10 DESIGN RESEARCH

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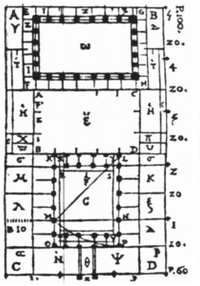
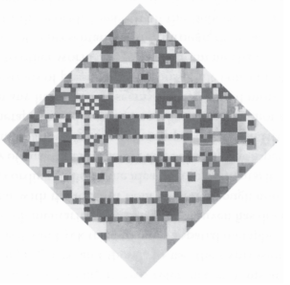
Design research - when it comes down to it, is the comparison of designs even though they are often implicit. Even if only one design (n = 1) is researched (casuistic-study), then this is carried out at the background of the design profession, its concept formation and terminology and, therefore, carried 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.



Cesariano, 1521

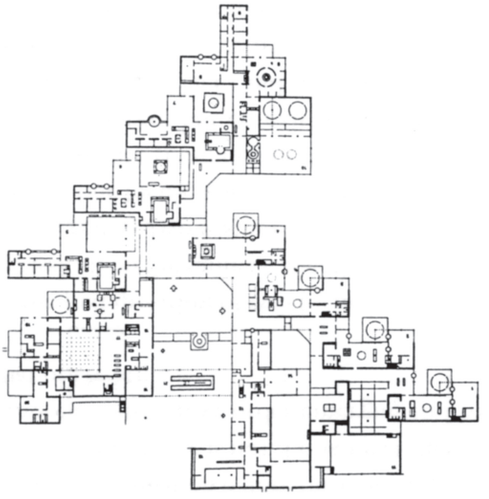


Mondriaan, *Victory Boogie Woogie*, 1942-1944

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.



Aldo van Eyck, *Burgerweeshuis*, 1960

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

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.

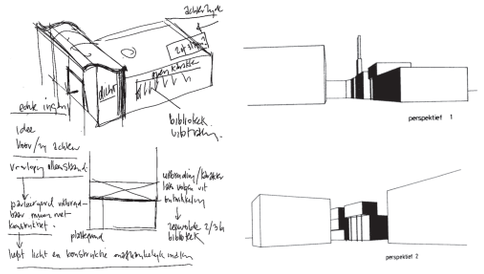
Therefore, strictly speaking, context is not situated *beside* or *opposite* to form.[b] After all, the (historical or prospective) context also has form, which is different at every scale level. In the table below, an overview, as a variant of Frielings' schema[c] is shown of research forms wherein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

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

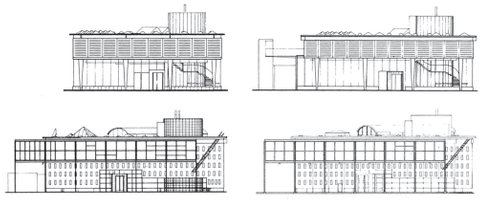
43 Types of design-related study

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.

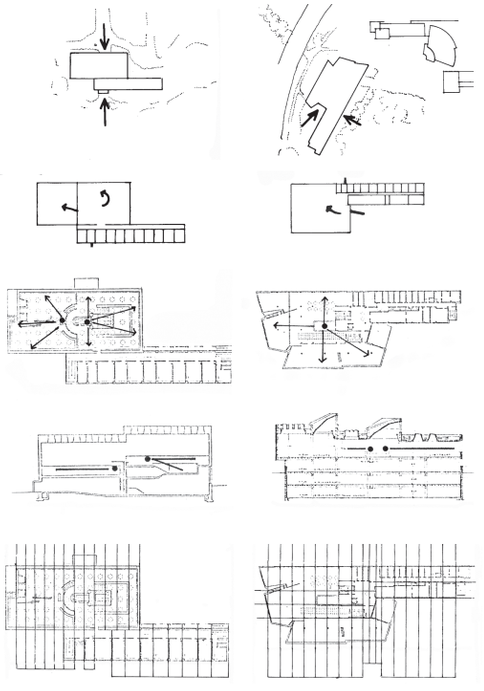
a Lefaivre, L. and A. Tzonis (1999) *Aldo van Eyck: humanist rebel*.
b Alexander, C. (1964) *Notes on the synthesis of form*.
c Frieling, D.H. (1999) *Deltametropool: vorm krijgen en vorm geven*.



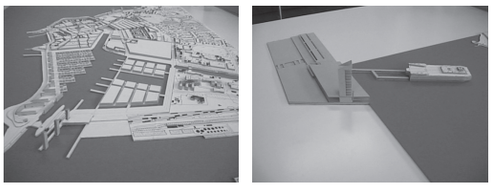
44 K. van Velsen, 1988, design study for the library of Zeewolde



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).

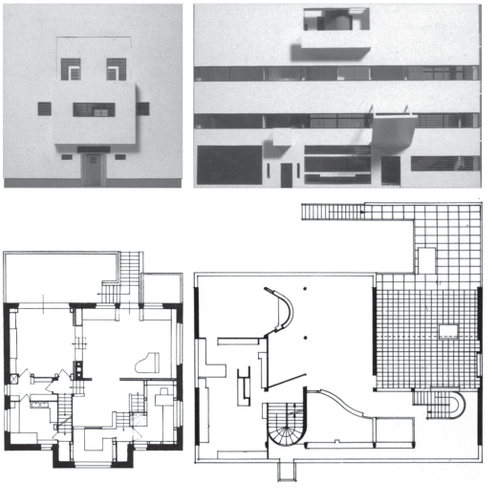
c Structure, the manner in which composing parts remain as a whole is defined here as the compilation of separations and connections in a joined whole.

d Function here is regarded as 'external action'

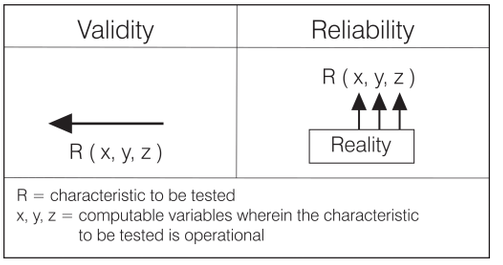
e See also: Frankl, P. (1914) *Die Entwicklungsphasen der neueren Baukunst*.

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*.



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 shortcomings 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 confirms 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 solutions in order to achieve the same aim, from which the variation cannot be explained measuring 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 numerous 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 possible 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 combine itself with a rectangular form? Once these questions have been asked the structural action 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 suggestion 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 constructional possibilities. Form (and format!), seen separated from a possible causation, is the situation of spreading of adjacent material, so that it, for instance, may be recorded, recollected and represented in co-ordinates.

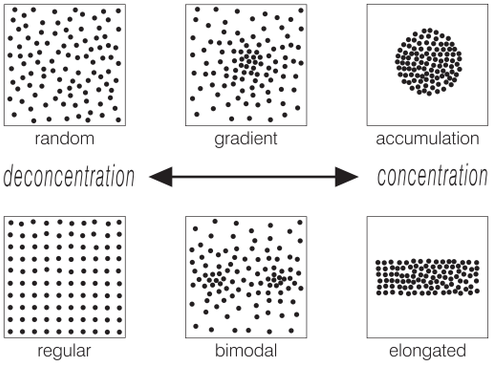
Concentrated situation of spreading can be described with an outline. If a regularity is found within a spreading situation a pattern results. A pattern with an increasing density is a gradient. This gradient may be a central, bi-modal, or tri-modal one.

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, proportional 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

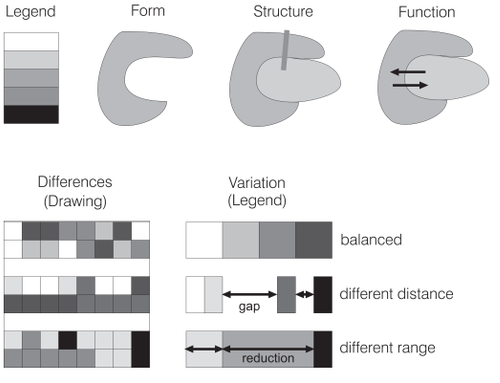
53 Difference not to be explained by the purpose [a]

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

54 Means resulting from Aim or vice versa?



55 Situations of spreading

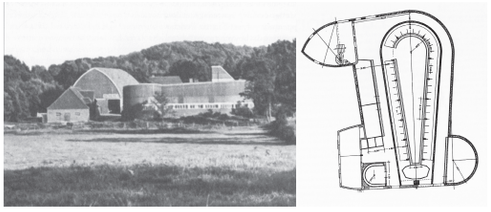


56 Legend (material or space)

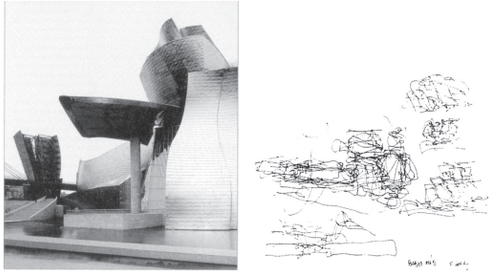
a Photograph: Theo Uytenhaak, Amsterdam

	matter	*space*	*image*
form (state of dispersion)	mass	divison	appearance
structure (separati-ons 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)

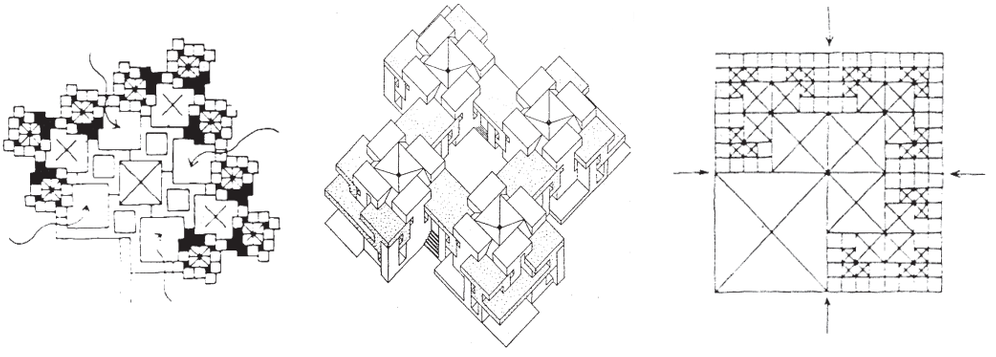
equal experiencing. Experiencing is an external working (function) of the form. However, the image of the form is, in its turn, something else than the experiencing of a form: for an image may precede the form; something experiencing cannot do. Each architectural drawing features legend units in material 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.