner finished off this principle once and for all when he commissioned Semper to build a theatre that would focus attention on the performance on stage. Since then, the shell-shaped auditorium has become a idea used many times, as in the theatres designed by Aalto, Rossi and Koolhaas. The similar spatial arrangements – the formal basic structure – we can also designate as examples of the concept of type. There are actually two types shared by the three theatres: the framed proscenium and the shell-shaped, or Bayreuthian auditorium. The similarities between these three theatres can be summarised in a diagram that represents the formal basic structure of the corresponding principles. Such a diagram we call a typological scheme. This scheme is a representation of the type; however, note that it is not the type itself. The concept type shifts between the schedule and the words - the language - in this case *the shell-shaped theatre and the framed stage*.

84   Semper, floor plan Festspielhaus Bayreuth and typological scheme applying to all of the four theatres.[c]

13.11 TYPE ACCORDING TO QUATREMÈRE DE QUINCY

At the end of the eighteenth century, the French architectural theorist and encyclopaedist Quatremère de Quincy gave a clear definition of the idea of type. He defined this idea by placing it in juxtaposition with the concept of 'model'.

"The word type is also used synonymously with 'model,' although there is between the two a difference that is easy enough to understand. The word 'type' presents less the image of a thing to copy or imitate completely than the idea of an element which ought itself to serve as a rule for the model... The model, as understood in the practical execution of the art, is an object that should be repeated as it is; the type, on the contrary, is an object after which each (artist) can conceive works of art that may have no resemblance. All is precise and given in the model; all is more or less vague in the type. At the same time, we see that the imitation of types is nothing that feeling and intellect cannot recognise, and nothing that cannot be opposed by prejudice and ignorance.
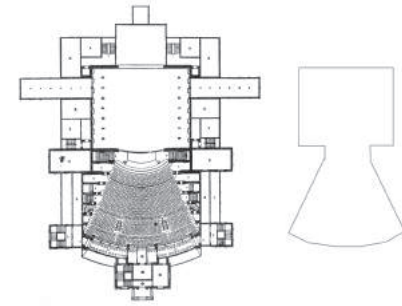
This is what has occurred, for example, in architecture. In every country, the art of regular building is born of a pre-existing source. Everything must have an antecedent. Nothing, in any genre, comes from nothing, and this must apply to all of the inventions of man. Also we see that all things, in spite of subsequent changes, have conserved, always visibly, always in a way that is evident to feeling and reason, this elementary principle, which is like a sort of nucleus about which are collected, and to which are co-ordinated in time, the developments and variations of forms to which the object is susceptible."[a]

85   Floor plan of the Scala in Milan, an example of a nineteenth century theatre.[d]

The Italian art historian G. C. Argan further elaborated upon Quatremère de Quincy's definition:
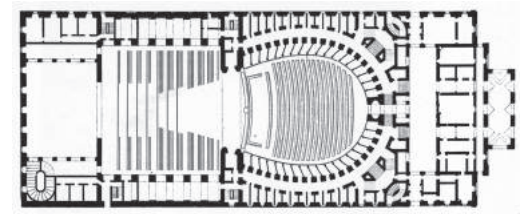
"The second important aspect when designing from typologies is the relationship between design decisions. This brings us to the question of typological levels. A typological level can be regarded as a scale of planning in which the design decisions present a unified system of choices. The number of typological levels (or layers) in a design is not dictated beforehand, but can be specified according to the complexity of the object and the modus operandi of the designer."

Argan distinguishes three such levels in a building:

- the configuration of the whole building,
- the major elements of construction
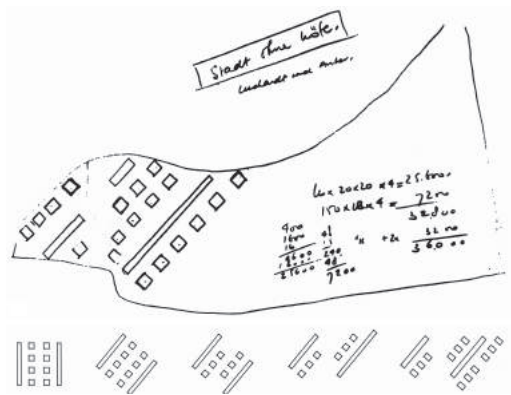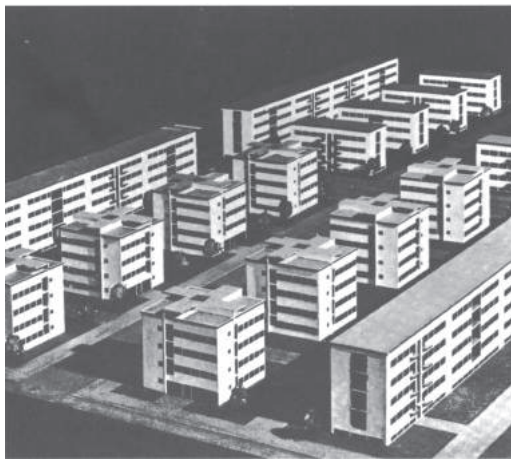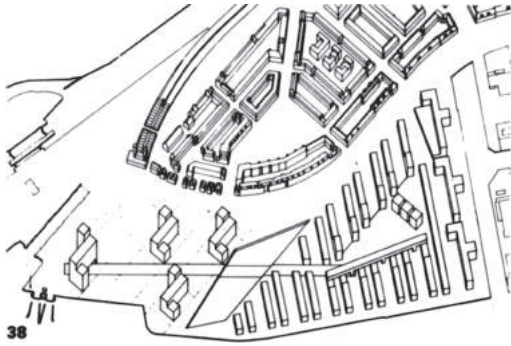- the decorative elements (façade, separating walls, stairs,..)[b]

a   Leupen, B.A.J. (1989) *Een nouvel concept*, p. 85.
b   Argan, G.C. (1965) *Sul concetto di tipologia architettonica*.
c   Source; unknown.
d   Source: Pevsner, N. (1976).

86 OMA, axonometry of the IJ square.[b]

87 Luckhardt brothers, model 'Stadt ohne Höfe'.[b]

88 OMA, sketch for the IJ square, with adjustment to 'Stadt ohne Höfe'. Scheme of the transformations.[b]

13.12 THE TYPOLOGICAL TRANSFORMATION OF THE ARTICULATION OF THE SITE

The urban design of the Western part of the IJ square in Amsterdam-North of the OMA office (Koolhaas) is an example of deliberate manipulation and transformation from an existing type to a new type. A transformation on the level of the articulation of the site is crucial here. When during the first stage of the designing process high-rise building was banned, the designers were looking for a different form of site articulation, so that their initial point of departure – a view of the IJ expanse of water for everyone – might be realised. Selection was made of a type based on a design of the Luckhardt brothers for a residential neighbourhood in Berlin. This 1927 design – not realised – *'Stadt ohne Höfe'*, is constructed out of two units of surface articulation: each time consisting of a long slab, flanked by a row of urban villas. This transparent type of articulation features a common green inner area, while access is positioned at the edge of the unit of articulation.[a]

Guided by an analysis of the OMA design sketches one may explore how the transformation of the Berlin type lead to the rise of the western part of the IJ square. Transformations both on the level of configuration of the blocks and on the one of surface and access manifest themselves.

On the level of the configuration of blocks the Berlin design may be reduced to two rows of cubical blocks with two slabs at both sides. The internal shape-structure may be rendered by the typological scheme 'eight cubes and two beams'. The first transformation to which this scheme is put, is a rotation in order to adjust to the situation. In this rotation two cubic blocks are omitted. Next, an important step: the two halves of the configuration of blocks are shifted *vis-à-vis* one another. By shifting the two halves, the urban villas become free in space. At that moment a transformation of the type occurs and a new type is born, constructed from a row of urban villas positioned before a slab, functioning in it as a backdrop against which the urban villas show out as loose objects.

The next imaginary step concerns lengthening the long block at the right and adding two rows of three separate blocks at the free side of this lengthened block. By locating the urban villas as much as is possible opposite of the large spaces the spatial effect of the urban villas before the slab is exploited to the maximum.

On the level of surface and access a complex process prevails. What it boils down to, is essentially that the original typology of access – as an open building block opened cluster of a beam and four urban villas – has been given up by OMA and is replaced by an access that has been made subservient to the architectonic furthering of the western part of the plan. Whereas with the Berlin plan a systematic change of street – block (open) inner area – blocks – street reigned, OMA deals with these parts as autonomous elements in a composition organised in bands. This positioning of the elements is much more determined by the will to create a montage of zones with distinct atmospheres on the surface than by the need to make public (street) and semi-public (inner areas) spaces. In this new positioning the street ends up between the long block and a row of urban villas. With this, the original access typology is turned inside-out, resulting in a new relation between public and private on the ground level.

a   Leupen, B.A.J. (1989) *Een nouvel concept*, p. 27.
b   Source: Leupen, B.A.J., C. Grafe et al. (1993) *Ontwerp en Analyse*.

13.13 TWISKE-WEST, THE TRANSFORMATION OF A RESIDENCE TYPE

Liesbeth van der Pol designed a residential neighbourhood with round urban villas for the area Twiske-West (Northern Amsterdam). It has two parts. One comprises a double ribbon with residences positioned around some ten courts. At the court-side these residences are three stories high. At the backside they slope down with a parabolic roof to one story. At this side, the one of the garden with water, the living-rooms have been situated. They have a special spatial signature since Van der Pol continues these spaces to the parabolic roof.

The other half of the plan is the zone where the round urban villas have been situated. Each of them contains seven apartments. The small buildings have been positioned like an autonomous sequence of objects between the street and the water. The square building-lot on which the round buildings have been placed is divided into seven gardens. The separation between the gardens is emphasised by the arched storage units on ground-level hugging the round drums.

All apartments have their entrance at ground-level. Six out of seven front-doors are situated on the small central open space in the middle of the drum.

Typologically these residences are very interesting. Each apartment uses the three tiers of the drum, divided in seven segments. By stapling the apartments spiral-fashion each time, each of them always occupies three of the seven segments. This way Van der Pol ensures that those at the north-eastern side also catch a sufficient amount of morning or evening sun.

The structure of the drums may be regarded as a typological transformation of two peculiar buildings. The way in which the circle has been sub-divided recalls the servants' home on the site of the former sanatorium *'Zonnestraal'* in Hilversum. Where it comes to the stapling of the appartments a similarity suggests itself with the small dwelling of the partial plan East III on the IJ square in Northern Amsterdam designed by OMA.

13.14 THE COMBINATION OF TWO RESIDENTIAL TYPES

Just like the drum residences of Van der Pol the floor plan of the servants' home at *'Zonnestraal'* may be understood from the division of the circle. In the case of the servants' home the circle is divided into twelve segments; geometrically a plausible number. By off-setting the radius of the circle against the circumference it is divided into six equal parts. Halving them results in a dozen. The division into fourteen segments of the drum residences (each dwelling segment being constructively split into two by means of a wall or a column) is not aligned to any geometrical operation and may be realised only arithmetically: which means that one must calculate the measures of all sides of the triangles determining the floor plan before the design can be drawn up on the drawing-board or on the site.
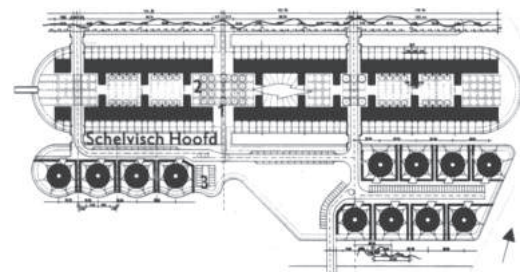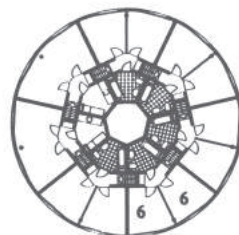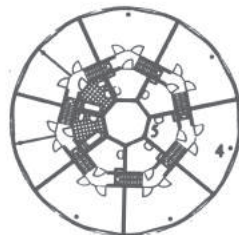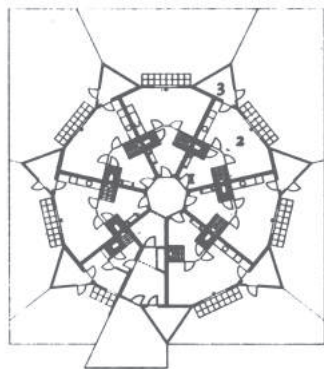
89   Liesbeth van der Pol, Twiske-West, urban plan and drum residences.[a]

90   Liesbeth van der Pol, blueprints of the drum residences.[b]

91   Duiker en Bijvoet, servants' home of the 'Zonnestraal' sanatorium.[c]
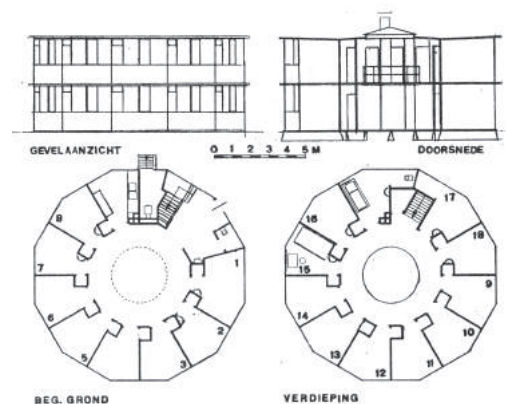
a   Source: Brouwers, R. (1996)
b   Source: Archis (1994) nr. 6, p.23
c   Source: Forum (1962) nr.1, p.40

92   OMA, block on the IJ square. Opened out
      axonometry en floor plan.[a]

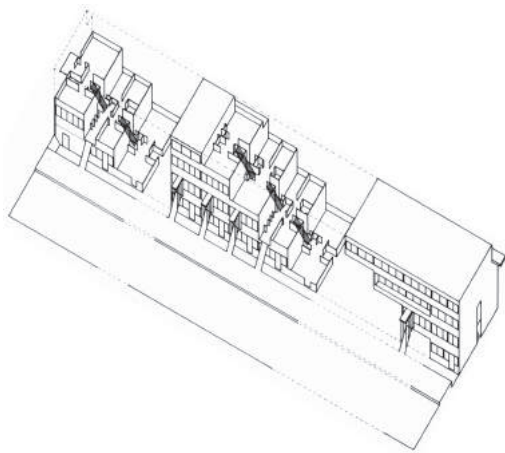In the case of the servants' home the façade consists out of a number of flat surfaces determining like twelve facets of a diamond the angular shape of the modest building. The ground-level of the drum residences has been shaped similarly, as long as the arched storage units are not taken into account. With a rising on this kind of floor plan the designer has in principle the option to place the walls rectangular to the front or on the corner point of the fronts. The first one has the merit that the angles of the space stay orthogonal – often to be preferred when it comes to putting pieces of furniture where they may serve - ; particularly when small spaces are involved. With the servants' home this solution gets an additional dimension because of the angle between the fronts in the middle of the outer expanse of the room. While standing on this spot behind the transparent front one has the feeling of standing in a bow outside the surface of the façade. Because of the positioning of the storage units this effect does not apply in Van der Pol's work. On the higher levels Van der Pol has opted for a circular façade. The diagonal trimming in wood, an echo from the craft of ship-building, strengthens the effect of a drum.

The spiral elevation of the apartments has been derived undoubtedly from the small block of the partial plan East III on the IJ square. The essence of the stapling of this block is that the living of one residence is situated above the bedroom floor of the neighbours: a stapling enabled by straight flights of stairs perpendicular to the wall; and passing it. This stapling results in a very compact internal circulation within the apartment. By this step-wise rising the designer is obliged to invent at the beginning and at the end of the block special solutions. On the IJ square this was realised by situating there HAT units. The other side of the block is finalised by means of a large dwelling unit for mentally handicapped living independently.

With the drum residences Liesbeth van der Pol manages to have the snake bite its own tail, so to speak. This way the step-wise ascending end is shifted over the step-wise descending beginning of the stapling. In her work the only particularisation in the system is the entrance. On this spot she can not realise an apartment with a kitchen on ground-floor level. There she situates a different type with a kitchen on the third floor; another illustration of the flexibility of the stapling she has chosen

13.15 RELATION BETWEEN TYPE AND CONCEPT

Finally, there is the question as to the relationship between type and concept. As stated in the introduction to this Chapter, the notions of concept and type are linked to different phases of the design process. Looking at it like this, the two notions do not seem to be related at all. However, it is certainly possible that the choice of a particular type is actually part of the concept. This is, among others, the case with the concept that MVRDV use in their design of the three porter's lodges. The archetype house is, in this design, a basic part of the concept they used. It is also possible that the choice of the type is a direct consequence of the concept. In some cases, the borders between type and concept cannot be sharply defined. In this context, the Unité as a building is an object situated somewhere on the border between concept (a housing estate placed on its side on pilotis) and a type (a slab shaped building on pilotis). The first description is more abstract and does not yet indicate a formal spatial arrangement, in contrast to the second description. For the slab shaped building on pilotis, the formal spatial arrangement can be defined and, if so wished, can be schematised.

a   Leupen, B.A.J. (1989) IJ-plein, Amsterdam een speurtocht
     naar nieuwe compositorische middelen: Rem Koolhaas /
     Office for Metropolitan Architecture

14 ANALYSIS OF BUILDINGS

PROPORTION AND MEASUREMENT IN EARLY TWENTIETH CENTURY DUTCH BUILDING PRACTICE

JAN MOLEMA

14.1 ANALYSIS OF BUILDINGS AS AN EDUCATIONAL TOOL

I cannot exclude history from my investigations, since I am dealing with existing buildings, but I am certainly not a historian. I treat buildings as actualities, not as historical data. I also cannot, should not and do not want, extract the chosen buildings from their cultural environment, yet 'the building of the building' as such is my subject. It is important to relate historical facts to the technical possibilities at the time of building and today by finding and researching the tools used for the design and the way it was realised with the building methods at the time. My hope is that the architectural student will, by analysing, learn from the building for his own future practice. Buildings and their elements of yesteryear are viewed as possible tools for the design-process of tomorrow.

Analysis of Buildings does not wish to select the subject-to-be-investigated *a priori* on the basis of Style or Movement. In fact, we studied works of a great variety of architects from different places and times: from Hendrik P. Berlage and Antonio Gaudí y Cornet to Johannes Duiker and Bruce L. Goff. Gaudí has become a topic without comparison, as may be concluded from the success of our books and our exhibition, shown again and again. But, on the other hand there are the productions that treat the Dutch Modern Movement. These products have come from a profusion of material collected by students in their research projects and elaborated by a small group of faculty members.

As the school was mostly unable to provide the money needed for the publication of the results, so the *Stichting Analyse van Gebouwen* (Foundation Analysis of Buildings) was formed, through which necessary funds are obtained from ministries and private funds. Books appeared about Gaudí, Duiker, Wiebenga, the Dutch New Movement 1924-1936 and exhibitions about the same, but also about Johannes Bernardus van Loghem.[a] A result of the investigation of Van Loghem's work in Siberia is the Uralski constructivist restoration and conservation project, in which faculty members take part as well as external professionals, Russians and Dutch alike.[b]

It will be clear, that there has also been a great variety in the choice of building types as we studied faculty buildings, sport complexes, schools and housing projects, Piet Blom's cubicles in Helmond and mobile homes. In Siberia (Kemerovo Oblast) the research programme even included environmental and urban problems to be solved.

Some time ago the chair for Building Integration and Co-ordination (BIC decided to extend certain studies of *Analysis of Buildings* done in the past and execute an overall research of Dutch building practice in the twentieth Century. The idea of describing this period is not original, but as our research method and viewpoint are different from the historical it can have different outcomes. The central topic is specific: the building as the result of a process of design and building. The reader must acknowledge here, that we do not speak of architecture, but of building.

14.2 THE METHOD

The method of analysis of buildings is simple. It is advisable to investigate the general structure of the building first, be it spatial or material, and draw a general layout. One needs furthermore good tools for measuring the chosen building, a bit of intelligence to understand its structure and good tools to draw and describe it correctly. It is important to know that archives contain a lot of documents, like construction drawings and contracts. This material can help to understand the building better and eventually the intentions of designer and builder. One needs a lot of training to make a good analysis and a satisfactory description, be it in

a   The exhibitions produced by Analysis of Buildings:
Antonio Gaudí, rationalist met perfecte materiaalbeheersing, 1978;
Jan Duiker, constructeur in stuc en staal, 1982;
Jan Gerko Wiebenga, apostel van het Nieuwe Bouwen, 1987;
Gaudí in de Beurs van Berlage, 1988;
Het Nieuwe Bouwen en Wonen in Nederland 1924-1936, 1990;
The New Movement in the Netherlands 1924-1936, 1992;
Johannes Bernardus van Loghem, architect van een optimistische generatie, 1996.
b   Rudolphine Eggink did the Van Loghem study. Her dissertation formed the basis for the exhibition and the starting point for the Uralski project of the Foundation Analyse van Gebouwen.

drawing or in text. Above all, the researching designer must have the capability of imagining a building spatially and make it spatially imaginable.

When starting to work with the students we first of all visit and investigate with them the chosen building in situ. Then we gather as many specific publications as possible about the object, a building or an ensemble of buildings. It is important to read the existing interpretations, before developing a new vision or drawing conclusions. We especially want to find information about the structural reality of the building and whether it has been build as it was designed. If this was not the case, we want to find out what the reasons have been to deviate. We also want to know which tools were used in the designing process and in the building process.

The second step is inspection of the sources at the NAi, the nation's most important architectural archive, at municipalities, architects offices and in private collections. We look chronologically at the original sketches, drawings, correspondence, commands of consultants, about rules for building permits, articles in newspapers, photographs, etc. We also do interviews, when possible, with the architect or with people who were connected with the architect('s office), the owner of the building, the contractor, consultants, and technical people. It is important in that stage to relate research results to the actual condition of the building.

The third step is to organise the material according to themes. We use essentially the same themes for every building, to be able to make comparisons. Examples of these themes are: assignment, architect, client, situation at location, history of the location, mass and volume, proportion and measure systems (design / build), structure of functions (design / build), structure of space (design / build), structure of materials (designed / build).

The last step is a complete description of the building, if possible into detail, including the conclusions of our investigation.

Specialised articles and lectures about a building or about a theme belong to the results. But, also complete investigations of one building in a monographic study. It is furthermore of interest to combine the results of investigations of several buildings under one of the investigated themes, for instance the proportion and measure studies of The Beurs, Hotel American and The Nederlandsche Handel-Maatschappij, all three in Amsterdam. It shows new ways of interpreting the proportional system, related to the dimensions of bricks.

14.3   IN SEARCH FOR PROPORTION AND MEASURE

The architect must study many aspects. One of these is, although applied by important architects from early times on, many times forgotten or at least underestimated: proportionality. *Proportion and measure* belong to the means to define a building in relation to its site and its functions. Already Vitruvius wrote about it; but also Fibonacci, Alberti, Palladio, Viollet-le-Duc. Le Corbusier wrote about it in his famous Modulor (see page 212).[a] Throughout history it seems to be forgotten every now and then, or devaluated, especially in daily design practice. It was recognised once more by the end of the 19th Century by architectural historians, like the German August Thiersch, but also by practicing architects, as in the Netherlands, specifically in Amsterdam.

While in the 18th Century Dutch architecture still flourished, it had gone into deep decline in the early 19th Century. In the second half of that century, Pierre Cuypers (1827-1921), architect of the Amsterdam Central Station, the National (Rijks) museum and dozens of Roman Catholic churches, gave Dutch architecture a new impulse. Influenced by Eugène Viollet-le-Duc, Cuypers predicated French Gothic as the right manner for the new architecture.[b] This was not so much out of stylistic considerations as out of rational thinking about the process of designing and building. The availability of new techniques, of newly discovered materials like tropical timber and of newly developed materials, like artificial stone and steel, inspired Cuypers to find a new way in architecture as it did other architects, who found theír ways through Eclecticism and Art Nouveau (*Nieuwe Kunst*).[c]

a   Le Corbusier (1948) *Modulor 1;* (1955) *Modulor 2*. English edition: (2000) *The modulor : a harmonious measure to the human scale, universally applicable to architecture and mechanics*. Vitruvius (1960) *Book 3*; Alberti, L.B. (1986) *Book 6* a.o; Palladio, A. (1997) *Book 1*.

b   The analysis by Viollet-le-Duc was only partly right. The 'gothic' did not exist as one style, one system or one structure. The common nominator, the essence of "the" gothic is the search and find of a different way of building, one that demands rather less material for larger envelopes of spaces. As such the gothic still exists in our days. It furthermore must have been of influence that the greater demand for permanent structures made it necessary to import materials along longer transport lines or to develop new materials. At the same time there is the wish for exclusiveness in a society of abundance. These are factors that played a rôle in the project for the Beurs.

c   Auke van der Woud's extensive study The Art of Building sheds a new light on the rôle of the different movements in the modernisation of Dutch architecture. Woud, A. van der (2001) *The art of building: from classicism to modernity*.

But, it was in fact with the generation of Hendrik Petrus Berlage (1856-1934) and his somewhat younger colleagues, like Willem Ceeszoon Kromhout (1864-1940) and Karel Petrus Cornelis de Bazel (1869-1923) that truly new architecture began. With their buildings architecture in The Netherlands reached international repute within two decades, equalling the worldwide known Dutch 17th Century standards in city planning and architecture alike. The Amsterdam Stock Exchange building, now named *'De Beurs van Berlage'*, became the Dutch hallmark for progressive architecture in the 20th Century. The development of its design shows in plans, sections and perspectives how, step by step, the definition of a new architecture developed. The sequence of proposals for the Beurs, starting with the competition project in 1885, presents the purification of form that became fundamental in Dutch architecture. It is this striving towards purification, the wish to go back to essentials as expressed in the Beurs that impressed later generations particularly.[a]

93 Different designs for *'De Beurs'*.[e]

14.4 THE BEURS, BUILT BETWEEN 1898 AND 1903

The examination of this building with the eyes of a builder provides insight into constructional and measurable physical aspects and reveals intriguing characteristics of it. One of these is the question of the basic measures related to the dimensions of the brick and the proportional system in plan, section and elevation. In his famous lecture in Zürich (1907) Berlage defines precisely how one should look at a building before criticising it.[b] He starts with a quote:

"Time alters fashions (...) but that which is founded on geometry and real science will remain unalterable". He continues: "I have come to (...) the conviction that geometry, the mathematical science, for the making of artistic forms is not only the most profitable, but even absolutely necessary."

Evidently Berlage's lecture was also influenced by theories concerning the coherence of the universe, which had been developed at the same time. He writes, "these shaping / creative / formative laws (*Gestaltung*) are of the same mathematical nature in the whole universe, that is where it concerns the bodily stereometric and where planes are concerned geometric". Berlage identifies the process of slow genesis in nature with quick production in building, the growing of the crystal with artificial imitation or interpretation of the same.

Essential to an understanding of Berlage's work is what he said next in the same lecture:

"...you should at once investigate how it was made, that is: with what consequence the forms have been applied. You have to make yourself clear with what talent the volumes concerned are brought in concordance with it. But, not only that, you even have to admit that the proportions have been applied with excellence and the decoration with great understanding and taste. All in all, you have to admit that the whole work shows an absolute entity in all its parts".

Here Berlage shows himself a classicist, following the old principles of harmony.

Choice of the proportional system

There has been quite some discussion about the basic figure that Berlage introduced in the façades of the Beurs, the so-called Egyptian Triangle with oblique side $\sqrt{41}$, base 8 and height 5 (proportion 1:1,6).[c] Half of this triangle is the square-angled one with base 4 and vertical 5. In this triangle the inclination of the oblique side is important. We know that in the traditional *'grachtenhuis'* (canal house) the windowpanes have a diagonal under ~50° with the horizontal, which corresponds more or less with the angle of the Golden Section (see page 212). In Berlage's Beurs this angle is 52°, very near to the ideal one of 51,82..° of the Golden Section, with a proportion of 1:1,618... The advantage of Berlage's system of proportion is, of course, that it works with full numbers, 8 and 5, in the horizontal and the vertical directions.[d]

On the other hand, Berlage worked with bricks and calculated heights and widths of the building in courses and headers. The measures of the applied 'Waal' brick format are 11.2 cm. and 6.25 cm (9:5=1,8) including joints, which means that only a certain multiple of the element corresponds with the Egyptian Triangle. Thus the question remains how did Berlage solve it?

a   For example p. 60 of Grundlagen
b   P. 14 of Grundlagen
c   The 1:2 proportion would make it suitable for one of the other triangles that Viollet-le-Duc indicated as proportionally correct: the equilateral, right-angled, were it not that there must be space between the bricks for the mortar and tolerance of size deviation. Also would it be difficult to set a brick with the 'Egyptian' proportion in a bond, this in contrast with the applied Waal brick.
d   Jansen had already been working for the owner of the hotel; Kromhout was invited to help only when the second or third plan was prepared. His position was probably comparable to the position of 'aesthetic advisor' that Van der Mey took in the *Scheepvaarthuis* case and De Bazel in the *Nederlandsche Handel-Maatschappij*, as will be mentioned later.
e   Source material found in archives can be rich in information about the building as such and the building process. Here, by a happy co-incidence, the highly informative diary of the overseer of the project has survived. The diary entries are terse, sometimes even cryptic. For example, why is no mention made of the drawings of the window frames on the second and the third floors, even though the overseer never failed to mention that he had received such drawings? The answer is very simple: they were never made! The frames from the old buildings were saved and re-used. No architectural historian ever discovered this, which led to quite intriguing misinterpretations about the formal intentions of the architects.
f   Had the architects been at liberty to build on an empty site, the result would undoubtedly have been quite different from the building that we know as the Hotel American. The unity, which they were clearly aiming for in the façade, would have been greater, and the building would probably have been less dynamic. Looking at the floor plan, one suspects that they would have preferred to execute it in reverse. This would have given the café a more favourable exposure: towards the sun and away from the less attractive Marnixstraat, which even then was a busy thoroughfare. That would have been an appropriate spot for the entrance to the hotel; indeed, this is where it was planned in the preliminary drawings.

Footnotes next page:

a   About Le Modulor and other proportional systems inspired by the 'golden section', see: http://www.tu-harburg.de/b/kuehn/lec4.html (also in Dutch)
b   Here we find in fact the 'proof of the pudding': if I had been able to precisely follow the rules of Analysis of Buildings I would first have measured the building, with the help of students, and as a result would have had measured drawings to work with. My conclusions would have been more precise.
c   It even is evident, that De Bazel has had a big influence on Berlage's evolution as an architect with the published, but not executed, design for the library.
d   After a design by Hendrick Jzn. Staets and Lucas Jszn. Sinck and on the initiative of the Mayor Frans Hzn. Oetgens.
e   Compare with the Scheepvaarthuis.

Berlage was indeed quite clear in his Zürich lectures about his choice of the Egyptian Triangle.[a] Far less clear was his reasoning for the basic module measure concerning which he only declared that it resulted after a long search as the right module.[b] Neither did Berlage attempt to explain the application of the Double Square in his Beurs ground plan, although the use of it there is easy to deduct.

As Berlage would have it, there exists in a well-detailed building coherence between the dimensions and proportions applied and the choice of materials. In main points Berlage applied three materials in the Beurs that co-determined the dimensions of the building: iron, stone and brick, the latter being the only one with standard production measures. Although the immense amount of brick in the Beurs would have made possible a specific standard, Berlage applied an existing one, the so-called Waal format, the most robust format that the Dutch brick industry was able to produce. It is not by chance, that the Waal brick has a basic proportion of 1:2, being 5,25 cm x 10,5 cm x 21,5 cm. Therefore, it did not co-ordinate with the Egyptian proportion Berlage wanted to apply.[c]

The simplest bond would be the running bond, but Berlage used a less dull cross bond in which at terminations (corners etc.) he could use the so-called *'drieklezoor'* (three-quarters of a stretcher) to improve cohesion of the wall. But also the bond that Berlage choose to apply has its restrictions. Parts of walls, as between windows, of odd numbers of brick heads result in a different (symmetrical) termination pattern from those of even numbers: a-symmetrical and therefore not quiet. As Berlage aimed at quietness we may suppose that he prefered the first solution and, therefore, made wall parts between windows with odd numbers of brick heads. The general module of 17 brick heads is thus correct, but the above mentioned wall part is 34 heads with 20 heads for the window openings and 14 between windows at the main floor, both even numbers.

14.5   HOTEL AMERICAN, BUILT IN 1900-1902

From the start, the Hotel American on Amsterdam's Leidseplein - close to the Stadsschouwburg, the new Rijksmuseum, Vondelpark and Concertgebouw - owed its fame to its café, the meeting place of choice for well-known public figures. The building itself, designed by W. Kromhout and H. G. Jansen, was an architectural masterpiece even today greatly admired for its exceptional design.[d] The first Hotel American (1880) was built at the same time as the Rijksmuseum. When, in the nineties, the decision was taken to renovate and expand the hotel, the site was already fixed: adjacent to and under the existing building. What was not yet settled, however, was the ultimate size of that site. The possibilities for expansion increased over time. Although little of the original building has survived, one is struck by the degree to which the new structure has been determined by the preceding structure. The extent of the formerly existing buildings and of the renovation is clearly visible in the archival drawing of the foundations, in which the architects have indicated both the old and the new structure. The structure of the new Hotel American was indeed determined to a considerable degree by the old, both in material and spatial sense.[e]

The desire of the architects to base their design on a simple basic floor plan becomes evident when one looks at the ground floor, especially the café. It is also immediately clear that they did not confine themselves to the basic plan, but were striving for a sound structure with a high degree of complexity, with meticulous detailing, and judiciously chosen proportions. The fact that Kromhout and Jansen made use of a measuring method to recreate the Hotel American on the basis of the existing construction becomes clear from the drawings and from the building itself.[f]

The dynamics of the new hotel are rooted in the buildings, already existing on the site. The old, both in material and spatial sense, determined to a considerable degree the structure of the new Hotel American. Kromhout and his fellow architect Jansen encountered a complicated situation. To conquer this they laid a simple basic figure on it and elaborated upon this until they reached the highest degree of complexity possible.

Choice of the proportional system

Although we do not find any sign of a proportional system in the Hotel American documents as such, we find evidence in some drawings for a non-executed hotel by Kromhout in 1911. The system there applies exactly to the final solution for the Hotel American. The fact that the architects Kromhout and Jansen made use of a measuring-method to recreate the Hotel American on top of the existing construction furthermore becomes clear from studying the drawings and the building itself.

Kromhout must have quickly become aware of the fact that the L-formed lot for the new hotel comprised about three squares; one of these covered the lot of the existing hotel, being exactly 18.80 x 18.80 m. The architects' need to base their design on a simple basic figure we read at a glance from the ground floor plan. We also see that they did not just stick to that, but as good composers pursued complexity. This is, for instance, reflected in the variety of spans over the main room. We find here the proportions 1:1, 1:2, 2:3 and 3:4, incorporating the numbers 1,2,3,4. These proportions gave the floor plans sufficient variety to fit in any of the desired spaces in the whole building. We can easily trace the applied method of measure and proportion from the drawings for the design, in which 3 existing buildings had to be incorporated. The rectangularity in the plans is pointedly present, as we see in the way the façades divert from the existing alignments at both sides of the building. The square and its diagonals determine the whole building in all three directions.

The height of the tower is remarkable. We find that it maintains the basic proportion of the building, 1:1, in the sense that the height equals the total width of the front façade of the hotel. In the preliminary design, made before the client acquired the lot of the neighbouring police station, we find the same principle, be it that the height of the building at that stage was more than the available width. Consequently, this led Kromhout at that moment to the choice of the equilateral triangle as basic regulating figure. All in all, he used the same principle as found in the Berlage Beurs, though with a different triangle in height.

I must add, that the remaining drawings do not show measures of height, length nor width. After carefully measuring I have come to the conclusion that the basic dimensions are those found in the café: height 592 cm and horizontally 592 x 888 cm (rectangle between the four central columns of the café). 592 Co-incides with what Le Corbusier defined much later in his Le Modulor, as well half of it, 296.[a] The latter should be seen as the module on which the building was designed. Also 148 is used for the smaller additions that Kromhout adapted the building to the building lot, which had several oblique sides.[b]

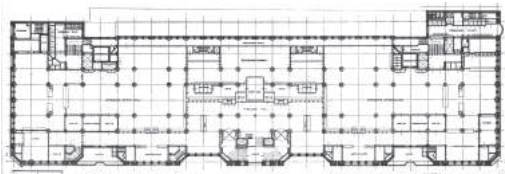### 14.6 THE NEDERLANDSCHE HANDEL-MAATSCHAPPIJ, BUILT IN 1919-1926

In spite of the expressionistic exuberance of the Amsterdam School, restricted form was still, around 1920, an expression of modernity. Karel P.C. de Bazel, as aesthetic advisor responsible for the exterior of the building concerned, had already in 1895 acted in accordance with it, with his solution for a library, preceeding Berlage's final design for the Amsterdam Stock Exchange (1898-1903).[c] We may want to ask ourselves, whether De Bazel still belonged in the early twenties to the architectural vanguard with his most important building, finished only after his death in 1923.

The history of the site for the *Nederlandsche Handel-Maatschappij* (NHM, Netherlands Trading-Society) goes back to the year 1612, when the decision was taken for the construction of the famous city-extension, known as the *Grachtengordel*.[d] The southernmost part of this historical plan was built from 1658 on and received as main tangent the Nieuwe Vijzelstraat, at which the NHM building stands today. The parcels along this tangent, which runs from what is now the Muntplein southward, were sold in 1665 and immediately filled. The sixteen parcels of the later NHM grounds, between Heeregracht and Keizersgracht were each slightly more than 20 feet wide and 70 feet deep. The parcels along the two canals were wider (24 feet) and much deeper (180 feet each).[e]
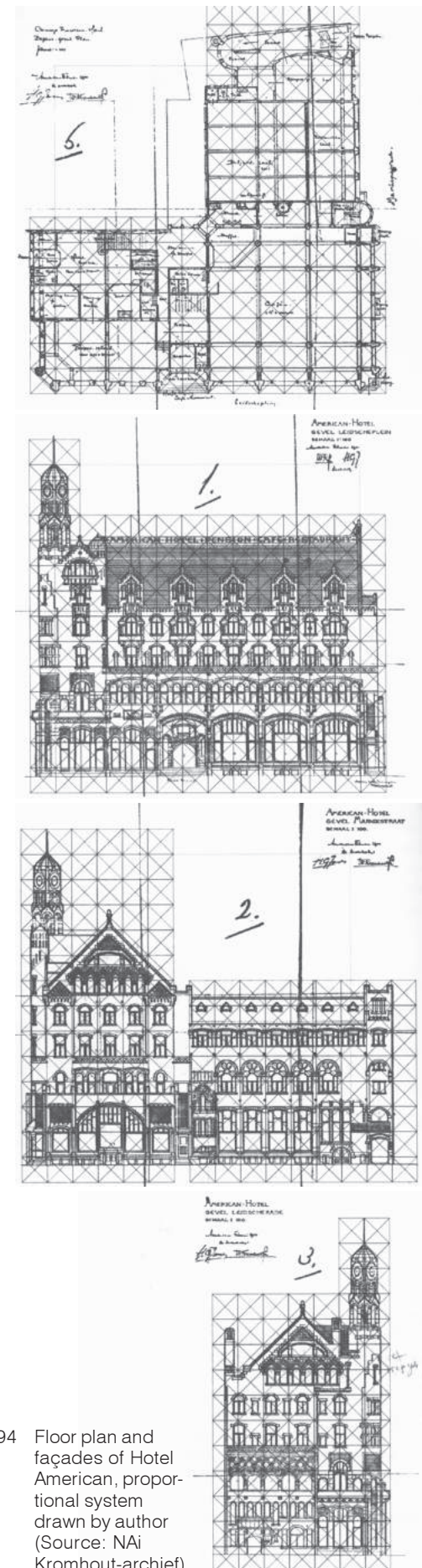
94 Floor plan and façades of Hotel American, proportional system drawn by author (Source: NAi Kromhout-archief)

95   Floor plan and façade of the *'Nederlandse Handel Maatschappij'* [f]

CHOICE OF THE PROPORTIONAL SYSTEM

In his book 'K.P.C. de Bazel-Architect', Wessel Reinink examined extensively De Bazel's use of measure and proportion. Briefly, his explanation is as follows: Already in his competition-design for a library the use of a regulating system of measure and proportion is evident. In the design process for the NHM De Bazel was working from the beginning till the very end on the basis of a square-angled grid for the ground plans and a system of horizontal lines for the façades.[a] The grid was applied as a system of squares, subsequently rectangles, with only one basic figure. In the first case this is a square of 360 x 360 cm; in the other, mostly researched and also finally applied, system the basic figure is a rectangle of 320 x 360 cm. In the vertical sense De Bazel used a line pattern of 30 cm. The most common measures are 90 and its multiples 270, 360 and 450 cm (while 320 cm is not found).

De Bazel's architecture looks very austere, to my mind a direct consequence of the rather rigid use of grids. The singularity of the ground plan grid gave him little compositional material for a high complexity, which becomes obvious in his sketches for the street façade, in which several parts clearly deviate from the grid. On the other hand we can read De Bazel's struggling in the many drafts he made on the basis of a pre-drawn grid. This grid was obviously too rigid indeed to give all different functions the right place, form and dimensions. The preconceived grid is too simple, a common mistake in architectural practice, which in the case of De Bazel is rather amazing. Why did he stick, in spite of his struggling, till the end to the same grid of 320 x 360 cm?[b]

The following explains the choice and his insistence. One of the letters to the architects, in which the municipality comments their plan, says that they must take into account the maximally permitted depth of the buildings on the adjacent lots at the canals at both ends of the NHM building, being 28.3 metres.[c] The measure of 28.3 m. may seem deliberate, but becomes understandable once we know that we find ourselves in the part of town built in the 17th Century. The original parcel division plan shows the dimensions of the parcels in Amsterdam feet. The depth of the parcels along the canals is, as already mentioned, 180 feet, which brings the total depth to 360 feet. The Amsterdam foot equals 28.3 cm.! The maximum building depth is therefore 100 feet. But, the most interesting is, that 360 are the measure of De Bazel's grid module in centimetre, from which follows, that he q. q. could place 28.3 modules on 360 feet!

On the other hand, the fact that De Bazel and Van Gendt applied a different module in the other direction may be explained from the total amount of modules on the depth of the parcel, which varied from 29.89 to 31.82 m. This depth would be sufficient for 8 modules of 3.60 m + 1.09 m to 3.02 m. Dividing the measure of 8 modules of 3.60 m in 9 modules of 3.20 m (both 28.80 m) and leaving the last module free admitted a greater height at the back of the building. Building as many cubic metres as possible was, before and after all, more important than anything else. Even more than representativeness.[d]

14.7   PUTTING THE THREE TOGETHER

As I tried to show, proportion played a major rôle in Dutch architecture at the beginning of the Twentieth Century. It must still be researched, though, how it influenced the move towards modernity. It is known from documents that around 1900 proportional systems were subject to many discussions between architects; especially in architectural circles of Amsterdam, where Berlage, Kromhout, De Bazel and others held talks and gave courses.[e]

The Golden Section was probably the most discussed proportion. Yet, it was certainly propagated more by theorists than practitioners. The definition of it in words sounds simple enough: the proportion between the smaller and the bigger of two elements equals the proportion between the bigger and the sum of both. But, it gives dimensions which are difficult to handle, be it in metre or in feet. The practical architect, like Berlage in his Beurs design, prefers 8:5 (1,6), very néar to the Golden Section (1:1,618..). For human eyes the difference is not perceptible, in building practice, therefore, the simpler method is prefered.

a   Here I must remark, that the 'aesthetic adviser' De Bazel was invited to collaborate with the house architect of the NHM, the well-known Amsterdam based Van Gendt firm. The reasons to involve De Bazel were purely political as he was to be the supervisor for the re-construction of the Vijzelstraat, the street at which the building would arise.

b   In the descriptions of the building I could not find a reason for it, neither did I find it in the correspondence between De Bazel and his companion A. van Gendt and the representative of the client.

c   This in relationship with sufficient daylight at the backside of the building; even in case the neighbours would fully use their right of building.

d   Though the building height in Amsterdam was restricted to 22m, the NHM building became in the end more than 30m high, thanks to political intrigue. NB All information about the NHM comes from the related archives at NAi, Rotterdam and the GAA, Amsterdam.

e   Molema, J. (1999) *Berlage's Beurs-concept and method.* Furthermore: Molema, J. (2000) *Hotel American aan het Leidseplein te Amsterdam.* and Molema, J. (2000) *Het Scheepvaarthuis, een droomschip met hekgolf.*

f   Sources respectively: *Bouwkundig weekblad en Architectura* (1927) no.2 p.11; Publication of *N.V. Nederlandse Aanneming Maatschappij v/h Fa. H.F. Boersma Hoofdkantoor 's Gravenhage* (1934).

Here and now we can conclude that Berlage, De Bazel and Kromhout made use of a regulating triangular figure in their designs.[a] They also had a few other, common, denominators:

- the regulating proportional system always starts at ground floor level; anything in the façade below this level is not taken in account,
- the basic proportion defines the whole building, including height of the tower if there is one.
- the vertical side of the 'grand figure' (half of the regulating triangle) co-incides with the axis of the tower, the basis of it with the ground floor,
- the grid lines co-incide with the boundaries, although not necessarily with the axis of the wall present and most important:
- the grid does not have in the first place an aesthetic function, but is meant to organise design and building process. It helps to clarify the presumably vague ideas at the conceptual stage of the design process and it helps the architect to make decisions.

14.8   BACK TO BERLAGE

From his presentation drawings for the final project we can deduce how precisely Berlage was working in the end. The inserted module lines indicate exactly how the different parts of the building are related to each other and to the whole, and also where the material is going to be placed, for instance with the centre line co-inciding with the modular grid. In Berlage's own words: 'The art of building is the art of composing precisely, such that from there on a building which is not composed precisely, can not be described as a piece of art'. (*Seven lectures on the Art of Building*) As mentioned before, Berlage discussed the importance of proportions in a building most extensively in his Zürich lectures, in which he rhetorically asked: "Would designing on a certain geometrical system not be a great step forward? A method, with which several of the modern Dutch architects already are working?" Evidently, he had learned a lot during the design process.

The rectangle 1:2 – the double or super square

In relevant literature the rectangle 1:2 with a diagonal v5 has been identified frequently as ideal for ground plans.[b] Although the Beurs ground plan, because of the given site, has a proportion of nearly 1:3, and thus is not a double square, it becomes obvious that Berlage used this basic figure of 1:2 repeatedly for the division of his ground plan. The three main halls all have the proportion 1:2, not including the side-aisles; also the two groups of small rooms at each end of the main hall are set in a double square. Remarkable is that Berlage secured the wholeness of the main hall and its aisles by moving his ground plan over the given situation along the Damrak building line. He had this possibility as the lot was longer than Berlage needed for building.

Finally, the northern group of small rooms is an exception, although it forms a square together with the two small exchange halls and their side aisles. Berlage made his choice for the double square between 1896 and 1898, as a comparative analysis of the first design phase, and the plans for the building specification, confirm.[c]

The brick

As observed, the brick applied in Waal format does not fit an Egyptian triangle. The smallest quantity of bricks necessary is 17 headers and 19 courses - each prime numbers. The conclusion is simple: Berlage took the smallest unit possible of whole headers and courses, starting from a header measurement of 11,2 cm and course dimension of 6,25 cm. both including the joint, using normal brick-laying methods, the standard of the Waal format and the practical proportion of 5:8. The course includes a 1 cm joint, the vertical joint being 0,7 cm. 17 headers and 19 courses give 190 and 118,75 cm. The last measure appears rather awkward,
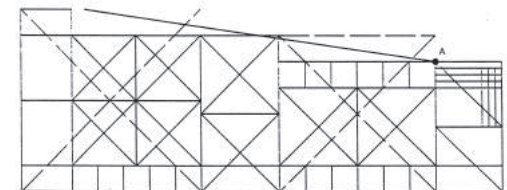
96   Proportional system of the ground plan of *'De Beurs'*.

a   And the Amsterdam School architects Van der Mey and De Klerk at some moment
b   August Thiersch, for example, proved that many Greek temples have a ground plan with this ideal proportion. Thiersch, A. (1893) *Die Proportionen in der Architektur*. Antonio Gaudí y Cornet also repeatedly used this figure as a basis for his design, in plan as well as in elevation.
c   It is, therefore, quite certain that Berlage learned about it during the meetings at A. et A. in 1896, where several lectures were held about proportional systems. From my research on Gaudí's work I concluded that the Catalan investigated it in his much earlier work around 1880. Read Molema, J. (1987) *Antoni Gaudí, een weg tot oorspronkelijkheid*.
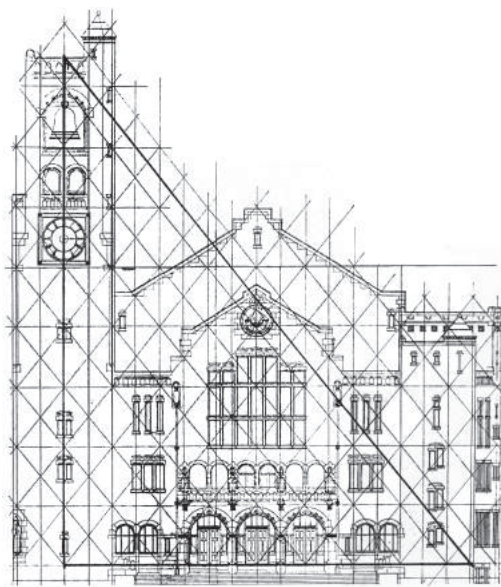
97 Façade and proportional system of *'De Beurs'*. Fat triangle drawn by author.

but results in exactly 16 courses per 1.00 metre rise, normal bricklaying practice in the Netherlands. The 190 cm is, furthermore, not too difficult to use. In the Golden Section 118,75 cm would mean 192 cm length, while on the other hand 190 cm would give a height of 117,5 cm. Berlage's choice was a rational one.

Façade at Beursplein

From measuring drawings and reasoning it appears that Berlage used the centre of the (main) tower as the measuring line for its height, a precedent established in other architect's work, such as the Hotel American. The tower occupies 4 modules in width; the axis of the tower splits the Beursplein façade into 2 and 17 modules, from these 17 modules resulted the height of the tower: 17 x (190 x 5/4) = 17 x 237.5 = 4037.5 cm (17 vertical modules), which is indeed what the drawings show.[a] It is notable that Berlage choose to use the prime numbers 17 and 19 on a grand scale. At the Damrak, the height of the tower does not have an obvious, clear proportion with the façade, which may indicate the importance and the character Berlage gave to each of the façades. Furthermore, we find the Egyptian triangle starting from the axes of the two towers of the middle section at floor level and their apex: 10 modules of 190 cm correspond with 10 x 237.5 cm = 23.75 metres in height. The gutter level at Damrak, 6 x 237.5 cm, corresponds with 6 modules, which is a 1.5 'canal house' of which 6 fit in the major hall and 5 in the small ones. It follows that the large hall plays the most important rôle in defining the height of the Damrak façade, although the building regulations may also have had a significant influence.

14.9   THE LESSON

Taking everything together we are witnessing a growing interest in, and domination of, the proportional system as a form giving principle in the development of the Beurs and other early-modern buildings in the Netherlands. Under the influence of discussions in those years between architects about proportional systems in the past and which ones could be used in actual practice, Berlage followed the recommendations closely in an analysis of his own, existing, designs for the Beurs. The introduction of the 'Egyptian triangle' led to the building being realised. Without exaggerating: the full proportioning of the design was instrumental in the development of the new architecture. Berlage probably could have gone further if he had been freer in the concept of the ground plan in the given situation.

It has been mentioned that Berlage was not a *Prinzipienreiter*, but it would not have brought him any further if he had been one. Where given conditions and principles do not cope with each other, a way-out must be found, which in most cases means one must leave principles aside. These confrontations of conditions and design principles give the buildings their specific character. There, as always, the architect has to decide what is the best solution in the given circumstances. A proportional system facilitates the decision process during design and is highly adequate in the building process. Such a system is not an aim, but a tool, one of a whole set. As I have shown, designers who use such tools are not the worst.

Analyses of Buildings is there to help students to discover these tools, investigate them, and learn to work with them and add them to their toolbox. Its impact can be much greater as the students also learn to write and publish their findings through articles, books, expositions and in conferences. A much larger public will be reached than just the single student at the faculty. Above all we want the architect(ural student) to do what the architects introduced have done: analyse existing buildings and literature, find out essentials and apply the findings where possible in their own practice. Only simple minds will deny the necessity of it. Originality is to be found in the origins. As Antonio Gaudí said, again and again, to be original one has to return to the origin: *Para ser original hay que volver al origen*. It is our task as a technological scientific institute to go and show that way through analyses of buildings.

a   The following heights may be found in the specification drawings:

4037,50	top of main tower	8,5	x	4,75 m.
2850	top of façade of main hall	6	x	4,75 m.
2375	top of towers at Damrak	5	x	4,75 m.
2018,75	top of gutter of main hall	4,25	x	4,75 m.
	(= ½ height of main tower)			
1425,00	top of gutter Damrak	3	x	4,75 m.
	(= ½ height of façade main hall)			

15 PLAN ANALYSIS

HAN MEYER

15.1 MORPHOLOGICAL REDUCTION

Morphology literally means 'form-lore', or knowledge of form. In the present case the knowledge of the form of the city is concerned: what is the essence of that form; does a certain logic in spatial composition apply, certain structuring principles? During the seventies, the interest taken in analysis of the form of the city and the wish to try and understand which compositional principles and spatial conditions and restrictions were underlying an existing part of the city or an urban architectural design witnessed new impulses. This was strongly related to growing criticism of functionalistic design philosophies that dominated urban architecture in the decades following WW II. The discovery that historic cities and parts of them often feature certain spatial characteristics relatively insensitive to changes in usage and significance through the years caused growing interest in the principles of composition underlying the spatial form of a part of the city – independent of functional, legal, social or economic considerations. The development of morphological analyses in the sixties and seventies that flourished in Southern European countries (Italy, France, Spain)[a] and in Northern America[b] was in the seventies and eighties to 'Delft' a source of inspiration to build a new foundation for urban design.

Several kinds of morphological analysis may be discerned; each of them with its own purpose and its own (drawing) technique. Especially the figure-ground analysis and formal plan analysis developed in Delft are mentioned here. These methods of analysis play an important rôle in the search for new urban compositional principles and in the debate on them. There are two important considerations; first, that morphological analysis is indispensable to the designer in order to be able to make statements on the position and significance of a building in a given spatial context. The second is that a morphological analysis usually does not lead to a clear conclusion that can be transformed directly to a design.

A common property of various kinds of morphological analyses is that they endeavour to provide an unambiguous explanation and/ or interpretation of the spatial structure of the city; the purpose or the aim of the analysis however may vary, resulting in differences in the 'usefulness' of the analysis for the design. Here, we make a distinction between:

- morphological analysis as a method for plan criticism,
- morphological analysis as a method for knowledge development and explanation of the origination of the form of the city,
- morphological analysis as an exploring preliminary study for formulation of the commission for the design.

Finally, a fourth category of analysis, important to urban architectural design:
- typological analysis as an exploration of the design toolbox.

15.2 PLAN CRITICISM

Figure-ground analyses

An important motivation for development of morphological analysis consisted in mounting dissatisfaction and criticism connected with the methods and products as they are employed in the modern building of cities. They were dominated by the intention to replace the morphology of the existing city by an entirely new one. However, the debate on the intentions and effects of modern urban architecture were still dominated, for the time being, by ideological motivation. The first generation morphological studies can be characterised as a quest for development of a 'language' enabling a way to discuss the effects of modern urban concepts and the significance of old, traditional city forms without deteriorating directly in ideological positioning.

a   Intended here is the work of Muratori, Saverio (1959) *Studi per una operante storia urbana di Venezia;* Aymonino, C., M. Brusatin et al. (1966) *La Città di Padova, saggio di analisi urbana;* Rossi, A. (1982) *The architecture of the city* (Dutch translation: (2001) *De architectuur van de stad*) a.o. in Italy; Fortier, B. (1989) *La metropole imaginaire: un atlas de Paris;* Panerai, Ph.;, J.-Ch. Depaule et al. (1999) *Analyse Urbane (1980)* a.o. in France; Sola-Morales, M. de (1993) *Les Formes de Creixement Urbà* a.o. in Spain.
b   Rowe, C. and F. Koetter (1978) *Collage City;* Moudon, A.V. (1986) *Built for change, neighbourhood architecture in San Francisco*.

98   Parma according to Rowe (1978)
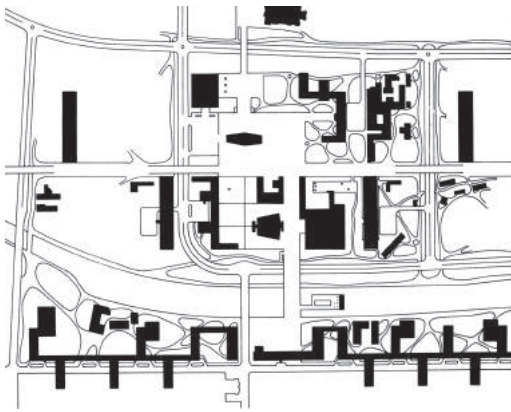
99   Saint Die (Le Corbusier) according to Rowe (1978)

As a method of plan-criticism morphological analysis has as its objective to ask, by means of a drawing, the question whether any spatial structure in an urban project is there at all. The most explicit type of drawing developed for that purpose is the figure-ground analysis, introducing an essential aspect of the urban composition: the ratio between (built) mass and open space. The central question is which of the two components plays a figurative or form determining rôle in utilisation of the area. This method of analysis was developed by the American professor Colin Rowe; in first instance with the aim to differentiate fundamentally between the urban architecture of the 'Moderns' and traditional city forms preceding the twentieth century.[a] With this goal in mind Rowe compares the city maps on the same scale of two different cities: the inner city of Parma, result of a process of development during centuries; and the design of Le Corbusier for Saint Die. Rowe explains:

"Thus, the one is almost all white, the other almost all black; the one is an accumulation of solids in largely unmanipulated void, the other an accumulation of voids in largely unmanipulated solid; and, in both cases, the fundamental ground promotes an entirely different category of figure - in the one OBJECT, in the other SPACE."

Saint Die is primarily a composition of objects, while Parma is primarily a composition of spaces. Rowe claims that actually two different models are concerned, both with their roots in classical antiquity: the model of the acropolis (the object in space) and the model of the forum (space surrounded by mass, the urban interior).

The figure-ground analysis is important in order to address the relation between building and open space. When an analysis demonstrates that open space is the category determining form, giving form to buildings is largely subservient to the logic of the structure of the open spaces. The design of the structure and form of the open spaces primarily puts conditions to giving form to the buildings.

By means of his figure-ground drawings Rowe wants to show that this space concept has left modern urban architecture completely. Emphasis on the autonomous qualities of the building stands central. Position and shaping of the building will relate particularly to composition of the whole of object-like buildings. Rowe wrote with a purpose: as a polemics against modernistic urban architectural concepts propagating them as the only obvious ones.

15.3   KNOWLEDGE DEVELOPMENT AND EXPLANATION

Studying the development of the form of the city and of the factors responsible for origination of that form is not necessarily directly linked to the ambition to make a design. Central is the wish to understand the form of the city, to give a theoretical explanation of its growth, independent of notions like 'right' or 'bad', 'beautiful' or 'ugly', 'valuable' or 'uninteresting'.

However, the usefulness of these morphological analyses is that they offer a framework that ultimately enables value-judgements, that can trace conflicts between different kinds of spatial systems, and that provides to the designer the wherewithal for forming an opinion on spatial qualities and bottle-necks of the city. Important studies in this field have been conducted by Muratori, Panerai, Moudun and others.

Amsterdam Urban Building

The most complete example in The Netherlands of such a morphological analysis is the book by Casper van der Hoeven and Jos Louwe, *'Amsterdam Stedelijk Bouwwerk'*.[b] By now it has the status of a classical study. Conclusions concerning changes in the form of the city deemed desirable have not been drawn in the book at all, nor is there stimuli to a design. Nevertheless, the book should be regarded as obligatory literature for any designer who wants to do something in Amsterdam.

It is an example of a theoretical discourse where reduction drawings play the leading rôle. The original designs of most of the plans analysed were not available; and certainly not

a   Rowe, C. and F. Koetter (1978) *Collage City*. See also: Trancik, R. (1986) *Finding lost space: theories of urban design*, p. 98 a.f.
b   See Hoeven, C. van der and J. Louwe (1985) *Amsterdam als stedelijk bouwwerk: een morfologische analyse*. Other important studies in this respect: Cusveller, S., R. Geurtsen et al. (1987) *Tilburg, wolstad in ombouw;* Geurtsen, R. (1988) *Locatie Delft Zuidpoort, stadsmorfologische atlas;* Hoog, M. de (1988) *De Pijp. Een morfologische studie met een accent op het stadsontwerp.*

the precise considerations that played a rôle in the originating of the historical designs. In the analyses it is tried to reconstruct those considerations.

An example is the analysis of Amsterdam's girdle of canals. In this analysis it is explained as a combination and adaptation of the ideal plans of the fortress building engineers Stevin and Speckle, spread out into a linear ribbon, in which several variants are possible leading to varying sizes of building blocks.

Another fine example of van der Hoeven and Louwe is their analysis of the Dapper neighbourhood. In six drawings they show what the principles were leading to the final spatial structure of this area. In the first drawing they show the basic principle: two rows of building blocks, mirrored at both sides of a central street. The second drawing demonstrates that is was necessary to introduce a torsion because of the shape of the plot available. According to the third drawing, a grouping of building blocks took place, causing two large ensembles of six building blocks and two smaller ensembles of four, respectively two building blocks. This grouping also leads to differentiation in the pattern of wider and more narrow streets. The fourth drawing shows that by narrowing the ground surface locally, and also by railways, triangular endings emerge. The fifth drawing shows introduction of some special elements, like a church and an oval square. Finally, the sixth drawing gives an idea of the basic structure of the neighbourhood.

How could the authors make these drawings? Probably the analysis itself moved in the opposite direction: the beginning is to put a transparent sheet over the map and to make a drawing like number 6. Next, all special elements have been removed step by step, until the first drawing remained as the drawing of the basic principle: a double repetition of a series small building blocks. By the same token, the presentation of this series of drawings is a theory, that is to say a plausible sequence of steps leading to the final form.

amsterdam
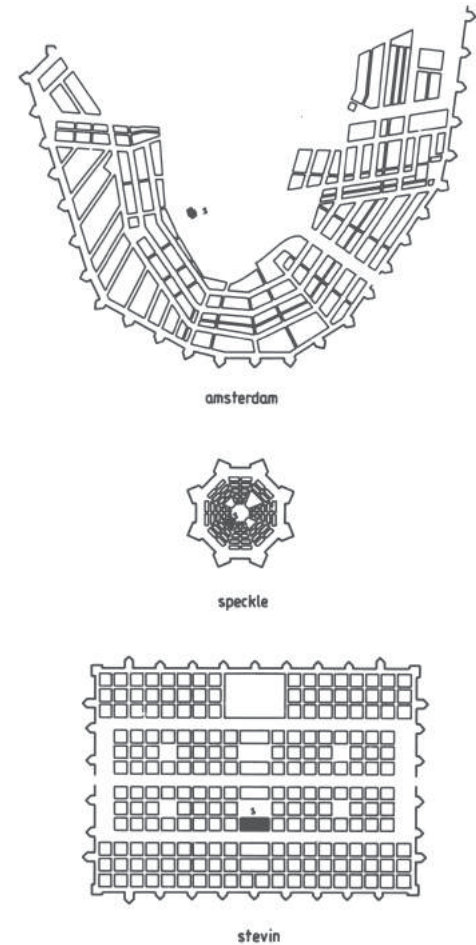
speckle

stevin

100 Amsterdam versus the ideal plans of Speckle and Stevin. Fig. 100-104 from van der Hoeven and J. Louwe (1985).

101 The girdle of canals as a variant on Stevin

102 Dapper neighbourhood

regelmaat

verdraaiing

groepering

afschuining

verbyzonderingen

hoofdmomenten
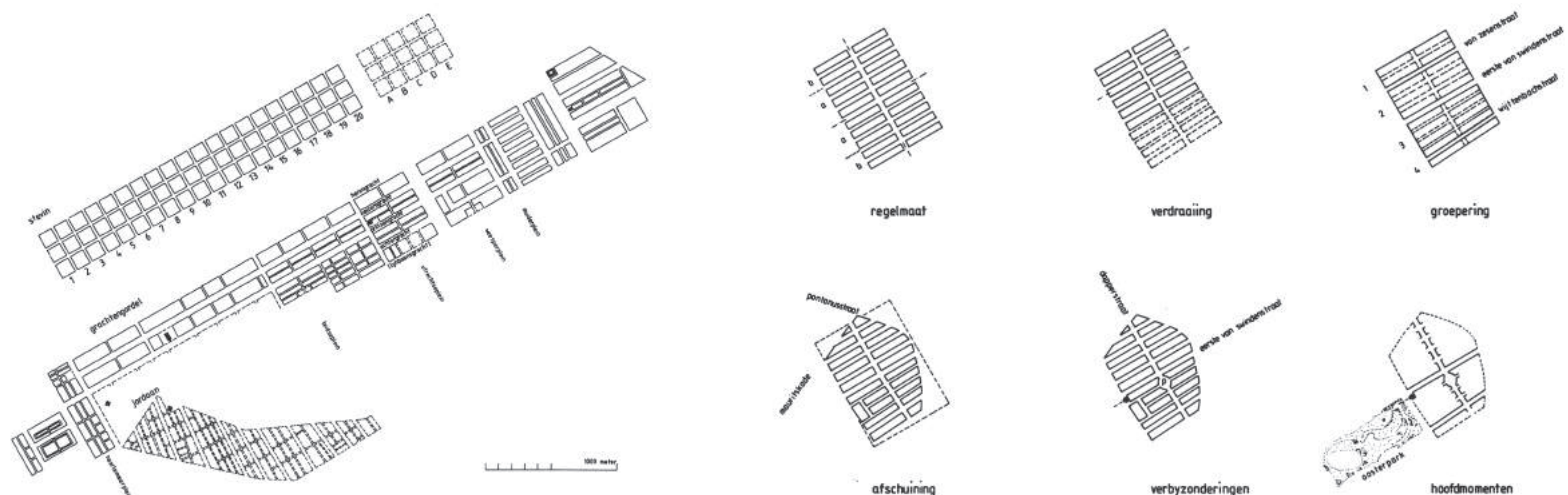
The method leading to such a drawn theoretical discourse is further described by van der Hoeven and Louwe in three separate processes; the informative, deductive and abstracting stages.

1. The informative stage concerns dating (collecting map material in chronological order), rubricating (putting the map material into the same scale and the same position), standardising (uniform rendering) and normalisation (omitting irrelevant co-incidences and exceptions). Although in this stage already various choices have to be made (which historical maps are relevant or not, which aspects are regarded as exceptions, etc.), the aim is to visualise as objectively and clearly as possible the developmental process of an area.
2. In the deductive stage studying and interpreting the factors that lead to the spatial composition are central. This stage concerns reconstructing (drawing the possible variants of a basic design and their transformations), deprogramming (cleansing the material from data pointing to legal or functional use), addition (of relevant parts outside of specific part of the plan in order to explain the position or orientation of certain parts), fragmentising (subdividing the drawing in parts and re-arranging them in a different inter-connection) and sequencing development (making a number of drawings of a subject with an increasing level of abstraction).
3. Finally, the abstracting stage. This comprises formulation of themes (a series of drawings with one theme per drawing), formalising (visualising which aspects of the spatial form are important: symmetries, orientations, lines of view, scale systems, etc.) and making diagrams (abstracting in such a way from the spatial plan that a schematic drawing with symbols results).

Together these three stages establish a method for analysing a plan area with precision as far as its formal characteristics are concerned. This does not entail that all drawings produced according to this method should also be displayed during presentation of a discourse. In that case it is important that one can restrict oneself to those drawings that support the discourse and render it. The sequence of drawings from the Dapper neighbourhood given here, for instance, is an example of a series of drawings from the deductive stage. In order to be able to make these drawings, the authors had first to make a number of drawings of the informative stage, that could not be displayed in order to make the discourse not too time-consuming. In the following series of drawings of a part of 'Plan Zuid' (between the Churchill and Roosevelt lanes and Staal's *'Wolkenkrabber'*) the authors have limited themselves to presentation of drawings from the abstracting stage, with mentioning themes – per drawing one theme – as well as formalising (indicating form aspects, lines of view, scale systems, etc.) and diagrams (high abstraction level of the drawing).

103 'Plan Zuid'

104 Medieval Amsterdam
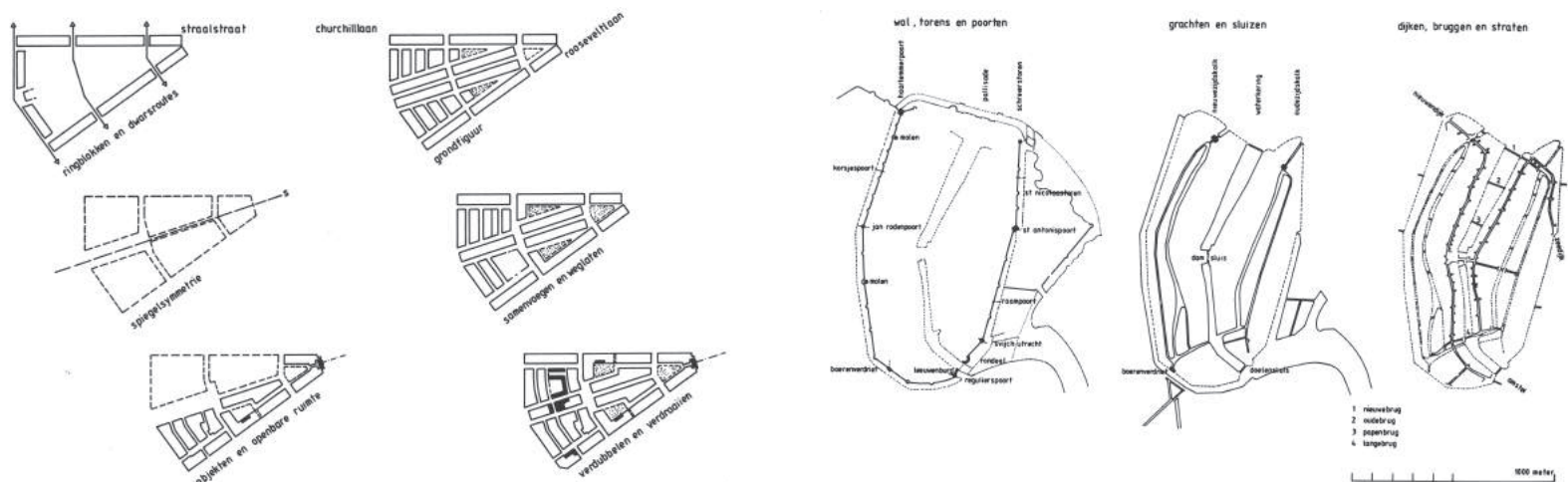
Form, use and structure

The methods of analysis described in the above give insight into factors and considerations which caused a specific form of a city. Van der Hoeven and Louwe's book analyses the various urban parts of Amsterdam from the medieval dam city up to and including the twentieth century city expansion *Algemeen UitbreidingsPlan* (AUP). During the historical stages different legends units play the leading rôle. The analyses of the medieval town relate to changing relationships between water and land: 'wallen', dikes, bridges, canals, sluices: establishing the most important elements determining form. The positioning of the buildings accommodates itself to these elements of the wet infrastructure.

From the seventeenth century onward a more rational form of city expansion emerges. Consciousness of the possibility to steer a form of building by allotting sites in a certain way is increasing continuously. In the drawings relating to the parts of the city originating from the seventeenth century more attention is also given to the relation between the structure of the system of public works, the urban 'islands'(that is to say the areas appropriate for allotting surfaces and building) and articulation of these islands. The direct relation between these three aspects (the system of public spaces, islands, and lots) manifests itself clearly as a factor determining form in the drawings. Separate drawings of the form and structure of the buildings are as yet hardly made in these sequences. There is also no need to: the structure and form of building in the city is from the 17th up to and including the 19th century a self-evident derivation from the structure and form of the lots.

The spatial form of this city was determined in principle by an unambiguous form of use of space, characterised by a direct and unambiguous relation between the system of public spaces and lots made available. Exceptions that cannot be directly explained from this logic are usually caused by infrastructural elements of a higher scale level (dikes, water courses) or specific geomorphic conditions (e. g. differences in soil composition).

In short: the contrast between public and private largely co-incided with the one between space and mass. . The analytical drawings of the 17th and 19th centuries predominantly give information concerning organisation of the public and of the private domain. The buildings were drawn as a distinct category only if they served as specific accents in the urban landscape.

Also in South-European 'sources' of the analysis of the form of the city it is striking how strong the emphasis is on the almost hermetic relation between the structure of the articulation in lots and the structure of building. The brilliant analyses, for instance, by Bruno Fortier of various transformations of Paris during the 18th and 19th centuries[a] show again and again – regardless of the complexity of specific transformations – that the essence of each transformation can be explained from re-organisation of the articulation of an urban island (like in the case of many passages), of the structure of the public domain, or of both. The individual plot is the basic unity in each drawing.

This way of drawing can not be used anymore in the analyses of the 20th century plans, since in the new urban architectural concepts the unambiguous relation between a piece of land and a building has ceased to be accepted. In the analyses of 'Plan Zuid' drawings of patterns of articulation fail to emerge for the simple reason that an articulation on the scale of the individual household does not exist anymore in 'Plan Zuid'. The individual building masses have undergone an increase of scale and co-incide with complete islands.

In the further expansion of the city of the AUP a relation between islands and building disappears as well. The unambiguous relation between public and private domain as cornerstone for the relation between space and mass that still existed in the city of the 19th century has vanished completely in the AUP.
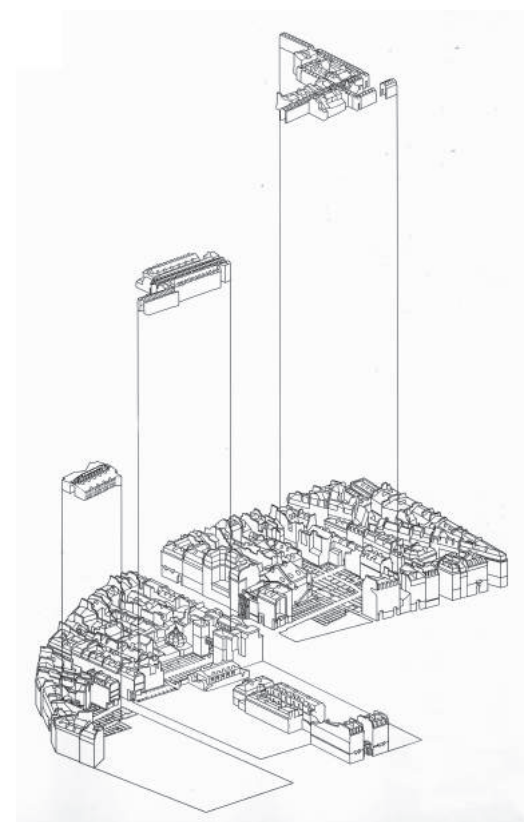
105 Paris: system of three passages (Panoramas, Jouffroy, Verdeau) according to Fortier (1989), city map (above) and decomposition (below).

a   Fortier, B. (1989) *La metropole imaginaire: un atlas de Paris*.
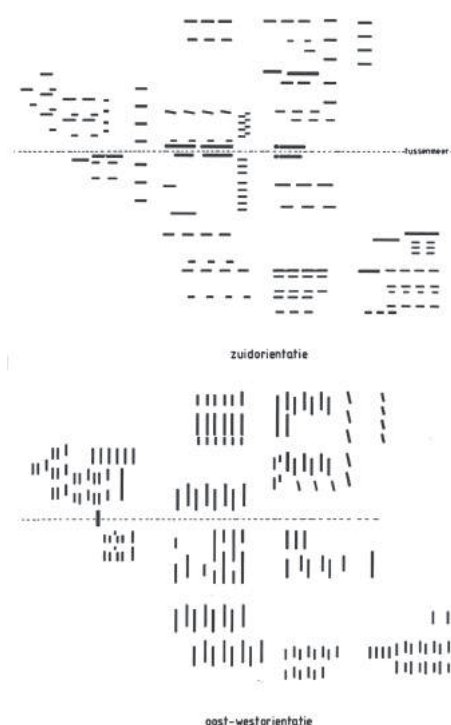
106 Osdorp, south orientation (above) and east-west orientation (below).[a]

107 Osdorp, result (above), repeated components (below)

108 Osdorp

a   Figure 106-108: Hoeven, C. van der and J. Louwe (1985) *Amsterdam als stedelijk bouwwerk: een morfologische analyse*.

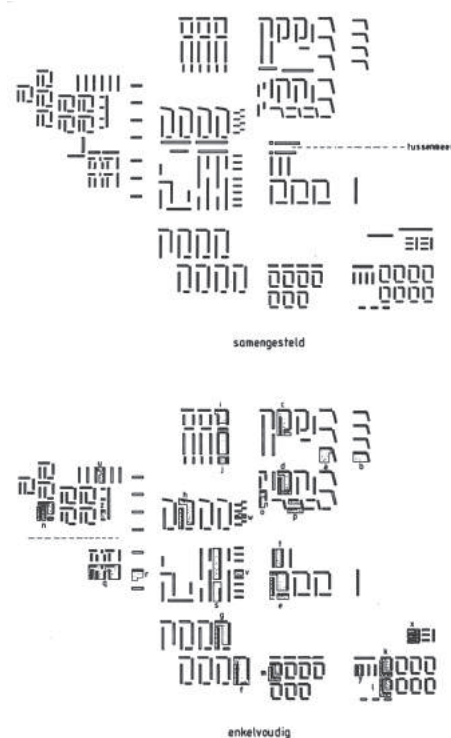The spatial composition of the Western Garden Towns has become a complex layered structure where different elements of the public domain (traffic structure, structure of vegetation, water structure) and the buildings represent different 'layers' in the design, which cannot be regarded anymore as directly derived from one another. For that reason one is forced to indicate these different layers in the analytical drawings. . The categories public and private domain, playing a leading rôle in the analyses of older parts of the city, are absent. With 20th century policy (the city administration as owner of all the land, land can only be leased) a condition came into existence allowing separation of the urban form and distinction between public and private. For the first time the building as a whole is being drawn, since the structure of the building can be explained from nothing else but by the building structure itself.

Formal plan analyses are a (deliberate) re-construction of a number of steps in the design and realisation process; with the purpose to provide a (theoretical) explanation for the final form of the city. However, explaining the design process does not automatically entail sanctification. On the contrary, this inventory of the original planning process makes it possible to put into debate the finally realised form and structure of the pattern built and the system of public spaces, or parts thereof.

Figure 107 shows the arrangements resulting from the putting together of the residences with an orientation towards the south and the east-west orientation from figure 106. Per type of arrangement one has been rendered with the adjacent green facilities in the form of fields and strokes. This 'demonstration card' is printed on the right half of the drawing. 'While sliding the arrangements together it is striking, that the arrangements with single repetitions are always bounded at one side by a special element. That might be a road, or a green ribbon, but also a residence. These buildings, not belonging to other arrangements, are this way put into a formal relation *vis-à-vis* the arrangements. Free-standing residences occur in Osdorp only on very special places. Examples are the two centres and the high-rise apartment buildings at the Sloterplas.'
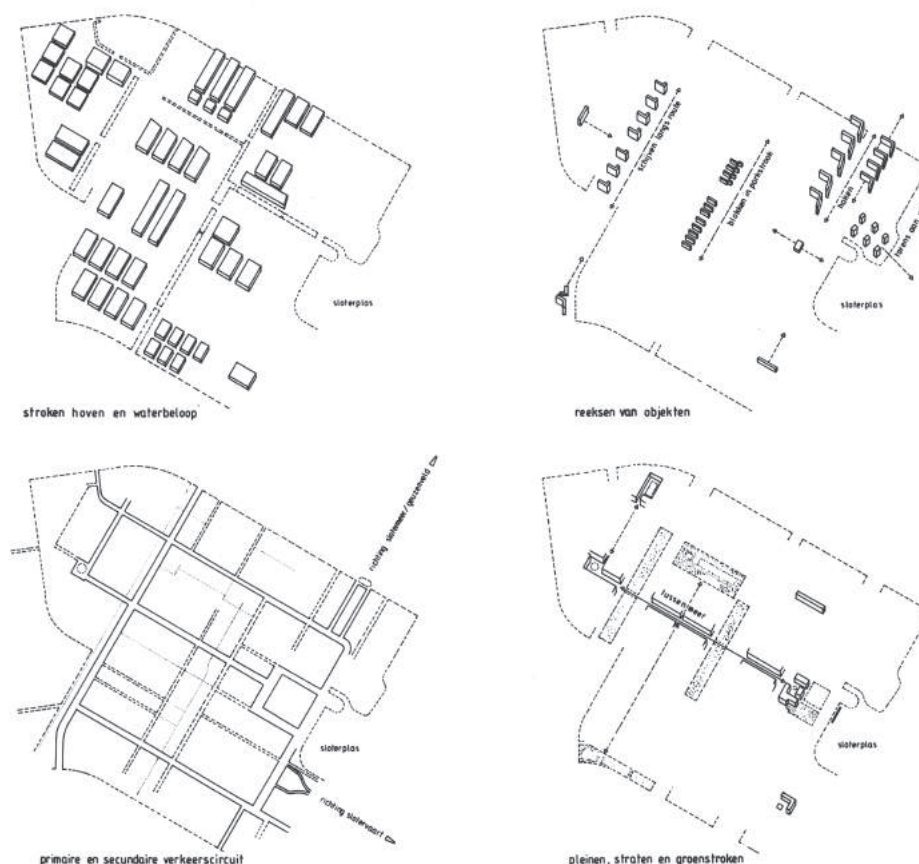
Van der Hoeven and Louwe stop with their analysis where Rowe starts with his figure-ground analysis. Rowe is emphasising and criticising the ever increasing autonomy of the differentiation of building masses mutually as a foundation for modern urban architecture.

Rowe suggests that several principles of composition merely rest on various ideological and aesthetic norms (space central, or mass central, while the book of van der Hoeven and Louwe provides material showing that the changing aesthetics of the form of the city are related to a changing relationship between geo-morphological conditions, allotting sites and buildings structure.

15.4   COMMISSION FORMULATION

Urban designers are often confronted by a situation frowned at by the authority giving the commission: something is amiss, a fundamental improvement of the spatial quality should be realised; but what should be done exactly, and how, is not clear. In short: it is up to the urban designer to formulate clearly what the commission precisely is, and in which way work could be done connected with it. With this the analysis gets a goal-directed character *vis-à-vis* the design. Morphological analyses are possible on each scale level. Three examples clarify this

Rotterdam Urbanised Landscape

In this analysis of Frits Palmboom emphasis is on the making of an inventory of the historic development of the urban landscape of Rotterdam.[a] The purely informative stage (editing different historic maps according to the same method of drawing and scale) is almost completely omitted in the final presentation; the drawings presented are almost all strongly interpretative. The book has a clearly different structure and purpose than van der Hoeven en Louwe's *'Amsterdam Stedelijk Bouwwerk'*: the purpose is not to survey as objectively as possible the spatial form and its explanation, but much more eliciting a debate on spatial form and on putting on the agenda what the important urban architectural challenges are in the city.[b]

Palmboom makes a distinction between three types of developmental processes. Each of them has produced its own 'layer' and determined this way structure and form of the city:

- the dynamics of the delta that formed the geo-morphological stratum;
- the process of building dikes, gaining land from water, cultivation and urbanisation, resulting in a cultural landscape;
- the economics of transportation that produced in the transporting city of Rotterdam a rather autonomous 'traffic machine', right through and over existing structures.

This layered structure resulted in a city featuring according to Palmboom two kinds of spatial characteristics:

- parts or long lines characterised by a rather unambiguous connection and continuity in the spatial structure, and
- knots where different layers or areas come into conflict.

The drawings rendering this interpretation of the spatial characteristics of the city are considerably more 'expressionistic' than the severely geometric drawings of van der Hoeven en Louwe. They not only show certain spatial structures, but in particular the dynamics resulting from those spatial structures: the 'polder' structure of the clay area of the South of Rotterdam results especially in a structure of irregularly shaped sheets with an orientation and dynamics orientated towards the centre, while the 'long lines' on the right of the borders of the Maas river produce large, linear structures, meeting with borders of opposition on certain places. The result is an 'agglomeration of islands'.

109 The process of damming up, according to Palmboom (1987).
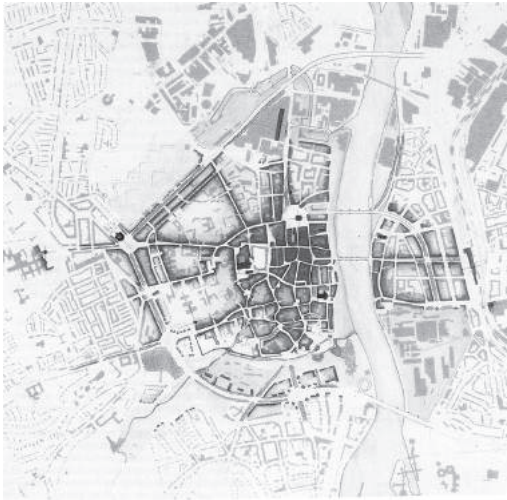

110 Articulation of polder land.

111 Rotterdam as an agglomeration of islands.

a   Palmboom, F. (1987) *Rotterdam, verstedelijkt landschap.*
b   Hoeven, C. van der and J. Louwe (1985) *Amsterdam als stedelijk bouwwerk: een morfologische analyse.*

112 Maastricht according to Geurtsen: the elements decisive for the spatial image of the city

On the basis of these interpretations and observations several design commissions are formulated: the connected parts, lines and structures demand a consistent approach that might strengthen the (potentially present) coherence, while the zones of rupture and knots call for specific solutions, to be formulated one by one.

Structural Vision Maastricht

The structural vision Rein Geurtsen prepared in 1990 for Maastricht uses a method comparable to that of Palmboom, but gives a more detailed description of the areas where urban architectural intervention is needed; and of the type of intervention required in those areas; that is to say the commission.

An example is the drawing below. The important open spaces in this map are not automatically the most important traffic roads. Depicted are just those streets, squares, etc. that, according to the description, *"are decisive for the national and international esteem for the city, to which lovers of Maastricht are particularly attached, and which determine the way in which a visitor will orient himself."*

The network of streets thus surveyed demonstrates a strong orientation towards the river, while its borders have been indicated as 'problematic areas' and are termed an important design commission. The borders have been made subservient increasingly to the throughput of car traffic in the decades following WW II. This caused loss of connection of the river border to the street pattern of the inner city. The drawing states that the design commission consists in restoring the traditional connection.

Renewal The Hague – South West

This graduation project of Paul Broekhuizen studies the morphology of The Hague. The spatial structure of the Hague has been determined historically by the structure of the ridges of the dunes, almost parallel to the line of the beach. Perpendicular to it several attempts were made to realise cross-connections and thoroughfares.

The cross-connections clash at various places with the structure of the ridges of the dunes; occasionally they have been completed only partially, or not at all. The morphological study focuses on tracing the most important problems and hiatuses in this double structure. The hiatuses are depicted in figure 115; particularly The Hague South West has a 'blind spot' when it comes to crossing structure.

Together with the observation that this part of the city has become marginal in socio-economic terms, the conclusion is that realising a cross-connection in the urban area is of importance for freeing it from isolation.
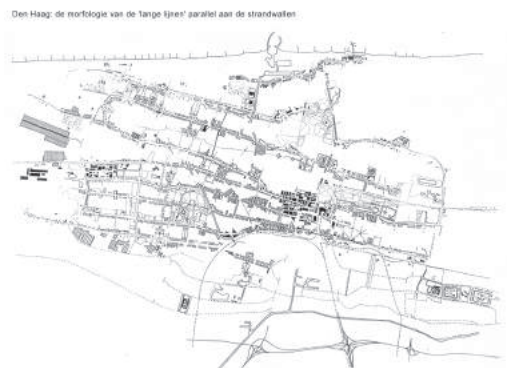
113 The Hague: the morphology of the 'long lines' parallel to the ridges of the dunes (fig. 113-117: P. Broekhuizen).

114 The morphology of the 'long lines' perpendicular to the ridges of the dunes

115 System of cross-connections in the infrastructure

116 Decomposition-analysis

117 Plan configurations

In principle an occasion for situating this cross-connection is already present: the 'Cartesian cross' of the Melis Stokelaan and the Dedemsvaartweg. This cross is characterised by a complex structure, sub-divided in its constituting parts in the drawing below. The last drawing demonstrates how starting from the axial cross a new cross-connection between the Melis Stokelaan and the coast could come into existence.

Characteristic for these analyses is that they arrive at a statement indicating what the challenge of the design in a certain place should be. The analyses themselves provide scant material for answering the questions how that design should be made, in terms of methods and tools. The next category of analysis is more fertile in that respect.

15.5   DESIGN TOOLBOX

As soon as the location and the commission have been decided upon, an investigation of the 'repertory' available is a logical first step. If the commission entails to realise somewhere a new cross-connection, traffic inter-change, an ensemble of buildings, or a new quay along the river connecting to the network of streets, a study of other comparable cases might be useful. What is intended is not so much collecting so-called 'reference images' that have become fashionable since the end of the eighties. These reference images rather serve the purpose to create consensus among the various parties during the planning process with regard to architectonic imaging.

In the case of the design repertory, typological analysis is intended here. This concerns the analysis of various variants of designs sharing a comparable intention who lead essentially to comparable spatial configurations. The aim is to reduce differences between the various configurations as much as possible to the most important essences. Maybe there are at first sight some twenty different variants of a type, but when we try to reduce each instance to the most important aspects of the spatial organisation, it may become clear ultimately that only two or three essentially differing variants of a specific type are concerned.
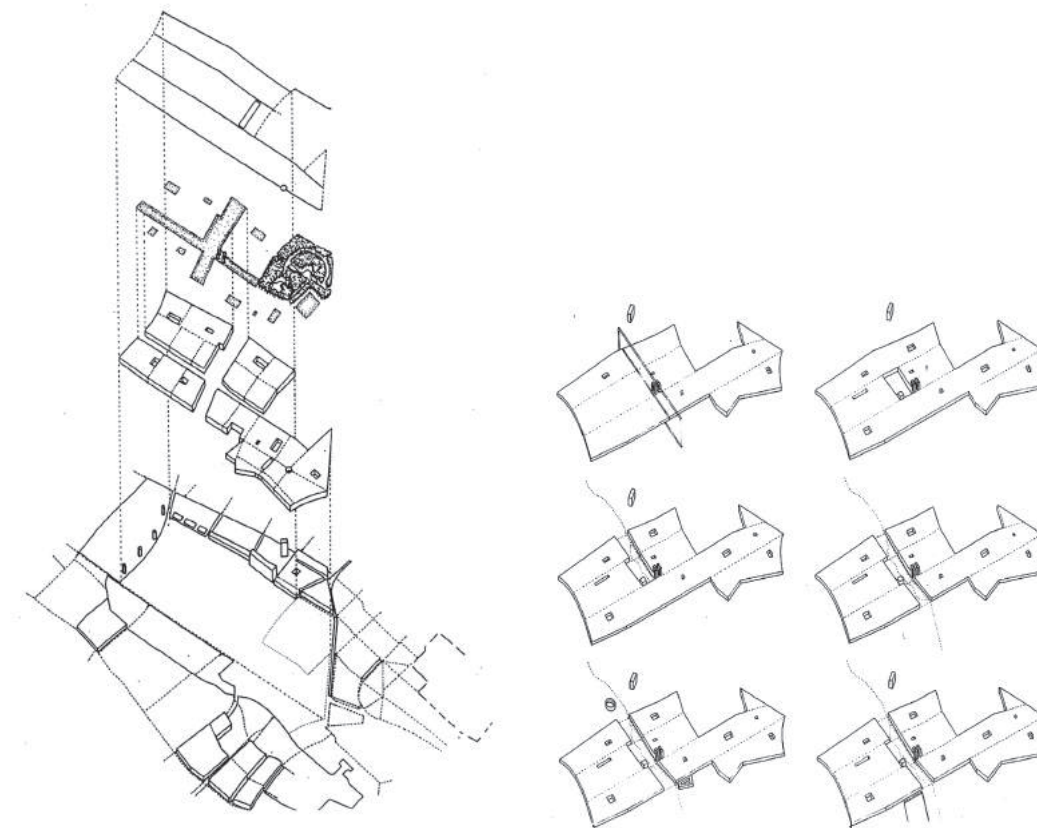
Such an analysis, leading to knowledge about a certain type, is called typological analysis. With such an analysis it can be decided whether it makes sense to use an existing variant of a type as a point of departure for the design, or to develop a wholly new variant. Let us present two examples.

Border of the river Rotterdam South

In this graduation project of Eveline van de Broek[a] the same type of morphological analysis is conducted as that of Palmboom and Geurtsen. She even arrives at the same kind of commission as Palmboom in 'Rotterdam Urbanised Landscape': the spot where the trajectory of the Dordtste Straatweg has been 'cut' by the building of the Maas harbour in the 19th century. Subsequently, this rupture has even been strengthened by the building of a high barrier against the water along the Maas harbour (Brielselaan).

Also because of the disappearance of harbour activities there, it is concluded that a new design for this spot is desirable and possible. The challenge exists in establishing a combination between:

- a new inter-connection with the route from the 'hinterland' (the Dordtse Straatweg) on the waterfront,
- a strengthening of the recreative quality of the waterfront,
- maintaining the defence against the water in the body of the dike, and
- maintaining the function of the Brielselaan as a thoroughfare.

For this design commission a study was made of spatial situations with a comparable combination of aspects. Firstly, she studied to what extent the river landscape of Rotterdam has general characteristics also found frequently elsewhere, or a number of typical characteristics. A first comparative analysis resulted in a distinction between three fundamentally different urban river landscapes: next to the river as an inner waterway in the city ("the river as canal", with Haarlem and the river Spaarne for example) and the river as nature along the city (e. g. Deventer with the IJssel) Rotterdam emerged as a separate type, with "the river as a water landscape in the city".

a   Broek, E. van den (1998) *Rotterdam aan de Maas, de rivier als centrale plek in de stad*.

118 Three types of relation between river and city according to van den Broek (1998)

119 Different variants of the type 'the river as a water landscape in the city'

120 Operation on the dike trajectory Brielselaan
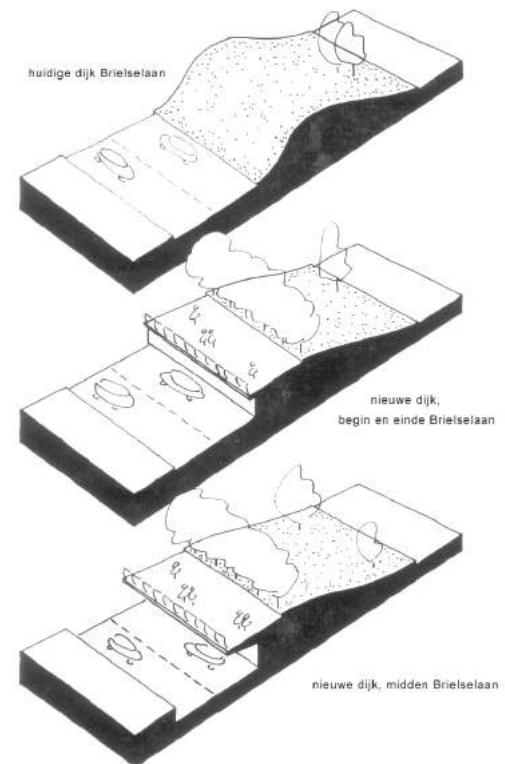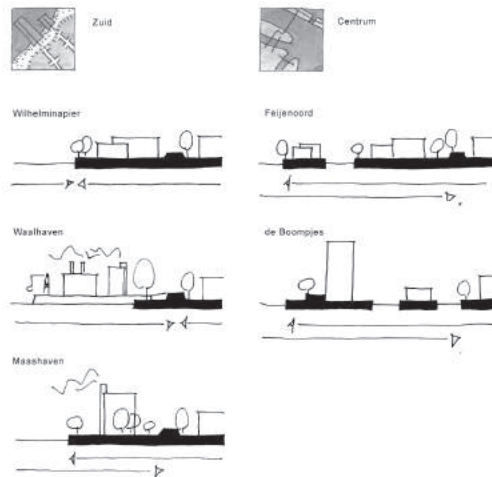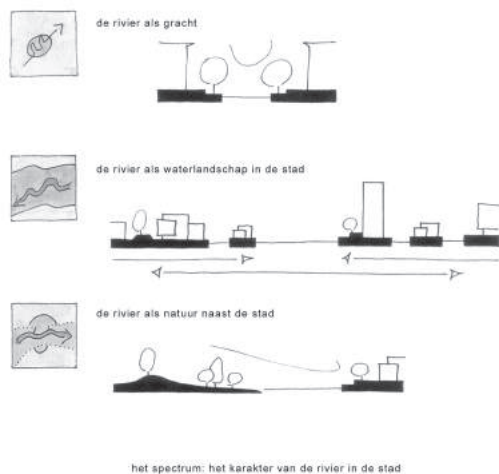
This distinction is significant for the spatial furnishing of the zones along the water, where urban morphology and river landscape enter into ever changing relations.

Within the context of the Rotterdam variant of "the river as a water landscape in the city" next various partial variants are discerned; with the Brielselaan for one of them.

However, the situation of the Brielselaan – with the autonomous body of the dike – proves to be so specific, that all existing situations in the Rotterdam river landscape do not provide a solution. By the same token, a new variant of the Rotterdam type waterfront must be designed. The conclusion is that the design challenge exists in acknowledging the typical properties of the Rotterdam water landscape in the City, as well as in finding a solution for the specific position occupied by the zone at the Brielselaan in this water landscape.

Finally, the design provides a new profiling of the body of the dike, with a terrace extending over the motorway, resulting in new possibilities of usage for the zone as a whole.
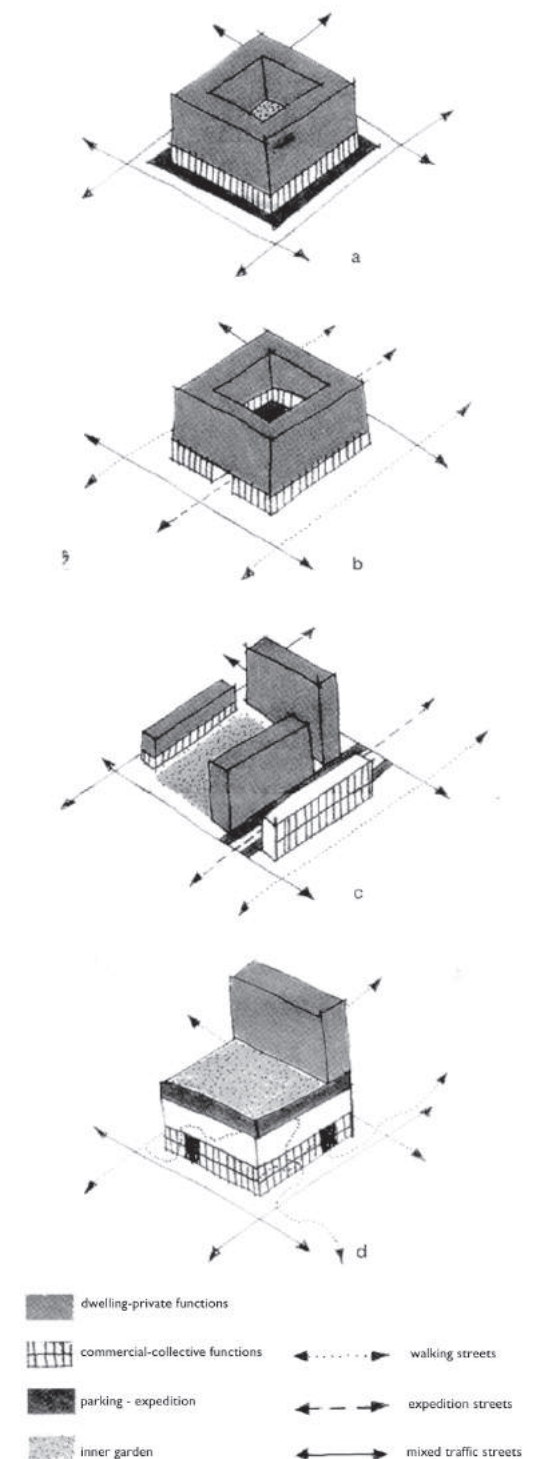
Urban Building Block Rotterdam

In this graduation project of Lyke Bijlsma a typological analysis is made of the development of the building block in the central area of Rotterdam. This analysis is centred around the question in which way commercial facilities (shops, etc.), private space (residences), collective space (shared gardens) and public space can be organised *vis-à-vis* one another in a new building block to be designed. The analysis is addressing the question which variants may be found in connection with the ratio between these units of legends. The analysis concludes that the whole repertory of building blocks in the inner city of Rotterdam may be simplified to three variants:

- the closed building block with gardens at the inside and shops on street level getting their products delivered from the public street;
- the urban inner court, where the inside of the building block is used as a space for expedition; the public street being freed from loading and unloading, but at the loss of collective green;
- the modern ensemble, with a differentiation of various kinds of open space with different functions.

In the fifties it was attempted with this variant to overcome the disadvantages of the closed building block (loading and unloading on the public street) and of the urban inner court (disappearance of the shared garden). Forty years later quite a lot of difficulties are linked to this variant, like the vulnerability of the collective garden because of its direct access from the public street, and the countless expedition streets, devouring a large part of public space and experienced as unpleasant and unsafe.

With these analyses the necessity of searching for a new configuration of commercial, private, collective and public space is put on the agenda: in the design a solution is ultimately only achieved by expanding from a flat surface into the third dimension.

dwelling-private functions	
commercial-collective functions	walking streets
parking - expedition	expedition streets
inner garden	mixed traffic streets

transformation of the building block
a. traditional building block
b. Rotterdam building block, urban inner court
c. opened-up Rotterdam building block (Lijnbaan model)
d. layered city (proposed solution)

121 Typological analysis of building blocks according to Bijlsma

16 DESIGN DRIVEN RESEARCH

JACK BREEN

The potential for design driven research in academic environments is examined. In this context lessons might be learned from educational exercises with a designerly approach and presentations stimulating discovery through systematic comparison.

On the basis of previous experiences with design and workshops, *eight types of design driven composition composition research* are identified, divided into two main clusters. The approaches vary, from more or less familiar forms of design research to more speculative approaches, involving design(erly) activity as integral part of the research method.

16.1 DESIGN DRIVEN RESEARCH APPROACHES

What might be the opportunities for design driven research? Can active designerly enquiry be made instrumental in design education and research? In which ways might activities, integrated in an academic educational environment, lead to convincing research products?

It has been argued that in architectural research there is a need for researchers to operate in a systematic and methodically sound way: standard procedure in traditional forms of analytical or comparative research, but perhaps of even greater importance in projects wishing to incorporate *explorative* forms of designerly enquiry as part of the working method.

The same can be said for education, whereby a clearly constructed *pedagogic* framework is essential. Theme-based teaching forms can stimulate experimentation and discovery and lead in turn to valuable - identifiable - insights for the students, but can also produce *results* contributing to insights on a higher level.

In design *practice* the working *methods* as such are generally considered of less importance than the design *product* and its qualities. However, in *research* a sound, transparent method is essential in order to judge the result and thereby ascertain *validity* of the research outcome. Although differences between design and research might suggest that the two domains of intellectual endeavour are intrinsically different and that these differences cannot be resolved (as is regularly suggested), it should be recognised that there is a need for more methodical *inter-action* between the two fields, particularly within academic environments. Although in design the *evolvement* of new ideas and insights is often unpredictable and decision-making relatively intuitive, working methods are generally far more systematic and methodical than they are often made to appear. Similarly, inquisitive research does not blindly follow pre-conceived paths. The researcher – like the designer - is also dependent on ideas and hunches, conceptual shifts and *shortcuts* which may lead to useful surprises. An undertaking involving the taking of risks and of recognising valuable - intermediate - insights.

Designerly enquiry – both as subject of study and as a potential research activity – deserves to be recognised as one fundamental constituent of intelligent design driven research.

How should design driven research projects be organised? The most 'scientific' approach would be one whereby targets and course of action are clearly specified beforehand, allowing for systematic evaluation of outcomes and the drawing up of unambiguous conclusions.

One possibility is to study results *afterwards*. This means that relevant themes need to be identified on the basis of design results and relationships and effects of these are examined and explained. Such a *result based* research can be structured methodically by introducing an underlying '*order*' beforehand, for example by placing binding themes or groups of related constraints, facilitating systematic description, comparison and evaluation of results afterwards.

As with a design task, in design research it is important to specify clearly what it is the study is trying to *solve*, *discover* or *clarify* beforehand. However, it is not always possible to narrow down and define from the outset precisely what is investigated and what the best

approach ought to be. More often than not, design researchers are confronted with a complex 'knot' of different factors, simultaneously at play and not easily 'disentangled'. In many cases actually *unravelling* underlying, inter-related themes and their relative *meaning* within the overall composition (including potential dominance of specific 'actors') proves to be the primary aspiration of a design research undertaking. In order to acquire a clear understanding concerning the *questions* a research is attempting to answer or to make more transparent, it is, therefore, often worthwhile carrying out *preliminary* investigations, before determining targets, status and methods of a project as a whole. On the basis of such *explorative* studies the issues and course of action can be clearly defined; *hypotheses* determined, and a *methodological* approach to empirical study specified.

16.2 ELEMENTARY RESEARCH CATEGORIES

By determining the methodological *design* for a project it should be made clear what the goals of a research itinerary are and what type of research is carried out. In this respect the *empirical cycle* of research remains the essential point of reference to determine the *status* of a research project. In the following scheme an overview is given of the three principal forms of research (after Baarda and De Goede).[a]

a.   Descriptive research

Descriptive research is a commonly used form of design research: an effective approach when it is the intention of the researcher to give a systematic explanation of one or more artefacts, or to give an in-depth account of underlying developments and backgrounds. This method generally involves study and analysis of source material and analysis and documentation of design products and process data. This usually does not involve the conception or empirical testing of hypotheses.

b.   Explorative research:

If the 'what, how and why' questions are central to a research, we may speak of explorative research. This type can be considered an intermediate form, between descriptive research and empirical research, with links in both directions. The point of departure is usually a set of notions or assumptions. The aim is to create insights: to identify, define and illustrate relevant phenomena, to explain specific characteristics and effects and (inter)relationships. The aim of such an approach is generally to formulate hypotheses, leading to more focused, empirical research.

c.   Empirical research:

In empirical research the task is essentially to see if certain, previously determined, hypotheses are correct. This usually involves creating more or less experimental conditions, with a clear methodological 'design' and systematic evaluation and interpretation of data. Even if there is no coherent theoretical framework there still might be empirical research, for instance if the intention is primarily to show a predicted effect. In such a case Baarda and de Goede suggest it might be better to speak of 'evaluation research'.

In design driven research projects – as in all research undertaking – it is necessary to specify *what* it is that is the subject of scrutiny and to determine along what lines the research will be carried out. Is the object of study a particular design or a collection of designs, possibly belonging to an individual oeuvre or movement? Are different designs or design *aspects* to be compared systematically in a case study? A research project may focus on existing design *results* – as a given situation which may be described and analysed - or on data from a design process – which may be interpreted in relation to what a design has become or *might have* become, possibly involving a more active, *designerly* approach. On the other hand, design initiatives – like competitions or group workshops – may be taken as a point of departure for explorative, or empirical research.

a   Baarda, D.B. and M.P.M. de Goede (2001) *Basisboek methoden en technieken*.
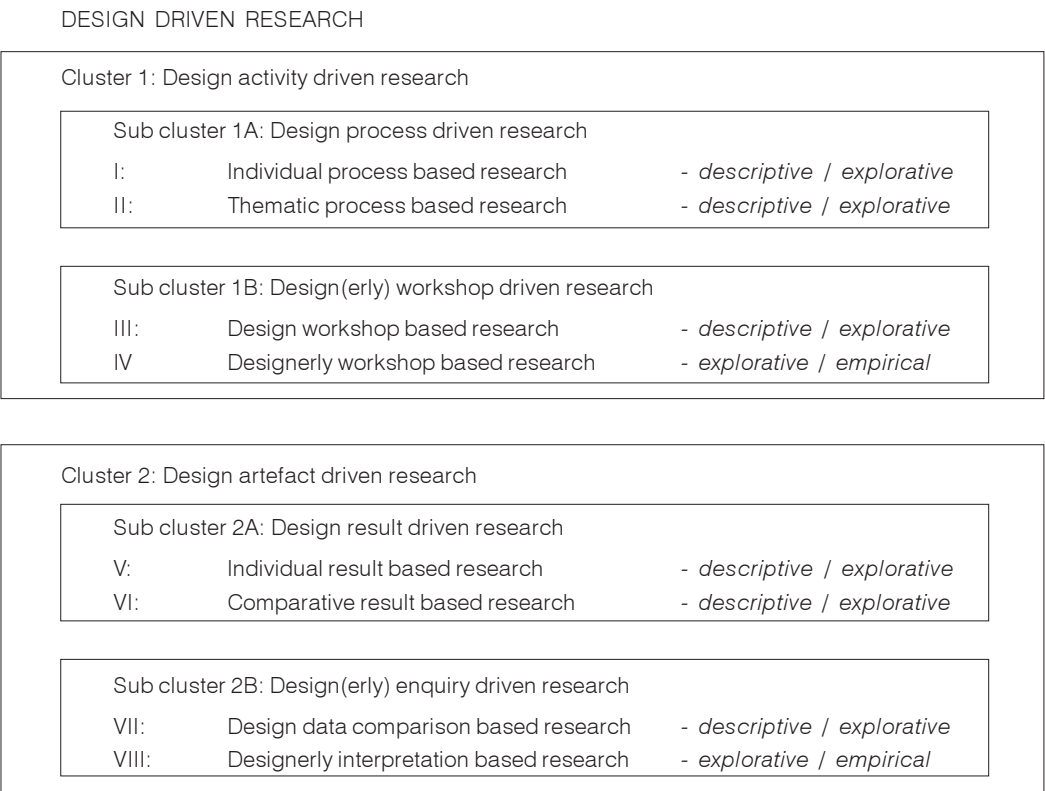
16.3 DESIGN DRIVEN COMPOSITION RESEARCH

There are numerous ways in which designs or design processes occasion academic research projects. In the following section a typological framework for design driven research ventures is constructed.

On one side of the spectrum, design activity may be incorporated into the development of technical applications or product innovation. Such an approach is similar to the practice of *research and development* (R&D) common in industry. Such development research plays a meaningful rôle within – technical – university environments and might be expected to be stimulated and promoted in education.[a]

On the other side, we find the kind of research whose primary aim is to explain *implications* of design interventions. The focus may be for instance functional, ergonomic, psychological, societal or philosophical. Such research generally views design results and processes from a certain 'distance' and makes use of proven methods linked to acknowledged empirical cycles of research. The results may often lead to valuable insights, but are not always held in high esteem by design practitioners and teaching staff.

Between these poles the endeavour of design *composition* may be considered the issue of research. Composition research can involve *conception* and *perception* of the overall design and its constituting parts. It may be concerned with the *workings* of design results, but also with the *methods* of design, including utilisation and effectivity of design media in the development process.

The following typological overview is divided into two main clusters of - design driven - research approaches. In the first the design *process* is made instrumental, in the second cluster it is the design *results* (artefacts and design data) which form the hub of research. Each cluster is sub-divided into two sub clusters (A and B), each consisting of two approaches, whereby A indicates more or less familiar research types, with specific merits but also shortcomings, and B denotes somewhat less proven, but potentially innovative research procedures, with relatively more emphasis on *designerly* methods of enquiry.

DESIGN DRIVEN RESEARCH

Cluster 1: Design activity driven research

Sub cluster 1A: Design process driven research

| I: | Individual process based research | - *descriptive / explorative* |
| II: | Thematic process based research | - *descriptive / explorative* |

Sub cluster 1B: Design(erly) workshop driven research

| III: | Design workshop based research | - *descriptive / explorative* |
| IV | Designerly workshop based research | - *explorative / empirical* |

Cluster 2: Design artefact driven research

Sub cluster 2A: Design result driven research

| V: | Individual result based research | - *descriptive / explorative* |
| VI: | Comparative result based research | - *descriptive / explorative* |

Sub cluster 2B: Design(erly) enquiry driven research

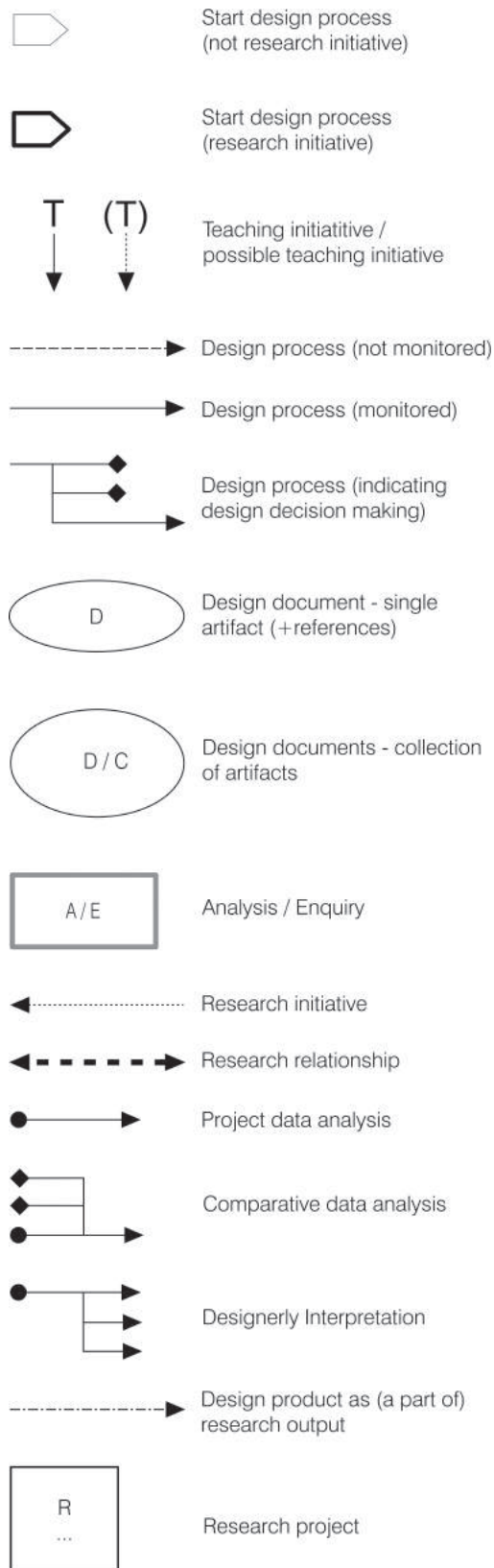| VII: | Design data comparison based research | - *descriptive / explorative* |
| VIII: | Designerly interpretation based research | - *explorative / empirical* |

a   An interesting example of recent Development Research at the TU Delft Faculty of Architecture concerns the development of new forms of structural glazing and façade systems for twisted building volumes. Vollers, K. (2001) *Twist & Build, creating non-orthogonal architecture.*

b   A previous attempt by the author to identify relevant research trajectories came to six types, divided into three clusters: Breen, J.L.H. (2000) *Towards Designerly Research Methods, an exploration of design-oriented research approaches.*

122 Typological overview of design driven composition research approaches

Start design process
(not research initiative)

Start design process
(research initiative)

T (T)   Teaching initiatitive /
possible teaching initiative

- - - - - - - - → Design process (not monitored)

————————→ Design process (monitored)

Design process (indicating
design decision making)

D   Design document - single
artifact (+references)

D / C   Design documents - collection
of artifacts

A / E   Analysis / Enquiry

◄· · · · · · · ·   Research initiative

◄– – – – – ►   Research relationship

●————→   Project data analysis

Comparative data analysis

Designerly Interpretation

–·–·–·–→   Design product as (a part of)
research output

R
...   Research project

123 Legend, symbols used in schemes of design
driven research types

124 *Type I:* Individual design based research

a   Hertzberger, H. (1991) *Lessons for students in architecture;*
Hertzberger, H. (2000) *Space and the architect: lessons in
architecture 2.*
b   Holl, S. (1996) *Intertwining;* Holl, S. (2000) *Parallax.*

The examples put forward as indicative of these *eight* approaches[a] are mostly taken from research initiatives at the TU Delft Architecture Faculty.

16.4   DESIGN ACTIVITY DRIVEN RESEARCH

In the first category the design *process* is dominant and forms a continuous line from the beginning to the end of the research, which is, as it were, constructed around the design's development. Generally speaking there is a notion of the research ambitions from the outset. To a large extent the development process can be monitored. As such, projects of this nature can be said to be *process driven* and the design results – at least to some extent – constitute a part of the research output.

The content of the research activity is largely determined – one might say 'initiated' – by the designerly 'search' of individuals or groups of designers. The extent to which the designs reflected upon are 'let through' into the research project's outcome can vary from integral, broad representation of designs generated in the process (A) to projects with a more rigorous form of scrutiny, filtering and selection of items which are at play (B). The design projects which are the subject of study may come from practice (for instance from competitions) or from education. Apart from following design processes and their results from a relatively safe distance, it is possible to create game-like situations with pre-set specific tasks and constraints, creating a 'design laboratory' situation.

16.5   SUB CLUSTER 1A: DESIGN PROCESS DRIVEN RESEARCH
Type I: *Individual design based research*

In principle, the initiative lies with a designer or design team. The design process is documented conscientiously for the benefit of study, whereby design sketches and development models, interim options and results, may be used to illustrate and motivate the final product and place it in a broader perspective. The process may be situated in practice – with the intention of the plans being realised – but simultaneously being developed in view of its research potential. Such an approach runs the serious risk of a lack of objectivity. If the designer - at the same time playing the rôle of researcher (sometimes supported by a 'ghost-writer') - is not able to keep a certain 'distance', there is a danger that 'theory' is confused with design doctrine , leading to indiscriminate promotion of personal convictions and fascinations. Without sufficient critical consideration, the result may soon resemble an office documentation than a serious research product. Nonetheless, such approaches can be valuable, because they offer insights into the domain of design decision-making and often play a meaningful rôle in design education.

Examples of such design based research in which design activity is used as a vehicle and reference point for broader design reflections may be found in the work of Hertzberger[a] and Holl[b], and to a certain extent in that of OMA and MVRDV.
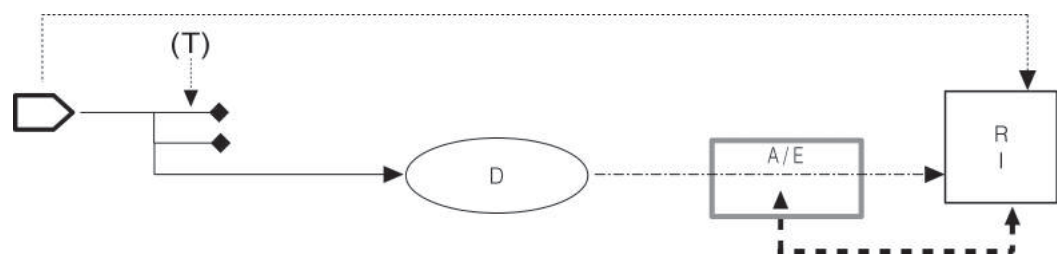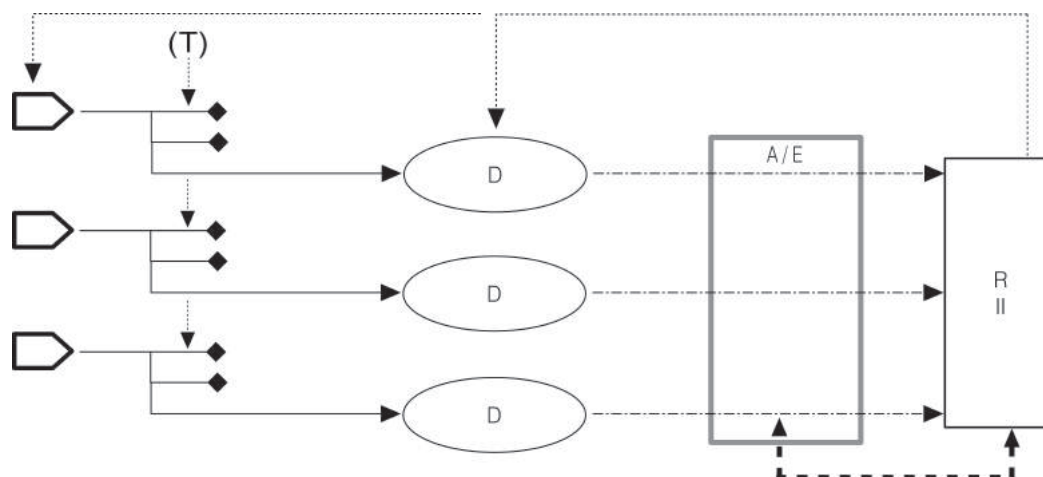
Type II: *Design project based research*

Design projects involving a number of designers can form the basis for design research. Such collective activities, with a set of pre-determined guidelines concerning context, programme and task can lead to a variety of results. These can, nonetheless, be compared relatively systematically, if there are pre-determined, binding themes. Examples of such initiatives can come from design competitions amongst professionals, but also from design projects in an educational setting, like thematic diploma projects.

Frequently, the design results from such projects are presented as an integral part of the research output. In some cases all projects are included in publications with a research ambition, regardless of their qualities. On the other hand, a selection may have been made by a professional jury, rather than by the researchers. Such research often tends to focus on the undertaking as a whole and to highlight particular themes and cultural developments, rather than offering systematic analysis of the outcomes. The clearer the 'format' of the exercise, the more methodical such an evaluation can become.

In many cases the research outcome remains primarily descriptive. However, if ambitions and expectations concerning what it is that he project is intended to address are specified clearly beforehand, such an approach can lead to explorative research, and potentially even to – hypothesis based – empirical research.

Examples of this approach are the research outcomes of the Architectonic Intervention programme – based on thematic diploma projects – at the TU Delft Architecture Faculty.[a]

125 *Type II:* Design project based research

16.6   SUB CLUSTER 1B: DESIGN(ERLY) WORKSHOP DRIVEN RESEARCH
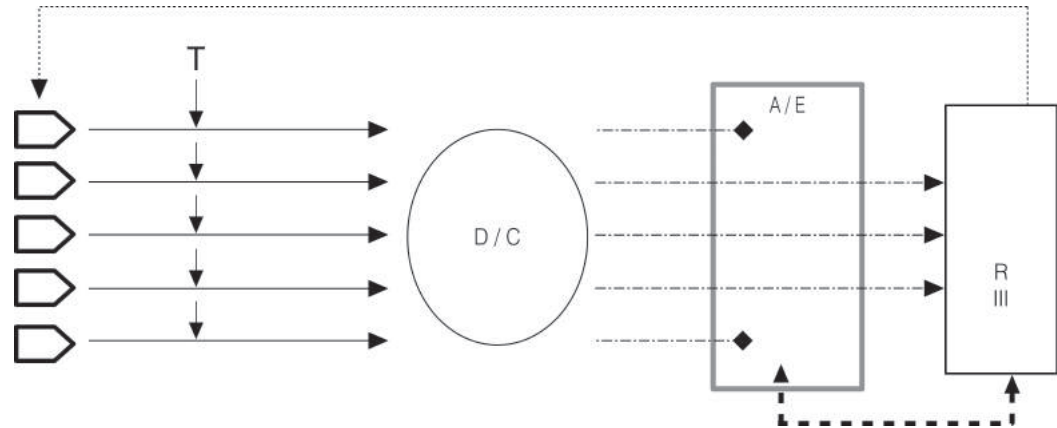
Type III: *Design workshop based research*

There are similarities between design *workshop* based research and type II. However, in this case the design process plays a different rôle and evaluation and selection has more prominence. In this context 'workshop' indicates a collective project whereby there is more than a loose binding theme; it means that all participants are facing precisely the same task. The workshop project sets certain rules, there is a clear programme (indicating what and even what is *not* expected) and limitations how far the complexity of the task goes (constraints). The idea of such a set-up is that by reducing complexity, the design work may attain a certain *depth*, rather than width. In addition, by setting all participants an identical task, the results should become *comparable*. The experience is that such an approach does not lead to identical results, but on the contrary, to a wide range of varied results. From such a collection insights may be gathered concerning relevant design *themes*, recurring motives and the effects of structural and compositional *variation*.

In this case the (academic) design environment is used to learn *about* design attitudes and methods. The rôle of the initiators is 'curatorship', the procedure is primarily explora-

a   For a summary of the Architectural Intervention programme and its results, see: Klaasen, I.T. (2001) *The Architectural Intervention (http://ai.bk.tudelft.nl)*.

tive. Design products are not considered research products (except of course in the light of the individual designerly research of the participants and their learning processes), but a collection of artefacts to be analysed and compared (and with other design precedents) for the benefit of research.

Examples of design driven projects in an educational setting are Form Studies / Media Studies workshops at the TU Delft Architecture faculty.[a]
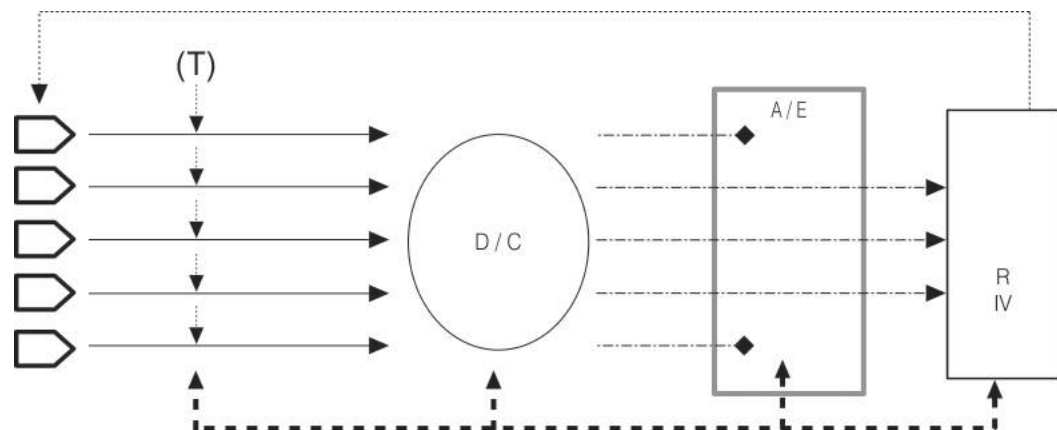

126 *Type III:* Design workshop based research

Type IV: *Designerly workshop based research*

In *designerly* workshop projects the methods indicated in type III are taken a step further. In this case it is not a matter of learning about compositional qualities of designs afterwards, but to target particular issues of interest and *infuse* these into workshop projects with active designerly enquiry by the participants.

This means that a workshop is set up consciously as an experimental, simulated working environment. The tasks may be organised relatively loosely; as in a pilot study – in order to explore procedures and gather information. On the other hand, a more strictly organised research 'construct' can be set up, for the benefit of empirical study, with clearly defined expectations laid down in working hypotheses, to be tested within the workshop environment. The process can be monitored in different phases of development. In such a case a 'game' situation with pre-conceived rules, constraints and formats may prove beneficial for research, creating a platform for systematic comparison of (intermediate) results and in-depth analyses. Such an experimental approach may target on *compositional* themes, but also focus on more *methodical* issues, like the influence of different (combinations of) design media.

In principle, such an approach involves setting design tasks, but could also in principle involve group driven *designerly studies*, as indicated in type VIII.

In the course of the Dynamic Perspective research project, the Delft Media Group has been working on ways to develop such types of workshop based empirical research. Examples of pilot studies are the Imag(in)ing study[a] and the Imaging Imagination EAEA conference workshop.[b]

127 *Type IV:* Designerly workshop based research

a   Apart from the series The Table / The Bench / The Bridge: Breen, J.L.H. (1996) *Learning from the (in)visible city, design media experiments in an educational setting;* Breen, J.L.H. (1998) *Learning from the (in)visible city, design media experiments in an educational setting.*

16.7 DESIGN ARTEFACT DRIVEN RESEARCH

In the second category the outcomes of design activity are central to the research undertaking. The research initiative is primarily concentrated on this product of the design process (with a not always very clear line of development). Generally speaking, the design's development cannot be monitored or 're-constructed' conclusively on basis of the process data.

The subject and form of such research may vary. The basis can consist of one *specific* design but can also be a concise *collection* of designs. The method may involve design result *analysis*, possibly involving relevant *references* or even *comparative* studies (A) on the basis of results. Alternately, researchers may attempt to get *behind* the implications and workings of design artefacts by studying *intermediate* design data or even by 'constructing' alternate design *options* in order to throw light on what a design has become through systematic *simulations* of what it *might also* have become (B).

The subject matter of such research may be expected to come from design practice. The artefacts can vary from emblematic, historic *precedents* to *contemporary* products, which may even include designs created in an *educational* setting.

The research output can be descriptive, illustrating and communicating the qualities of artefacts considered worthy of study, but might also more *explorative,* with the intention of discovering more general 'truths' concerning (aspects of) design culture, composition and perception.

### 16.8 SUB CLUSTER 2A: DESIGN RESULT DRIVEN RESEARCH

Type V: *Individual design based research*

A relatively familiar form of architectural research, whereby the results of design processes usually form the departure for a detailed, methodical evaluation.

The subject might be a realised building or ensemble, but also a collection of design data (drawings, models, written information), referring to a project not (yet) realised. The method of study usually amounts to analytical evaluation and descriptive documentation of the design artefact, although the researcher may try to 'work back' through the design data in such a way that light may be thrown on how design decisions or working methods have fundamentally influenced the design result. Another method is to place a design in a particular context, by comparing it to precedents, or through cross-referencing (with designs from the same period or with other designs from the same designer or movement).

In such research the definitive design result is usually the dominant factor, whereby the decision-making process is of secondary importance. The approach is primarily descriptive, intending to uncover relevant background information and to offer insights into compositional qualities and cultural or historic importance of the product studied.

As such, the research tends to focus on artefacts considered worthy of mention in the context of contemporary debate. It is important to define beforehand where the emphasis should lie, what the reference points of the study are to be in order to create conditions for *objective* reflection. If this is not the case, the work may be taken as journalism rather than as a *scholarly* undertaking. There are many studies of this sort carried out and published, frequently in 'border zones' of academic enquiry and descriptive reporting.
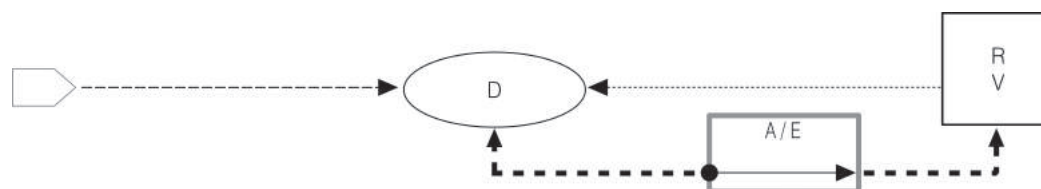
128 *Type V:* Individual design based research

a   Does, J. van der and H. Giró (1999) *Imag(in)ing, a fresh look at design, presentation en communication.*
b   Breen, J.L.H. and M. Stellingwerff (1998) *Imaging Imagination, exploring the impact of dynamic visualisation techniques in the design of the public realm: results of the EAEA Conference workshop.*
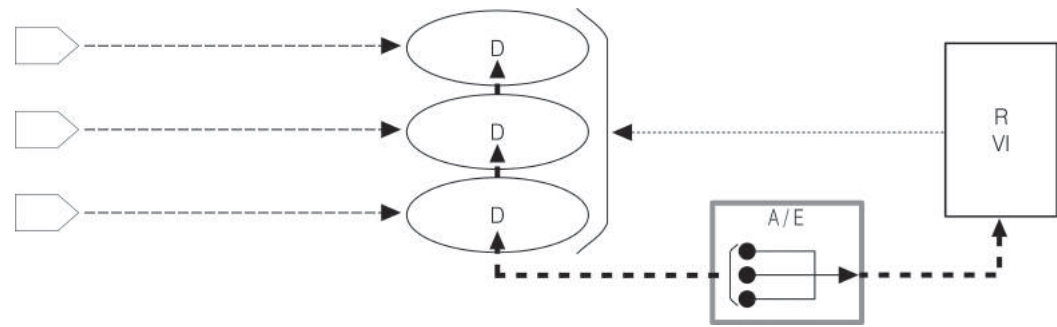
Type VI: Comparative design based research

An approach with distinct similarities to type V. However, in this type of architectural research the design *cases* studied are usually grouped and *juxtaposed* in such a way that they may (be expected to) 'throw a light' on each other, to offer insights concerning characteristic *analogies*, as well as crucial *differences* between the objects of study.

Case based studies are an efficient way to study compositional aspects of architectural artefacts. Exploration of design aspects of such 'collections' of projects or oeuvres can shed light on underlying themes and convictions and the effects of different architectural design *interventions*. Such analytical, comparative research, on basis of built environments and design documents, tends to be *explorative* in nature, involving not only description of what there is, but also identification of distinguishing *consistencies* and patterns in *variation*.

The format of output may influence working methods. For instance: an exposition format may be chosen, in order to allow viewers to make their own comparisons. This means that the material is to be ordered and visualised in such a way that it will facilitate such mental activity. Apart from familiar descriptive methods, more *designerly* approaches may be employed, for instance by making new drawings, schemes and models on the basis of existing artefacts. This can be instrumental in *communicating* results to others, but can also contribute to *discoveries* in the context of the research process itself.

An example of a study involving unbiased investigation and documentation of artefacts by groups of students was the 'Raumplan versus Plan Libre' project, a comparative study focusing on the design modes of Loos and Le Corbusier.[a]

129 Type VI: Comparative design based research

16.9   SUB CLUSTER 2B: DESIGN(ERLY) ENQUIRY DRIVEN RESEARCH

Type VII: *Design document based research*

In document based research it is not only the *end* result that counts (although it is obviously taken into consideration), but also the overall design *process* leading up to the final product explored.

This may be done in order to add to the body of knowledge concerning the artefact(s) in question, but in addition can shed light on a designer's design *motives*, *attitudes* or *methods*. The research may also have a more general ambition, like identifying representative design *phenomena* and their effects. The subject of study could be a specific design artefact but also a collection of designs with some identifiable relationship.

There are parallels between this type of approach and type VI. Apart from being descriptive, such a research can often be said to be explorative. The process involves 'reconstructing' design choices from data which may not always be consistent. An example: a 'definitive' design drawing which does not correlate with photographs of a (possibly demolished) realised building. The *interpretation* of design intentions and the effects of design options and solutions require a *detective* spirit, the researcher attempting to uncover what is 'behind the *event*' of the design in a rational way.

Specific aims and methods may vary per project. It may be necessary to 'fill in the gaps' and possibly even to *extrapolate* design developments on the basis of existing data. Alternately, the starting point might be an altered building, whereby the task is to *reconstruct* the design virtually as it once was - or was *intended* to be.

a   Risselada, M. (1988) *Raumplan versus Plan Libre: Adolf Loos and Le Corbusier 1919-1930*.

Research on the basis of design data is relatively familiar. An example of an exercise involving active interpretation by students was the 'Un-built Loos' project at the TU Delft's Architecture Faculty. The task was to 'complete' house designs by Adolf Loos which had never been built (like asking music students to complete an 'unfinished' symphony). This potentially innovative project deserves to be worked out more convincingly and documented more systematically.[a] A recent example of a document driven research project was the international Mel'nikov study, in which the use of spatial models played an important rôle.[b]
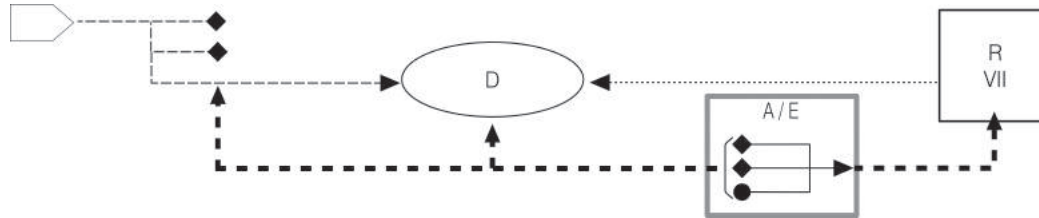
130 *Type VII:* Design document based research

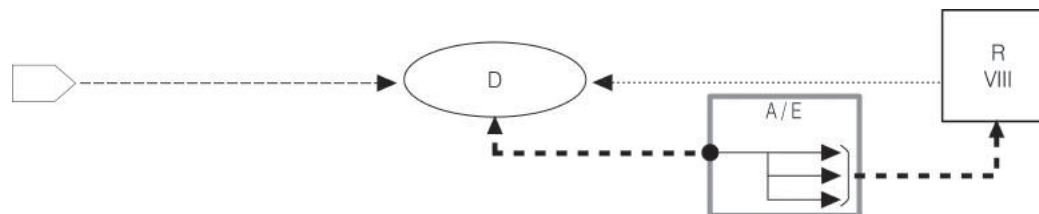Type VIII: *Designerly interpretation based research*
Designerly interpretation provides opportunities for bringing together research ambitions and *design expertise* present in the profession (and to a certain extent in the design education environment). The underlying motives and ambitions of such research are to discover more about specific designs or the 'science of design' (which does not necessarily imply considering design *as* a science).

Such research, involving *designerly interpretation* also calls for a '*detective*' attitude and as such there are distinct parallels with type VII. However, in this type of study the researcher generally has less information to 'go' on. Such a lack of 'clues' means that clues need to be *constructed,* allowing design considerations to be played back and forth in a kind of 'mental experiment'.

The researcher may take a 'design perspective', using designerly modes of *enquiry* to 'get under the skin' of the design project. In this way the researcher (or designers invited to take part in the research project) can generate 'simulated' design options, in order to identify and clarify aspects of *real* design results. Such designerly *variations* may be developed and compared with the actual result in a relatively systematic way in interpretative 'cycles' involving: designerly orientation, variation, evaluation and explication. For this to be possible, a methodical framework needs to be constructed beforehand and the design aspects to be addressed need to be identified and defined. As always in result driven research, such interpretative projects should not start 'from scratch'. The basis may consist of one or more design *precedents*, which will be explored using the working methods of designers within a methodically transparent research 'construct'.

Such an approach does not have to stand on its own. Combinations are conceivable, such as with type VI (by taking a group of design results as a starting point involving cross referencing and comparison) or with type VII (by combining existing information with 'constructed' information. More 'players' can be involved, as in type IV. In addition, different combinations of design media can be used. Such research is primarily explorative - and will often be carried out in combination with methods mentioned earlier - but empirical research on the basis of hypotheses is conceivable.

Although this approach is still relatively speculative, it deserves to be developed further, as it potentially builds a bridge between the empirical approach of scientific research and the expertise present in the domain of design (in practice and in education).

131 *VIII:* Designerly interpretation based research

a   Saariste, R., M.J.M. Kinderdijk et al. (1992) *Nooit gebouwd Loos; plannenmap van huizen ooit door Adolf Loos ontworpen nu door studenten uitgewerkt.*
b   Meriggi, M., M. Fosso et al. (2000) *Konstantin Mel'nikov and the construction of Moscow.* For an impression of the research process, see: Mácel, O. and R. Nottrot (2001) *Leningradskaya Pravda, 1924.*

16.10 PERSPECTIVES

If we wish to *extend* the range of design orientated research, other methods have to be found - or developed - doing justice to the creative *variation* characteristic for architectural composition.

New opportunities for innovative and imaginative design research may be offered by integrating active forms of *designerly enquiry* into research. Designerly working methods can create new opportunities for architectural and environmental design research. The experiences in educational settings and explorative workshop projects mentioned may give an indication of the types of design driven trajectories to be explored and pursued further.

The methodological component of design driven research projects should not be under-estimated. If results are to stand up to scrutiny by researchers from other disciplines, 'research by design' projects will need to be logically and transparently constructed, as well as clearly and consistently reported. A great deal may be learned from existing empirical research methods.

The challenge facing researchers of design ought to be to employ existing design knowledge and experience whilst creating new *designs* for imaginative and innovative research.