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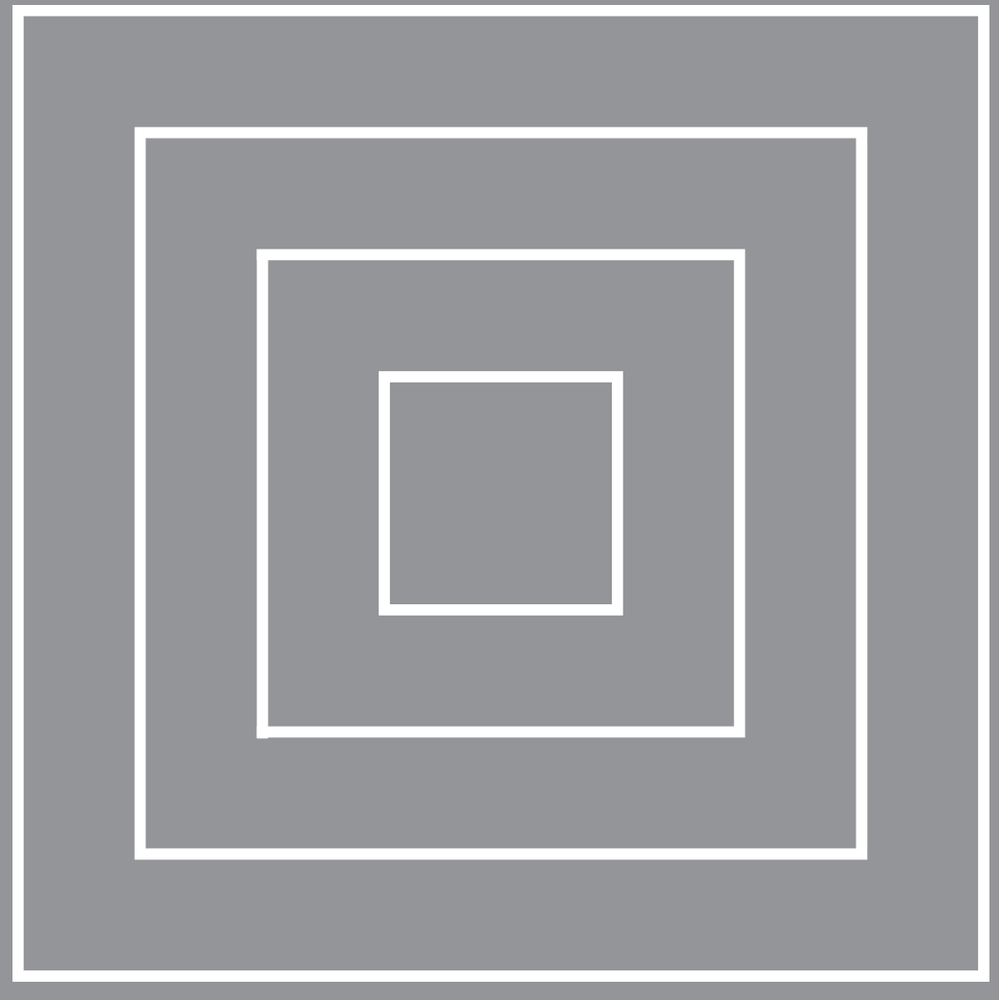

PREFACE

Within the range of a technical university the object of design – in terms of (urban) architecture and technique – is the design subject that is amongst all others most sensitive to context. The programme of requirements is not only derived from an economical and technical context, but also from contexts hailing from political, cultural, ecological en spatial considerations; on many levels of scale.

This applies as well for the effects not foreseen in the programme of requirements for a soil-bound object with the longevity of a building or a neighbourhood. The survey in this wide context of the effects of the built environment requires long-term perspectives envisaged on all these domains, from where boundary conditions may be read for forecasting effects; with, or without, a method; for within one perspective the effects of the built environment might work out much differently than in another.

It may be expected from a built environment that it was designed in such a way, that it may function in several perspectives without too many negative effects. This aspect of an architectural design is termed ‘robustness’. It does entail much more than flexibility and adaptability: it encompasses multi-functionality and diversity as well, and freedom for users and exploiters to come to choices. The principal of an architectural object does not usually require a predictable, average solution; but rather one matching the identity of the principal and the unique potential of the location. This implies that the architectural designer should not only display a many-faceted sensitivity to context, but also great creativity, and a will to explore ever again new ways. This is the technical-scientific challenge to the architectural engineer.

For getting one’s bearings in all these contexts, while providing at the same time spatially integrating proposals, one single, unequivocal scientific method is not available. During the innovation of education of the early nineties this question was put to the first Committee of Methodology of the Faculty of Architecture which methods would be essential in this respect. Opinions diverged.

On one side of the argument, Priemus advocated the idea, formulated in Chapter 26 of the present book, that the classical empirical-scientific method and its expansion into system theory would be sufficient for the scientifically trained architectural engineer. On the other side, Tzonis mentioned his opinion that there were as many as two hundred methods, all of them could be ranked as ‘scientific’; each of them at times needed to be applied to location-bound challenges and tasks. The Committee agreed to a preliminary recommendation to work out further eight categories of methods for education and study. This mixed application of methods was sorted out, during the following ten years, in order to come, for the benefit of many years in the future, to a rather more conscious synthesis.

A second Committee of Methodology has been working, since the turn of the millennium, on methodological matters. Your reading eyes are focusing on its results. This methodological book has been divided into the eight previously distinguished sections of scholarly methods, each of them addressed individually by different authors of the same Faculty along individual lines:

A.: Naming and describing
B.: Design research and typology
C.: Evaluating study
D.: Modelling

E.: Programming and optimising study
F.: Technical Study
G.: Design study
H.: Study by design

Design study is the daily practice of design studios not designing exclusively on the basis of intuition. They tend to document their design decisions, in order to be able to evaluate the design process afterwards because of a sense of responsibility. Study by design is the ultimate challenge, ever-changing boundaries and one to be expected anywhere, at any design institution. However, by definition, it entails that one must reach beyond the known scientific domain and methods, at the risk of being considered unscientific. However, if that risk is not taken, no ways are to be found into an unknown territory .

How does this architectural challenge and task relate to other Faculties of a Technical University? The context within which a designed product must function is always the source of its programme of requirements; and at the same time, the victim of its unintended effects. For the programme of requirements of most technical products the context of financial economics is central. It reaches from global forces on markets via efficiencies and effectiveness on the personal level to economical use of materials; on a smaller level still within the object to be designed.

This cultural context also impinges more greatly upon other technical products than architectural ones in terms of social acceptance and implementation. A product may fail, even if it has got a market for itself.

Designing personal goods must allow for a different cultural context than the design of capital goods that should be accepted in various entrepreneurial and governmental cultures.

To designers of components the technical context is particularly important. Within each technical discipline they are beholden to agreements about dimensions, inter-connections and to performance requirements within the design as a whole. Usually the technical context of relatively small complete products may be adapted by way of an interface or housing to be fitted locally. In this sense, the built environment is the final layer; the site may be adapted in one way or another, but the climate is a global, ecological, context beyond the influence of the designer; as is the social climate in its many perspectives, or scarcity of space.

In all technical sciences, therefore, also in architecture, these contexts may be recognised; but in building & architecture they seem to attain maximal extension and significance. Restriction to the site, scale and longevity of the object of design is playing a rôle. The (urban) architectural object as a whole can not look for a free market, unlike a mobile product. It functions, by itself, as a context for human activity and the industrial products connected to it. By the same token the architectural object does not only feature external, but also internal political, cultural, economical, technical, ecological and spatial contexts. They are the ones determining the programme of requirements; they will undergo the future, long enduring effects – both intended and un-intended – of the object designed. Any imaginable effect will, sooner or later, strike a local human chord. Then it may be understood that architectural objects do enjoy, nowadays, social visibility. A great many local interests are coming to the fore in order to contribute to the design process or delegate interest to the government level concerned.

Therefore, this wide and multi-faceted context is playing a much grander rôle in the design process of those who are building, than in the solution of those who are facing problems as there are (air)-conditioning, separating, joining and carrying. Since the three millennia preceding us, solutions do already exist; but we may vary them. By the way: the architec-

tural engineer, in all this, is showing his might: repeating existing solutions does not equal the kernel of the task that is a design.

The number of architectural solutions and possibilities of usage within classical contexts is larger than the number of atoms in the universe. If the 'Windows' icon with its 16 x 16 pixels of 256 colours is equalling all 256 * 256 possibilities of use for design, the designer of a 3-dimensional location with 300 possible building materials is finding himself in a multiple universe of possibilities. Only partially technical specification directs the numberless design decisions; in as many uncertain contexts facing the architectural designer.

The explosion in terms and numbers of combinations as offered by the scale of a building or a neighbourhood and the differentiating character of their commissions does establish a scientific challenge; this book provides elements to meet it. In addition, it supplies its readers with perspectives on innovating architectural thought. However, the prime importance and achievement of this book is that the scientific debt of a mix of methods honed to one single location needed for this task have been eased and facilitated. Methodological components are accessible and may be pointed out.

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1 INTRODUCTION

TAEKE DE JONG
THEO VAN DER VOORDT

This methodological book describes eight forms of study as they relate to design:

- Naming and describing;
- Design research and typology;
- Evaluating;
- Modelling;
- Programming and optimising;
- Technical study;
- Design study;
- Study by design.

These eight sections are the spine of the work. Its compartmentalisation is based on the work of two Methodology Committees of the Faculty of Architecture at the Technical University of Delft (in 1990 and in 2000 AD) and establishes, in this sense, the list of the methodological end-terms of the education. The sequencing of the sections and the chapters within them is showing a certain space for conditioning. Design research, for instance, is impossible without a description of the designs to be studied; in its turn describing study pre-supposes that the components and concepts in these designs can be named and retrieved (naming).

1.1 OBJECTIVE

The book contains suggestions for making project and study proposals as well as for the scientific design and study work itself. That will always be an inter-play of several methods, systematically explained here. The possibility to refer to this book makes the methodical founding of new study projects operational, transparent and accessible. The book addresses scholars, teachers and students. The scientific ambition and the comments on these forms of design related study have been worded additionally in the following Chapter ‘Criteria for Scientific Study and Design’ (see page 15).

Each of the eight sections comprises several Chapters, written by some fifty authors of one and the same Faculty in a vocabulary and idiom that is already, for that reason, a common one to a certain degree. A cluster of Chapters is always preceded by an introduction to the section as a whole. These introductions establish together a systematic survey which is not repeated in the present introduction. The reader may start with it and get an idea of the multi-faceted content while leafing through. The book may be considered as a systematically structured encyclopaedia for design related study on the field of architectural, urban and technical design.

Next to this systematic approach the book attains a kind of completeness with some six hundred references to literature on the subject. An effort was made to highlight contradictory and complementary views on design and study in this domain and their contrasts. It is precisely by this that one totality emerges. It is difficult to give, within one book, the floor to people who consider themselves to be in conflict with others. Usually different opinions are published in separate books.

Although two potential authors refused co-operation on these grounds, the power of the book is that it is giving access to different opinions. However, that aspect also created a size that may be rather daunting at first sight. For that reason a lot of attention was given to ease of access and use. By way of cross-references authors are pointing to one another and readers may investigate different opinions or perspectives on the same subject. The book is equipped with some five hundred illustrations, most of them especially drawn, facilitating searching by paging through.

The table of contents of the book as a whole, its detailing at the start of each section and at the start of each Chapter provide a detailed systematic gate of access. The Index (page 531) is an unusually extensive, alphabetical entry to some 10.000 names and terms referring to the first or most important page where the key-word is explained or mentioned in a context relevant to its significance. This Index is not restricted to names and nouns. Adjectives and verbs in various guises have been admitted as well; even parts of sentences. For the technical sciences of designing and making especially, verbs cannot be avoided. This Index provides the book with a source facilitating the methodology and terminology of the empirical and designing study itself as an object of study and debate: 'What does 'typology' mean, according to Leupen, to Van Duin, to Breen?' However, first of all it is functioning as a vocabulary for the first objective of the present book: the facilitating of working scientifically and of co-operating.

Scientific study is facing the task to unmask tacit pre-suppositions in order to make deliberate choices or to lift the blockade of designing. In its turn, it is the scientific task of designing to create from there new possibilities and conceptual spaces; and to initiate therewith renewed study. If this book contributes to broadening the horizon of the true 'Universitas', its second objective has been reached.

This provides the link to its third and final objective: facilitating such a productive cycle between studying and designing: study by design. How are we getting, at the same time, the components as well as the composition as a whole in motion, the objects as well as their context, the means as well as the objective? With this we are not throwing light on one or both, but on their relation. If we just vary the context in order to generalise types that may be employed anywhere (typological research), we are not making as yet a design that can be realised, although the type itself may be the object of study. If we are varying just the object in order to generate the right fit in a given context (design study), we only find incidental solutions, although we may document, analyse and generalise them (design research). If we continue to limp on both thoughts, we are on our way, but not yet at our destination. Also with this book that destination has not yet been attained, but the ingredients are ready. 'Anchors aweigh': there is a chart and there is a rudder.

1.2 PROBLEM

As a whole the book embodies a classical empirical problem formulation: a hypothesis; and it facilitates the oldest method to operate at the frontiers of science: fair debate. They are addressed in the following.

If design is left to creative powers and does not need to comply with scientific criteria, each and every university design education lacks its right to exist. The Faculty's Methodology Committee and the editors of this book state as a central hypothesis, that a form of scientifically based designing exists, transferable to education and not exclusively based on empirical or logical knowledge. It is the duty of technical universities to lay the foundations for this. If they do not appear to be able to do this, the assumption that design courses are not at home in the university is as justifiable as the certitude that they do belong there.

The implicit question is: Are the current logical-empirical methods and research techniques generally accepted everywhere in the university world, satisfactory for study by design, the production of a design or design variants and the studying of the effects? Priemus answers this question in this book in the affirmative (see page 249) and offers a null-hypothesis:

'For many decades a generally accepted research methodology, for behavioural sciences and for technical sciences has been in existence, which has been taught in scientific education faculties and institutions for many decades. In all those educational programmes the letters M&T form a permanent part of the foundation courses; research methods and techniques are part of the standard equipment of every student, and certainly of every graduate.

The Architecture Faculty of the TU Delft, in the year 2000, is pursuing a personal methodology for architecture, in other words: its very own design methodology. Up until now this did not take place using knowledge of and reference to the classic research methodology from other faculties, nor jointly with faculties in other countries where architecture is also being taught and design skills are adopted, nor jointly with other TUD- (sub) faculties where construction (CiTG) and/or designing (IO) is central, nor even jointly with their sister- Architecture Faculty of the TUE.

Is this sensible? No. Is this effective? No. Are there good reasons for such a self-containing eccentric approach? No.'

The international character of the Faculty from which this book originates belies the isolationism suggested by Priemus. However, the dividing line is genuine and international. It runs straight through the Faculties, albeit with extensive boundaries. Therefore, there is sufficient reason to study primarily its polarity in that diverse tension area. The criticism that the world of designers takes no interest in accepted scientific business is being taken seriously here.

Equal amounts of attention are paid to the empirical-scientific methods, of importance for architectural designing, and to authors firmly convinced that these methods are insufficient to learn designing. Some people even think that such methods can impede the design thought and that, maybe, new scientific opportunities can, and must, be developed. The onus lies with them to prove this. However, in order to do this, they must be able to understand empiricists and their methods. The antithesis is required in order to be conclusive. This is a purpose of this book. Methodology means understanding and valuing each other's methods. New scientific possibilities do not necessarily contradict empirical research; they can also be complementary, or place empirical research in a broader context.

1.3 FAIR DEBATE

Fair debate is founded on a division of responsibilities between *proponent* and *opponent*. This division prevents a case where two propositions are substantiated in turn without any empathising with, and intervention into, the other person's proposition. This substantiation may seem like an attack on the other proposition, but, in essence, it is not (consider the 'talking at cross-purposes' we see in our television debates). The division of tasks between proponent and opponent has two important hygienic consequences: the proponent is not identified with the proposition that he is defending, and the opponent steeps himself in the other's proposition. Thus the process becomes a mutual investigation into the question whether this proposition is 'defensible'. If the proponent loses the debate, he is not considered a suspect; he simply participated in an investigation.

Counter-examples

Thus, the above is the first pre-condition of fair debate. The technique is also based on a sequence of steps that should not be deviated from. The first is that the proponent explains his proposition. Experience teaches that the most foolish thing the opponent can do at this point is attack immediately, since there is not yet any communal foundation for dismissing this proposition. This opponent has to elicit this communal foundation.

His first question towards this end should be: "Do you mean, by this proposition, that…?", often based on counter-examples. With questions like these, he establishes that proponent and opponent are talking about the same thing. If the opponent presents the most extreme and implausible interpretation of this proposition in the opening question, it is wise to give the proponent the opportunity to *specify* his proposition through denial ("No, that's not what I mean" – "Then what do you mean?").

Rebuttal

After specifying the proposition, which may involve various steps, it is again foolish for the opponent to open his attack immediately, since only a part of the communal foundation has been established at this point. Thus the second kind of question for the opponent is: “Do you agree with me that…?” This usually involves a more general proposition from which, on the basis of a particular postulation, a possibly implausible conclusion can be derived. This phase may also involve various steps, whereby the proponent can make the reservation that he agrees just for the duration of this part of the debate.

Tenability of a proposition

Only after a communal foundation has been laid this way should the opponent open his attack by demonstrating a contradiction between the proposition (or an implausible derivation from it) and that which has been agreed upon. If he manages this, he should give the proponent the opportunity to return to his reservation. If he does this, the proponent must look for another communal foundation. If he does not, the opponent must give him one more chance: “Was the specified proposition actually what you meant?” If the proponent says “yes”, he has lost, or rather the debate has demonstrated that this proposition is not defensible. If he says “no”, the proponent must switch to a new specification so that the debate can be repeated from that point onwards. This may result in a formulation that is indeed defensible. In this case, everyone has the feeling that this debate helped science, technology or politics to take a step forward.

Science entails translating reality into transferable thought, while design and technology is translating thoughts into reality. This book concerns the possibility of these human projects in urban, architectural and related technical design. Dijkhuis’ contribution addresses the possibilities and pitfalls of translation as such.

2 LANGUAGES
FOREWORD BY THE TRANSLATOR

WILLEM DIJKHUIS

This book is the result of a concentrated effort to harness knowledge, insight, expertise, lore and (sometimes, perhaps) the wisdom of some four dozen professional Europeans on the topic of design & study in architecture for the benefit of a truly international audience. None of the contributions was written in English by a native English speaker, although every single author is steeped in reading it: the text is a translation into that most peculiar language: English.

The Dutch translator of this book, who is not a native speaker of English, was asked to translate and edit in terms of language the heterogeneous mass of Dutch sources (design, technology, science, humanities and social sciences) as precisely as possible into a uniform English; whilst using the same words consistently for the same meanings to enhance retrieving from the index. In this way the text should become readable and comprehensible for non-native speakers and users in scientific practice. It should create a common language to different scientists from the same school.

The translator insisted of course, being a non-native speaker himself, that his toil should be reviewed extensively and carefully by a native speaker of English, qualified to perform that vital function. David Baynton, a retired British Headmaster and a native of Kent, England, played that rôle with precision and prudence. In that way the text was cleansed from mistakes and inconsistencies in English usage, grammar and idiom; approximating better a *Lingua Franca* for an international audience.

2.1 LINGUA FRANCA

Above the gate allowing entrance to Plato's place in the country, '*Academia*', where he taught pupils, a motto was chiselled into the stone lintel, reading: '*Without Mathematics let no one pass*'.

Similarly, above the gate allowing entrance to understanding foreign communities, a hundred human generations later, a motto may be chiselled into a digital lintel, reading: '*Without English let no one pass*'. That language is deemed to be the '*Lingua Franca*' of the third millennium of the era. Before the Second World War, in a smaller world, German provided that communicative function from the time of the Romantic Movement.

'*Lingua Franca*' – literally 'a free tongue' – hails from the Latin. After the decline and fall of the Roman Empire and the so-called 'Dark Ages' a scholarly, artificial Latin emerged. One millennium ago, thorough academic learning could not be attained in Europe without the Latin tongue; in both languages: that of the ear, speaking, and that of the hand, writing.

The Latin of Vitruvius, secular Patron of Architecture, but also of Cicero and Virgil had ceased to be the mother tongue for anyone. No one using Latin in order to come to grips with his peers in the sub-continent could use the language as 'native speaker', since it was nobody's mother tongue. The academic '*lingua franca*' of places of learning in olden days was perfectly egalitarian, not discriminating between peoples, regions and nations. Any two 'students' or 'scholars' – the indications being roughly equivalent at that time – say, one from Cracow, the other from Oxford - capable of understanding one another using Latin, had acquired that facility by formal education; by studying and imitating schoolmasters rather than their mothers.

In this respect the Latin of the start of the second millennium differs profoundly from the English of the start of the third; regardless of the immense value of having access to that language in writing and speaking. Native speakers of the English language presently enjoy - and will for the foreseeable future – unique intellectual, political and cultural advantages.

Some observations by way of introducing the present book are necessary. The famous Dutch physicist Prof. Dr. Hendrik Casimir – for decades Director of the equally famous Physical Laboratory of the Philips Company –in 1965 delivered a speech at a formal dinner of the International Institute of Electrical Engineers. It was entitled '*When does jam become marmalade?*'.[a] The non-native speaker of English reflected, in English, on the problem of the two cultures, the one of the sciences and the other, of the humanities, "*so eloquently formulated by C.P. Snow*". Casimir's after dinner talk is as witty as it is illuminating.

Reflecting on the fastidiousness with which Britons reflect on fine distinctions between 'jam' and 'marmalade', – the Dutch consider 'marmalade' a sub-species of 'jam', whilst that other breed of men at the other side of the North Sea entertain different views – the physicist and scholar offered considerations on "*the amazing richness of the language which tempts the English to make distinctions where others look for general concept. Now I should like to suggest that the so-called difference between the two cultures is largely a case of jam and marmalade. There exists in Dutch, in German and in the Scandinavian languages a word* Wetenschappen, Wissenschaften, Videnskaber *that includes all branches of learning. In English* 'science' *usually refers to the natural sciences only. […] We Dutchmen will emphasise the common elements in all* 'wetenschappen'*: the collection and systematic arrangement of data, the search for general principles and for relations between initially unrelated subjects, the willingness to dedicate one's efforts to the pursuit of knowledge and so on. A scholar and an natural scientist are both* 'wetenschappelijk' *because they accept similar criteria, have in many ways a similar attitude.*"

Since, in our western tradition the roots of designing architecture are not only embedded in the soil of the natural sciences and physical crafts, but also in the humanities and social sciences, the observations of Casimir establish a perfect context for the origin of the present book: in the Faculty of Architecture of a Technical University in the Netherlands.

Casimir's wit has been a beacon while translating and editing the original Dutch texts of contributions to this book into British English. Of all the world's languages, that language, a great borrower from all languages: Celtic, Norse, Saxon, Norman French, Latin, Greek and Dutch; features the largest vocabulary by far of any language. Still, the single Dutch word '*doel*' has a wealth of almost equivalent words in English, well schematised in the contribution by Priemus and de Jong in Chapter 27.

The richness of (almost) verbal equivalence in English – a richness of its own – is perhaps best surveyed by the life-work of Peter Mark Roget (London, 1779 – West Malvern, 1869): his *Thesaurus of English Words and Phrases* (1852) is a comprehensive classification of synonyms and verbal equivalents. Roget was a physician as well as a philologist. His book was the harvest of his retirement as an active medical practitioner, although his system of classification dates back to 1805. Roget's Thesaurus has been kept up-to-date and was expanded since its first edition by publishers on both sides of the Atlantic in a concerted spirit along the lines of lexicographical diversity.

The lemma 'Enquiry', number 459 in a modern edition, occupies two large pages printed in small type; one following it, 'Knowledge', number 490, in the same chapter, entitled 'Intellect: the exercise of the mind', needs the same generous amount of typographical space. It stands to reason that both lemmas are main ones in a scholarly work on studying design and designing study in architecture. Reading those pages at leisure is an experience that should overwhelm those who are trying to translate the written results of pondering in a foreign tongue into English.

This enormous vocabulary is made operational, after '*1066 and all that*', by way of one of the sketchiest of grammars, in a vast semantic cloud of idiom, allusions and associations. Many languages have contributed essential elements to the present structure and content of English and its expressive potential. This uniqueness presented both peculiar prob-

[a] Weber, R. L. and E. Mendoza (1977) *A random walk in science: an anthology*. p. 1-3.

lems and promising opportunities during the translation and evolution of the manuscripts leading to the present volume.

2.2 STUDY AND DESIGN

By way of example, take the English word ‘study’. It may be a noun, indicating a room in a building equipped for a specific activity; or the activity itself. Or, it may be a verb, used in a wealth of (in)dependencies given its syntactical context. Then there is, for instance, the rather new-fangled, rather American noun ‘research’, nowadays seldom understood in its most literal sense ‘re-search’: to search again. Following the Second World War the American term ‘research’ should be considered to be one of that nation’s most successful and crucial conceptual exports.

George Bernhard Shaw termed the United Kingdom and the United States three generations ago two nations separated by the same language. That chasm may have become rather less wide by now, but there is no doubt that it is still dominating the international landscape of scholarship, sciences, and technologies. Both branches of the same trunk share the property that the conceptual distance between substantial and verbal use of one and the same word is very often subtle, sometimes slight.

For the word ‘design’ much the same applies. Noun and verb mirror one another. While ‘study’ derives via Norman French from classical Latin, ‘design’, historically of a much more recent vintage, entered the English language from the Florentine language of the Renaissance ‘*disegno*’. The word will not be found in the big bang of Western architecture, Vitruvius’ Ten Books. Coined in the environment of Giorgio Vasari, it was understood to be the umbrella sheltering the tripod - painting-sculpture-architecture. It came to share quite readily the vigour and flexibility of English words in the wide compass between adjectives and nouns. All things considered it is remarkable that meaningful questions exist in the language such as: “What are you doing?”, to be answered by “I am designing”; or “What are you bringing to this project?” by “Just designing”.

It should be added, that in the life and times of Dutch founding fathers of modern architecture like H.P. Berlage, J.J.P. Oud and their little band of peers, the word ‘design’ could not be found – as yet - in contemporary Dutch dictionaries. Their work, and reflection on it, employed the term ‘*ontwerp(en)*’ and that endemic linguistic network is still alive and kicking, next to the successful import form the Anglophone world: ‘design(ing)’.

The present contribution by no means attempts to survey exhaustively all the difficulties a translator faces in providing an English equivalent for a Dutch text on Study and Design. However, still one more example should be mentioned. At the end of the Middle Ages, the English verb ‘to ken’ went out of common usage. For a long time it had complemented another verb, ‘to know’. A verbal pair like that, with the same implications, was demonstrated – and still is - in most languages spoken on the Continent: Dutch ‘*kennen*’ – ‘*weten*’; German ‘*kennen*’ – ‘*wissen*’; French ‘*connaître*’- ‘*savoir*’; Spanish ‘*connocer*’-‘*saber*’; and so forth. The distinction between the two is eminently meaningful and useful. Today, the English verb ‘to know’ is facing the awesome task of serving two fundamentally differing meanings.

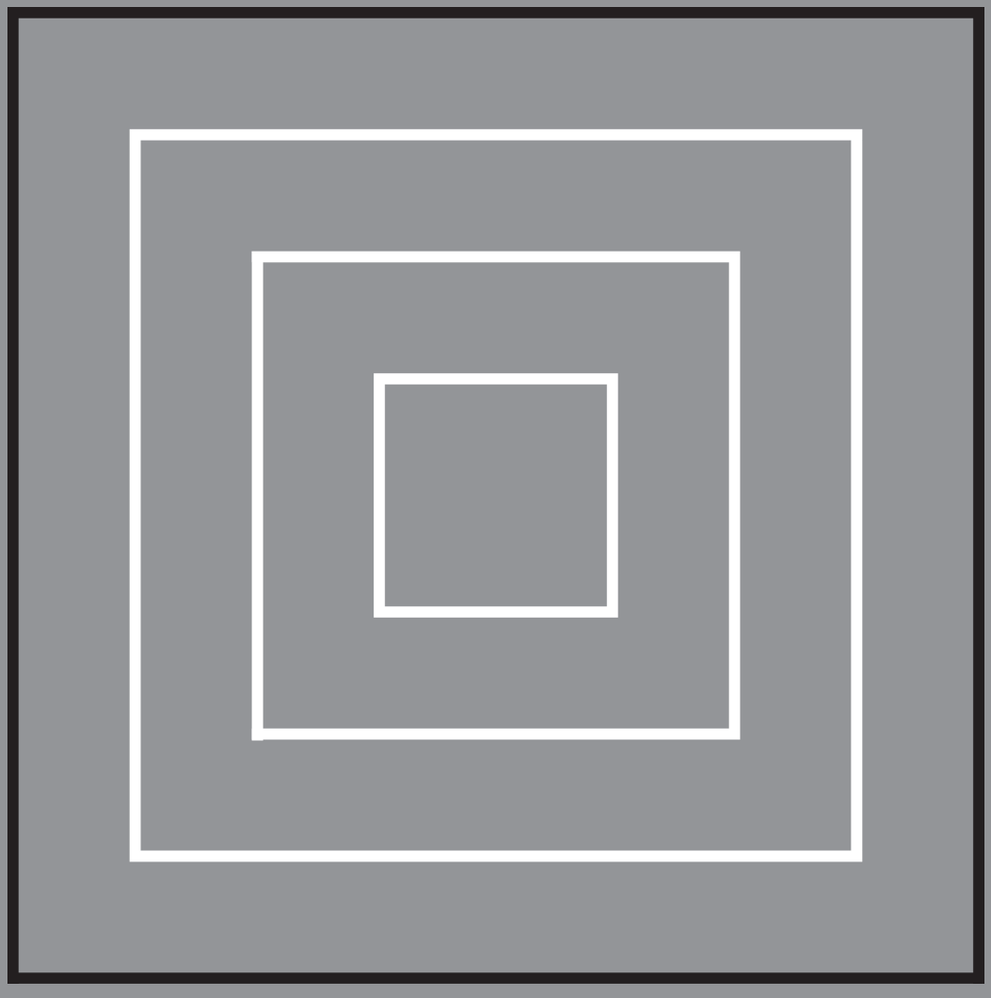
2.3 CONTEXT

Seen particularly from the perspective of the study of architecture the linguistic panorama is vast. In the Victorian era, English words like ‘learning’, ‘scholarship’ or ‘professional’ entailed meanings not co-inciding with their meanings more than a century later. Meaning can never be associated with timelessness: a letter is nothing without a word, a word is nothing without a text; and a text is nothing without a context. The text of the present book tries to follow British English usage; also in its most modest and concrete aspect, spelling. However, its intellectual, conceptual and academic context and tradition hails most decidedly from the European mainland.

These observations are not meant to be an excuse or apology for its possible lack, now and again, of easy-going parlance that could be addressed to any sixteen-year old native speaker of English anywhere. In addition, equalling, or even surpassing masters of great and elegant prose ranked low on the list of objectives at which the authors were aiming.

Just as the subject of this co-operatively created work endeavours to investigate and chart in a new way, as clearly as possible, the confines of thinking about, and working with, the meaning of designs and designing to architecture and architects, the language by which this subject is addressed explores occasionally a new semantic domain, sometimes beyond common usage of terms. It is not just because of academic idiosyncrasy, quirk or whim that the contributors and editors owe to the essence of architecture, as it encompasses arts, sciences, humanities and social studies: intellectual and professional life itself.

NAMING AND DESCRIBING



A NAMING AND DESCRIBING

An important condition for scientific work is a conceptual framework and careful description of the subject to be studied. Naming, describing and referring are also essential constituents of study related to design.

Naming components and concepts

In their contribution, De Jong and Rosemann stress the importance of concepts in design, as well as their focus, supposed scale, possible overlaps. The lack of concepts in naming the mountain of possible forms and transformations whilst communicating on design actually is a problem for the science of designing. It causes a proliferation of neologisms, often not to be fathomed by outsiders. Definition does not always offer a solution. For that purpose the constituent concepts fail that are presumed when a definition is in the making. Defining is preceeded by the conditional positioning of concepts A and B *vis-à-vis* one another: which concepts A pre-supposes concept B to be defined? May concepts A be named?

It is important to avoid a change of level of abstraction in a discourse or use of 'legenda', the 'things to be read', in construction. Mistakes preceding logical ones like these often play a rôle when designs are discussed. Designers tend to use rather paradoxical expressions whilst commenting on their design, like 'concentrated deconcentration'. Words often fail to suggest the world of shapes.

Retrieval and reference

The contribution of de Jong and van der Voordt dovetails both practically and theoretically with suggestions *vis-à-vis* citations of scientific results and facilitating that.

Descriptive research

Lans and Van der Voordt explore the value of a painstaking description of reality for theory development and the practice of designing. They argue to describe facts or designs in such a way that, 'ex ante', a minimal amount of inter-connections is suggested. That description should be clearly distinguished from the interpretation of facts and the establishment of relationships. Criticism by way of comparing different interpretations of the same material depends on this in order to exist at all. Concrete examples of study illustrate advantages and disadvantages of the phenomenological approach. The authors advocate to raise the dominant form of design study – analyses of plans and comparison of previous cases – to a higher level. In addition, process description is discussed by way of two examples: the planning process of the '*Bijlmermeer*' project of the City of Amsterdam in the sixties, and the individual one, and one of thought as well, of a designer of architecture. Both studies yielded relevant insights for the theories of planning and of architecture.

Historical research

Máčel shows that the results of historical research depend on the interpretation of history as a science. His contribution consists of three parts: 1) heuristics (how to deal with historical sources and references), 2) analysis (how to analyse text and drawings dating from the past), and 3) interpretation (focusing on issues such as context, typology, style and meaning). Finally he reflects on architectural history as a social science and the relationship between historical research and architectural criticism.

Map Study

Moens' contribution focuses on the formal and functional description of the earth's surface, on the basis of aerial photographs and maps. It discusses several types of maps; how they

are made and how they may be used as support of design decisions. In addition, traps and foot holes are indicated in order to prevent faulty interpretation of the towers of map-making. Without interpretation, it could not be done at all. Just think about the 'things to be read', the units of the legend and choosing them. The degree and measure of interpretation is then at stake; and to what level they are suggested. Only after description the topographical facts should be placed into mutual relations according to a model. In the case of topographical maps of the military the problem becomes clear. Different connections are already pre-supposed in them; no longer susceptive to design decisions.

Casuistry resulting in laws

Most ancient social application of induction, a distinct set of cases within one general ruling, is the law. The juridical method where casuistry leads to jurisprudence is a predecessor of the scientific method. Facts, their modelling, debate and inter-subjective judgement play an important rôle.

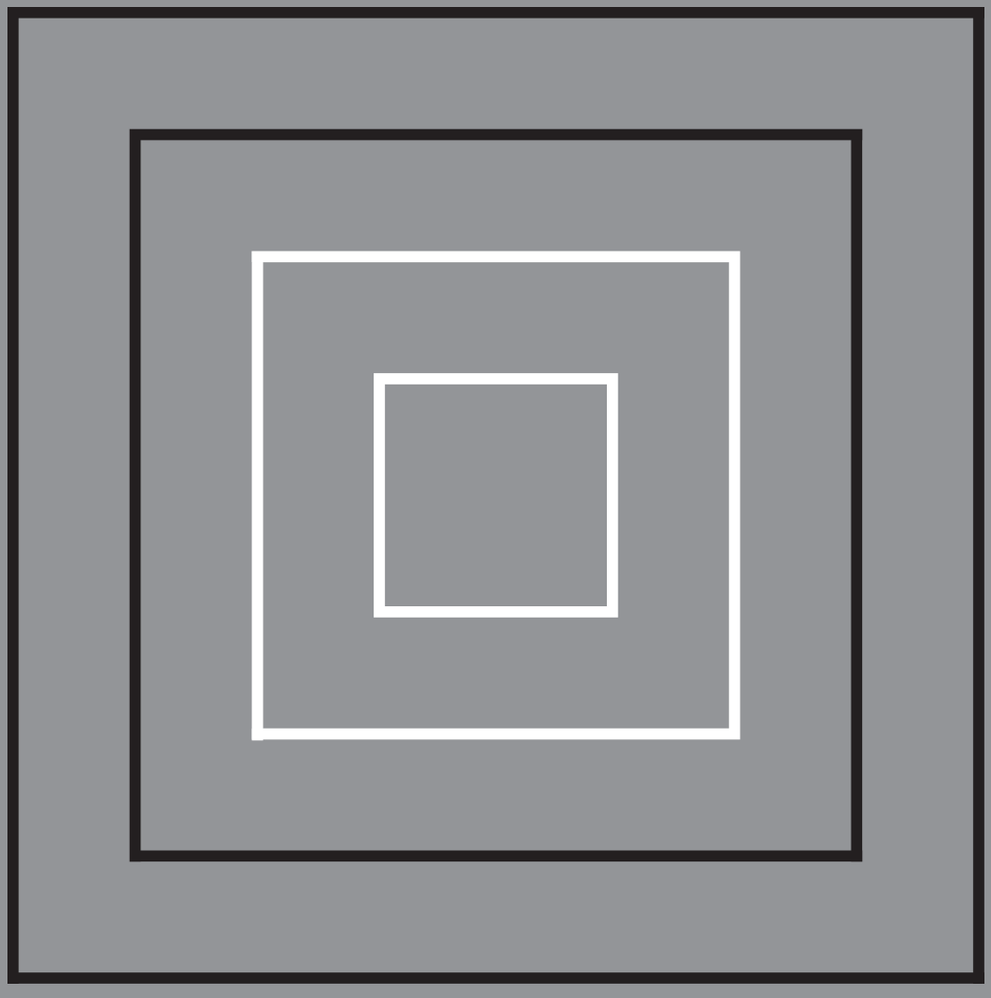
Hobma and Schutte discuss the importance of legal study in the context of designing. On one hand they make practical distinctions, based on straight application of legal research: essentially retrieval and sorting; for instance for getting a building license. On the other, they deal with scientific legal study, explicitly aiming for a more general kind of knowledge.

The Chapter is consolidated in this section, while this prolegomenon from quarters not exclusively empirical gives a feeling for a scientific approach as it applies in the domain of architecture. An exclusively empirical approach fails to give a solution for many problems in this respect.

Conclusion

Together, the five sections reflect the value of descriptive study, the necessity of a clear, unambiguous terminology, and checking points to pre-empt all too subjective interpretations, or even faulty ones, of reality.

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.

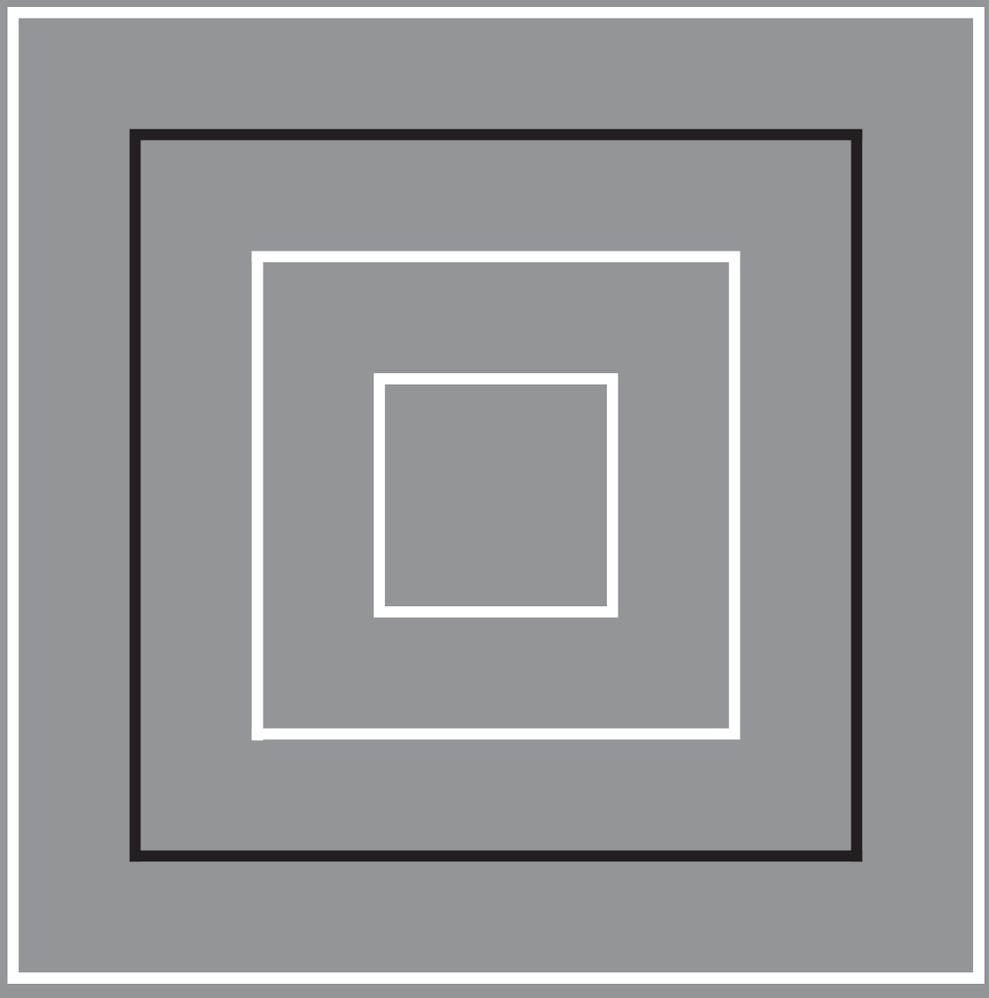
Design driven research

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.

EVALUATING



C EVALUATING

In addition to the intended effects of a design as they are formulated in the programme of requirements many effects not intended and further consequences may become manifest. This part of the book discusses if and how these effects can be predicted ex ante or be measured ex post.

Ex post evaluation of buildings

The effects of a design can be ascertained in the most simple and precise way after the building process, when the object has been taken into use. By that time circumstances in terms of policy, culture, economics, technicalities, ecology and space are also known. In these fields the effects must be evaluated seperately, and, furthermore, social debate determines the weight of each field. In the contribution of Van der Voordt en Van Wegen methods and techniques of evaluating research ex post are discussed. A lot of experience has been gained in this both nationally and internationally. The contribution focuses on a discussion of relevant themes for evaluation, linked to quality assessment and optimal matching between demand and supply. A combination is advocated of comparative description and analysis of precedents and the empirical measurement of the achievements of the building. Utilisation study in the form of Post-Occupancy Evaluation (POE), site visits and checking the design against the programme of requirements, norms and results from evaluative study done elsewhere are the most important sources.

Ex ante research

It is crucial to be able to make already during the development stage of the plan a guess into the effects of the programmatic choices and design decisions. Prophesying these effects before the object is realised (ex ante) is not simple. Hulsbergen and Van der Schaaf show that systematic analysis of effects in the form of evaluative study ex post may serve well. Such an evaluation necessitates formulation of a perspective within which the effects will manifest themselves; in political, cultural, economical, technical, ecological and spatial terms. Results from evaluating research ex post are an important source for so-called ‘pre-design research’. An excellent means to discover critical uncertainties is the study of scenarios wherein alternative views of the future are thought through with regard to spatial impact and their relationships to possibilities, desirability, and likelihood.

Ex ante performance evaluation of housing

Thomsen discusses an instrument to evaluate the quality of housing. This so-called cost-quality test is an important tool for evaluation of plans; both ex ante and ex post. Thus, not only the most important qualities in terms of usage are unveiled; also criteria for evaluation and assessment of the planned or realised achievement of housing and individual dwellings are highlighted. By relating quality to costs a motivated estimate can be of the optimal ratio between both.

Evaluating prototypes

Some of the advantages of ex post evaluation could be realised ex ante by making a prototype. Van der Voordt describes some criteria for that kind of research, illustrated by a study by design of prototypes of correctional facilities and health care facilities.

Comparing and evaluating drawings

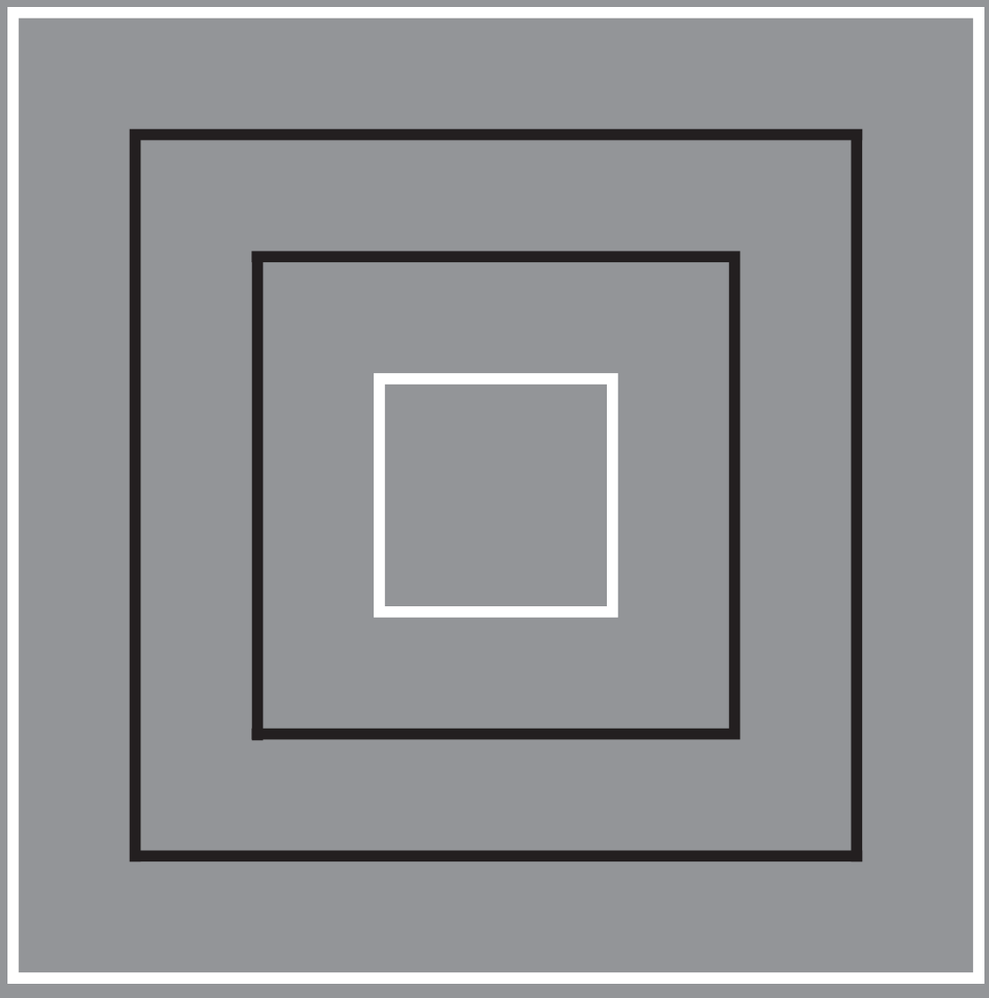
In the final contribution De Jong shows how drawings can be used as a means to evaluate designs ex post and ex ante. He emphasises the importance of a clear legend and a transfor-

mation of different drawings to the same scale in order to be able to compare designs in different contexts.

Conclusion

The different contributions show that a long tradition exists in evaluating of designs ex post and ex ante. However, most evaluations of functional aspects are prepared and executed by researchers with a background in social sciences, whereas designers or architectural critics do most evaluations of formal aspects. Integrative evaluations including functional, formal, technical and economical effects might lead to a better mutual understanding of different parties involved in the design and building process and lead to a growing body of knowledge of architectural, urban and technical design.

MODELLING



D MODELLING

In empirical science existing reality is modelled. Central in this section stands the making of consistent verbal, mathematical and visual models and their relation to reality.

Modelling reality

There are many types of models, as Klaasen will explain in the first Chapter of this section. It is highly significant, that several types of models are in existence, but not several models of types.

Verbal models

The best described, most widely accepted form of consistency is formal logic. This also is on a higher level of abstraction a model (meta-language) of common language. Verbal models of architectural objects carry on their own level as an object-language the properties of this model. In the corresponding section de Jong adresses proposition and predicate logic, and their linguistic restrictions.

Mathematical models

De Jong elaborates different mathematical tools to be used in architectural, urban and technical design and evaluation. In the mathematical model of a design, connections may be read that enable evaluation of constructive or functional connectedness.

Visualisation and architecture

The language of the drawing is, due to its endless variation, less consistent than conversational language with her verifiable syntax, grammar and inherent logic. Considerable sensitivity as to context and interpretation of the drawing implies both her logical weakness and heuristic prowess at the same time. Yet, consistent and verifiable visual models can be made. Koutamanis gives examples.

The empirical cycle

On a higher level of abstraction the empirical cycle is also a model; according to many – including the author of that Chapter, Priemus – the only consistent model for scientific practice. It can be copied in any research project. That model is broadly accepted. It is based on the growth of knowledge to be generalised by well-defined testing. The time consuming shaping of a hypothesis, like with the architectural design, is in this respect ‘free’, not further modelled. The usual scientific approach pre-supposes in its turn consistency in discourse.

Forecasting and problem spotting

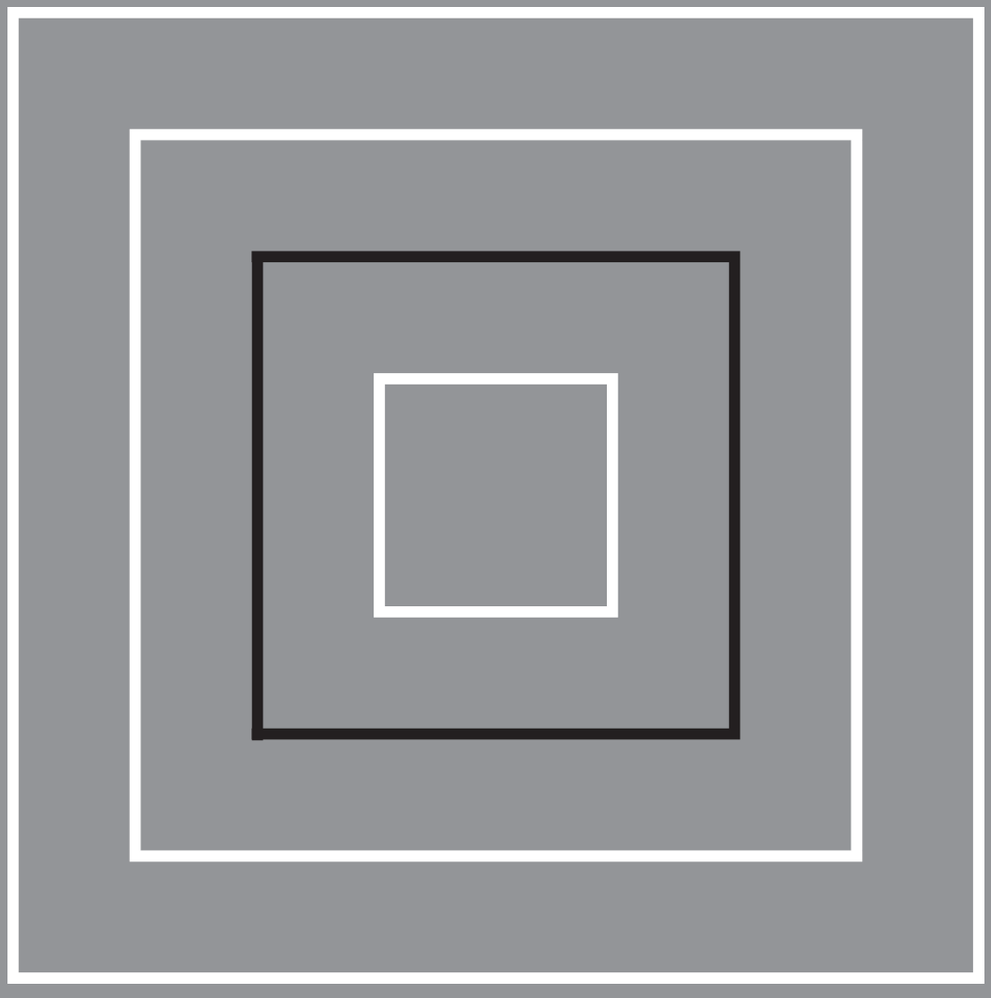
Mathematical models play an important rôle in forecasts and consequently in problem spotting that may give rise, for example, to the formulation of an architectural programme of requirements. Their conceptual framework is explained in the corresponding Chapter of de Jong and Priemus by way of large-scale examples.

Conclusion

A model demonstrates more relations than a concept or type, let alone an intuition: it is more consistent. However the model is not yet reality and should not be confused with it. Many relations – topographical, situational – will be lacking in the model. Incomplete models of a design may be made in order to make sector effect analyses and to test the design according to certain values and objectives of the relevant stakeholders (evaluations). Sometimes this requires more modelling than the design itself allows. A scale model is a model, if it allows

evaluation like that; very realistically, like in a wind tunnel. A sketched-scale model rather has a function for further development of the design; also if it has not, as yet, the consistency of a model with its inter-subjective checking potential.

PROGRAMMING AND OPTIMISING



E PROGRAMMING AND OPTIMISING

Making a programme of requirements for a building or urban plan pre-supposes a model of the future. With the help of models discussed in the previous section, discrepancies may be signalled between the present situation and the most likely situation in the future and the most desirable one. Starting from a future model like that, urban, architectural and constructive programmes of requirements may be drawn up in order to deal with problems signalled or predicted. The programme directs the design, even if it determines the spatial model in a limited way. A programme represents a need from the context of the object on a certain scale level (e.g. national, provincial, local) and of a certain nature (e.g. cultural, economical, technical). Positioning the need in a contextual scheme is an important part of programming design.

Urban programming research and programming of buildings

In the contributions of Guyt and Hulsbergen (urban level) and Van der Voordt and Van Wegen (building level) the method of programming study is worked out further; not only for re-programming existing situations, but also for programming new architectural objects. Both approaches show a careful inventory of wishes, needs and activities to house. Study among present and future users, functional analyses, norms and characteristic values, lessons learned from evaluative study and statistical prognoses are important sources for formulating a programme of requirements. The use of scenario methods is a good tool to picture the spatial consequences of different possible futures.

Programming building construction

Eekhout and Cuperus discuss programming on lower levels of scale (<100 m. radius), but in the same time in a wide range (until 1 mm.) and within a more strict technical context of performance requirements.

Designing a city hall

The Chapter by Weeber, Van Eldijk and Van Kan is an example of a design process where the programme of requirements functioned explicitly as guidance for the design.

Design by optimisation

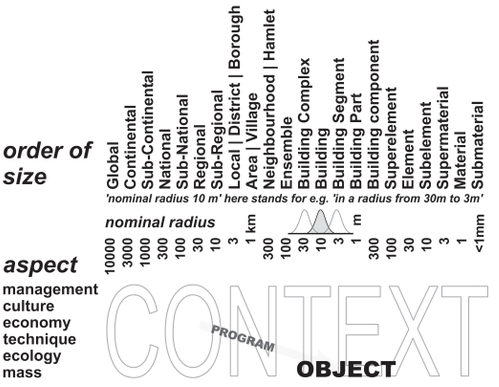
In a programme of requirements wishes and requirements related to an architectural object are often contradictory. In that case choices and priorities must be made. Decision theory has made a lot of progress in weighing conflicting requirements transparently and democratically. Van Loon shows what mathematical optimisation models can contribute. His contribution is focused on use of linear programming.

Optimising performance requirements

Houben describes a more verbal approach. In his view not only factual arguments matter, but – as least as important – also the way in which actors in the process communicate. An important distinction is the one between norms, laws and results from scientific study on one hand, and collective and individual preferences on the other. Rational and emotional arguments often conflict. Consensus under an umbrella concept and a phased development of the plan are important ingredients for taking decisions acceptable to all parties.

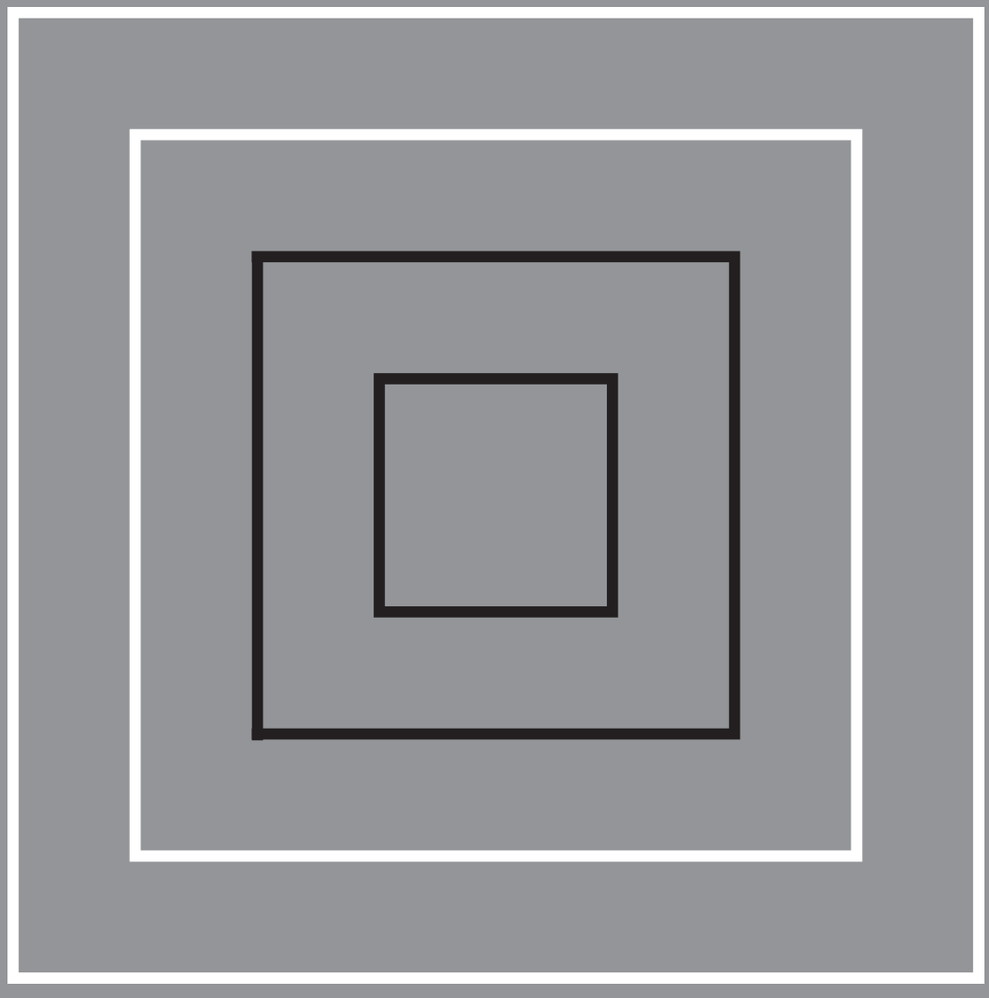
The environmental maximisation method

The contribution of Duijvestein argues not for optimisation, but for maximisation of dominant values, in this case: a safe, healthy and sustainable environment. With maximisation of an interest like that the importance of weighing interests of separate parties shows again.



285 Context

TECHNICAL STUDY



F TECHNICAL STUDY

Construction technique serves spatial design. It is also a subject of education, study and development. Designing includes construction-technical design; linked with all other subjects of this book.

Re-design and renovation

Presently the largest part of the built environment already exists; as soon as it is completed, a new building is added to the stock. An important dimension of the challenge of building for the future includes renovation, maintenance, re-adjustment and improvement of existing buildings (Verhoef, page 323).

Study of building services and installations

Schalkoort discusses the study of technical facilities in buildings most close to man: climate control, installations for transport, electricity, sanitary, communications, cleaning and risk prevention. The more space they require, the earlier its concern has to be involved in the process.

Methodical design of load-bearing constructions in buildings

Kamerling discusses the study of technical facilities more remote from man, sometimes even invisible. This kind of study covers a limited range of scale levels and limited context variables. The resulting clear-cut considerations could serve as a prototype of more complex design study.

Classification and combination

In this Chapter Cuperus argues that there are several ways to order building technique, each of them with a specific objective. Architectural transformations do not occur spontaneously. They result from human decisions, ultimately linked to the way components of the building are connected. One approach may be to order building along the lines of the ‘building node’. The interface of the building node defines not only an ordering for the levels where decisions will be made, but also one with respect to sub-systems.

Methodology and component development

Components (‘constituent parts of a whole’) may be part of architectural (sub-)systems and separately developed. Eekhout argues how, in which case and context.

Industrial design methods

Designing components resembles industrial design of loose products as done on the Faculty of Industrial Design Engineering. De Jager refers to this branch of design methodology and discusses similarities and dissimilarities in context and methodology of product development, industrial design and architectural design.

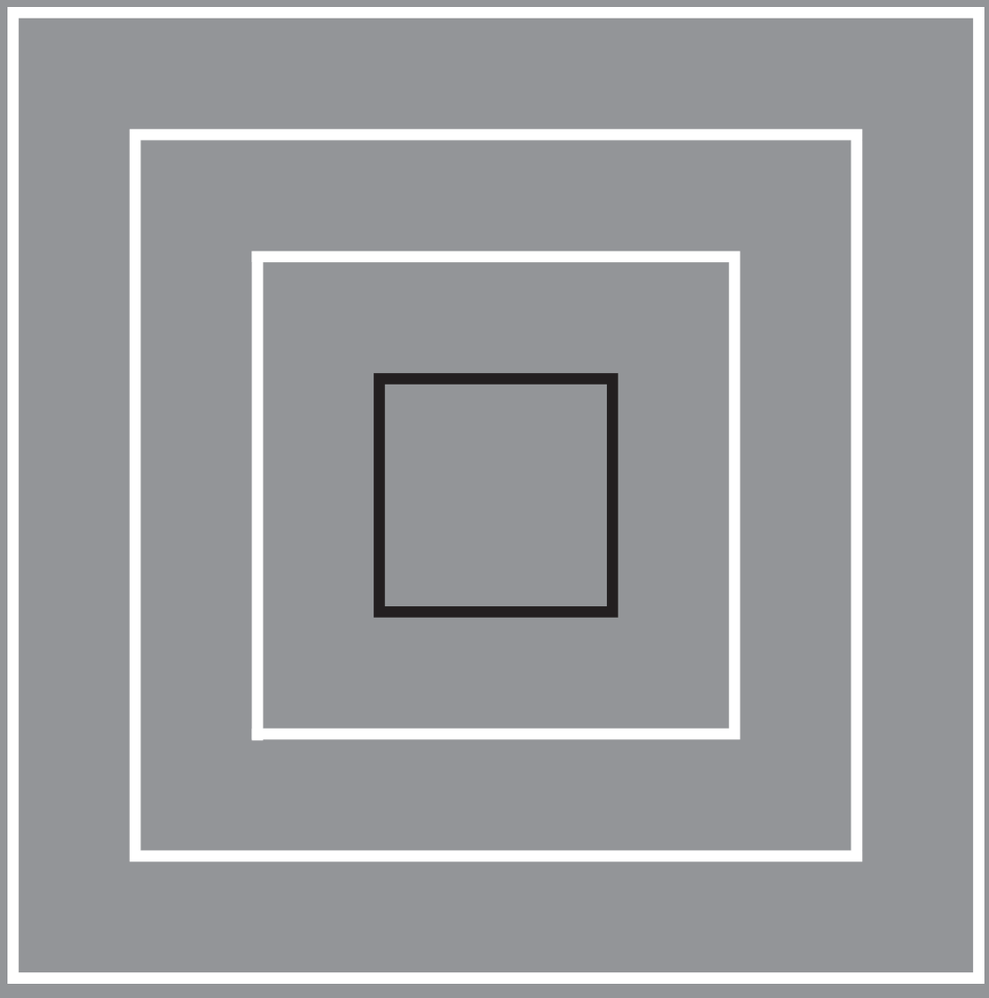
Future ICT developments

Sariyildiz *et al.* indicate that both ‘hard’ and ‘soft’ computing techniques such as artificial neural networks, fuzzy logic and generic algorythms are helpful in complex design processes and architectural education. They discuss four application domains of ICT: creative-design, materialisation, realisation, and process and management.

Conclusion

Technical design is an interface between hard knowledge as discussed in the previous sections, and soft growing concepts. They are subject of the next sections.

DESIGN STUDY



G DESIGN STUDY

As an inquiry into possibilities of a given context (site and programmatic desiderata) designing does not call for methodological requirements, but rather for liberation from down-trodden problem definitions and their solutions.

Creating space of thought

Hertzberger explores the methods assisting in opening up the possiblities, instead of determining them. Descartes' *'Discours de la Méthode'* focused on doubt. Design study distrusts, like classical sciences, all that is obvious, but does not throw everything overboard all at once. Experience evaporated into routine deserves suspicion of the scientific approach, deeming no pre-supposition sacred. However a culture, certainly a local one, surrounds us with pre-suppositions unbeknown to us; like a fish without knowledge of the water it is taken from, at the same time there is certitude of existing conditions: a table, a bed, a kitchen entails great forms of freedom.

Perceiving and conceiving

Because of this Hertzberger then appreciates greatly collecting architectural examples, references. However, awareness of these references requires a technique of reduction if they are to be used in a different context from the old one, and not at their beck and call.

Formation of the image

De Jong and Rosemann survey notions on the formation of images from scholarship, science, philosophy and the arts. Where do we cross the threshold from pure experience into making? Starting point is development psychology but the end is design.

Experience, intuition and conception

Geuze, Van Eldijk and Van Kan show the design process of a gifted student from analysis of the location until the final design with all its pitfalls and dead ends.

Designing an office

Brouwer, Van Eldijk and Van Kan then show a design process of an experienced architect directly starting with a concept, the influence of context, metaphores and fixing sizes

Designing a village

At last, Heeling, Van Eldijk and Van Kan describe the more formal design process of an experienced urban designer with a more global frame and grain.

Urban design methods

Enlarging frame and grain limits applicable methods, but, Westrik discusses so many methods in this field, that we can conclude that there are more methods than designers.

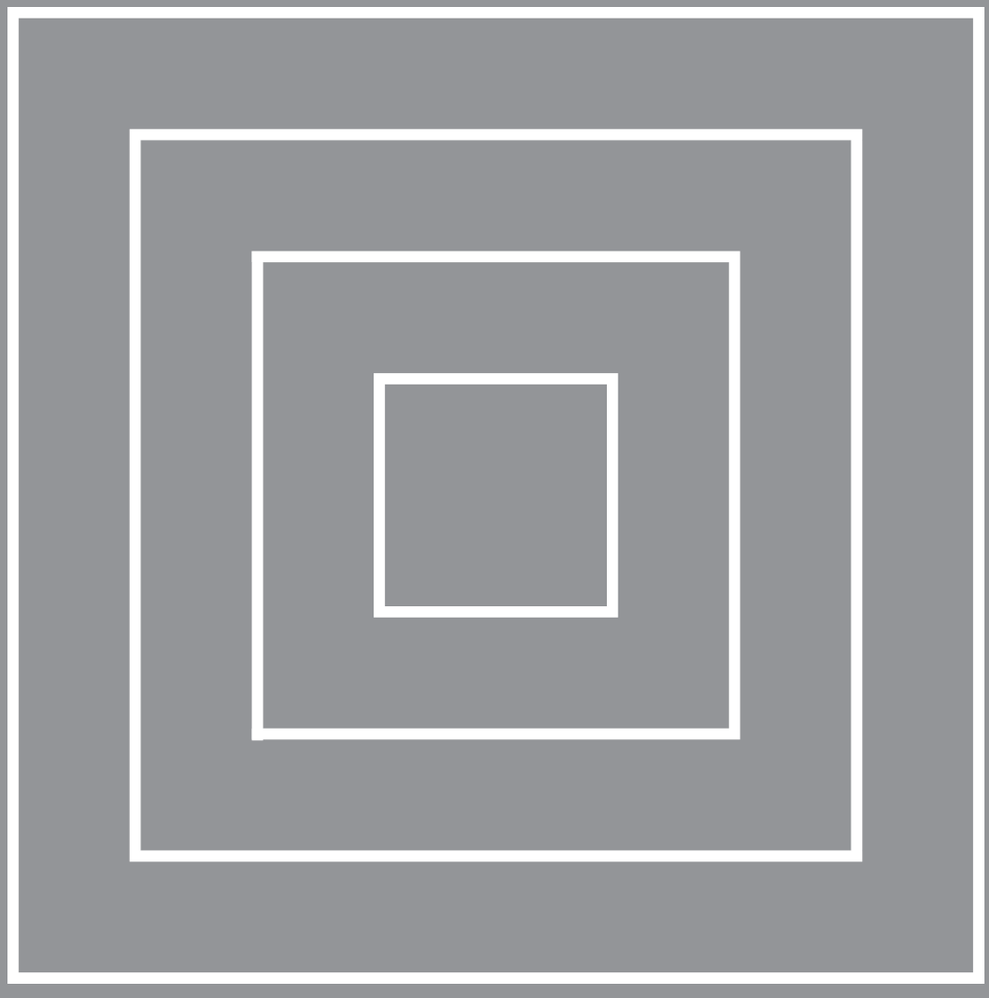
Designing in a determined context

Finally de Jong allocates them within the communicative maze of the building team.

Conclusion

There are more design methods than designers. Nevertheless, we recognise something in every design process. Though we can not name or systemise all phases, we can learn from it.

STUDY BY DESIGN



H STUDY BY DESIGN

Design research as discussed in Chapter 10 concerns determined designed objects within determined historical contexts. Design study in the preceding section considers the actual context, the location and the commission for the time being determined as well, but the object is variable because it has to be designed.

But, as we all know, context is always differing, changing and could even be object of design as well on a higher level of scale. Research on different locations and historical periods produces types (Typological research as discussed in Chapter 12) as long as we find object constancies. Sometimes we do not. Considerable experience has been gained in forms of study where the object or context is fixed by typological research or design study. If both context and object are variable (study by design), an alteration of typological research and design study can be resorted to. In this the object and the context are alternately varied. However, it is not inconceivable that this research can hold its own unaided by these two research methods.

Types of study by design

Van der Voordt and De Jong try to find some classifications of study by design. They do not choose but give some examples to find a scientific direction at last.

Designing Naturalis in a changing context

When the location changes during the design process, as happened designing Naturalis by Verheijen (see page 459), the type of building and even the programme of requirements may change as well. How do we study a variable object in a variable managerial, cultural, economical, technical, ecological and mass-space-time context? That means also, that goals out of that context are shifting. The study becomes more means-orientated and less determined by assumed goals.

488 Changing the location of Naturalis from downtown Leiden into the edge of the old city

Designing a building for art and culture

Röling, Van Eldijk and Van Kan describe the design process of an experienced and socially involved architect with great sensitivity for changing contexts

Contemplations for Copenhagen

Van den Bergh describes the development of a design without a programme of requirements. That brings him back to the very roots of the discipline of design, the ancient sources of our culture.

Learning from The Bridge project

The Faculty of Architecture TU Delft three times bore witness to an experiment, organised by Breen arousing scientific discussion by exhibiting the results of the last two in the main hall of the Institute. With a very strict, but limited programme of requirements in 1993 he asked approximately three hundred students to make a high quality model of a table at scale 1:5. In 1996 he did it again requiring a bench and in 1999 a footbridge at scale 1:20. Three beautiful publications describe the experiments and publish a selection of the results. The scientific community became increasingly fascinated by the combinatory explosion of solutions within a strict, but limited programme of requirements, culminating in the bridge exposition. The programme of requirements and the exhibition did not contain contextual data. The visitors to the exhibition had to imagine different contexts themselves when observing each bridge. So, object and context both varied, meeting the definition of ‘study by design’ in

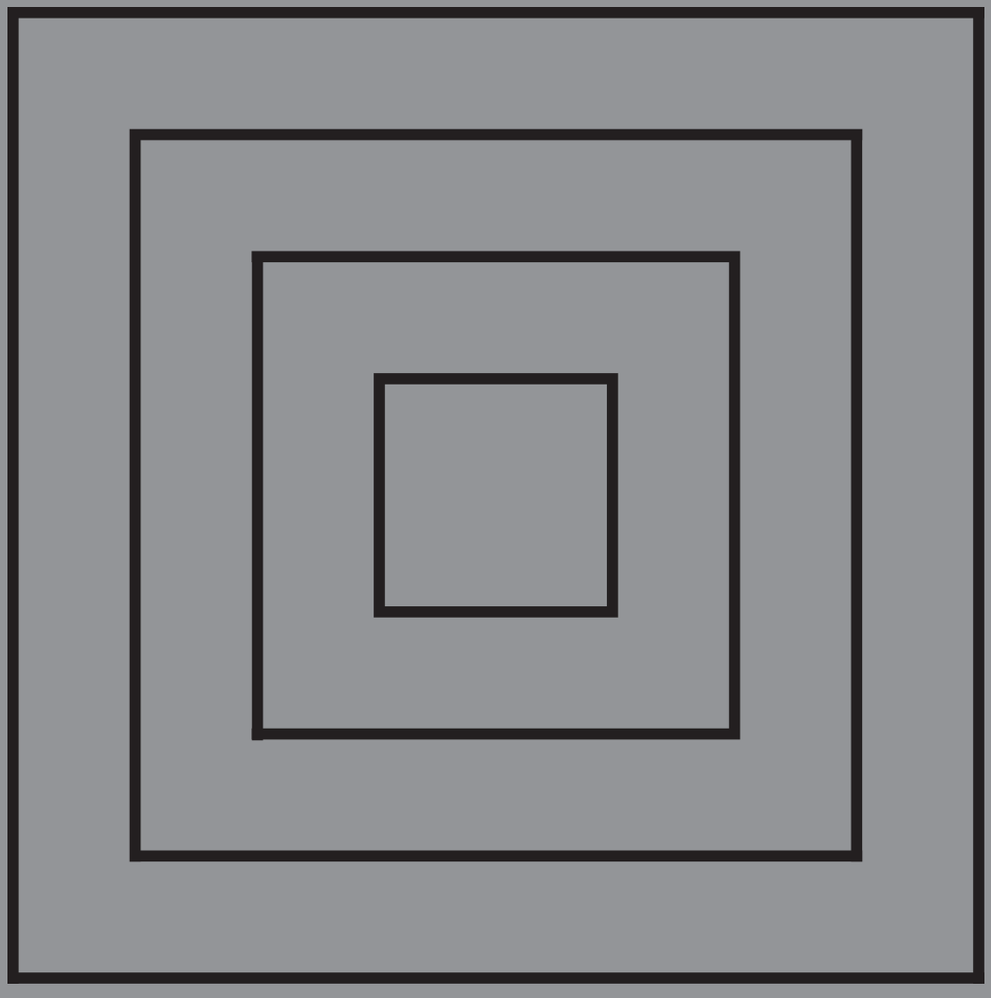
this book. In the Chapter '*Learning from the bridge project*' Breen describes his own perception of the experiment.

Creating non-orthogonal architecture and design in strategy

Vollers' and Frieling's study are the first indications of systematic study by design. Vollers proceeds from the desing resources opened up by the use of CAD to give form to potential objects and applicable contexts. Frieling's basic premise is a dynamic public deliberation between projects on a small scale (objects), and perspectives on a large scale (contexts) in connection with the decision-making on the Delta Metropolis.

Conclusion

Graduation projects, in which the students are allowed to determine context and object themselves, present an archive of more and less successful experiments in the field of study by design. However, this archive is not yet sufficiently documented and updated, or accessible for scientific study (http://iaai.bk.tudelft.nl). Such an effort is necessary to find enough comparable examples for design research. Design research supports our most challenging effort, to bring study by design on a scientific level.



57 EPILOGUE

THEO VAN DER VOORDT
YPE CUPERUS

57.1 THE ANATOMY OF THE BOOK EX-POST

The initial objective of this book was to write a text book on research methodology for architecture, urban planning and technical design students, with a particular focus on *research by design*. As such it aims to offer an extensive follow-up of earlier discussions of the so-called Methodology Board of the Delft Faculty of Architecture on types and methods of design related research. One member proposed that design driven research applying to be labelled as science should meet the methodological principles of A.D. de Groot's *Methodology: foundations of inference and research in the behavioural sciences* (1969). Other members disagreed and suggested that there are hundreds of 'scientific' research methods. After long discussions the committee published a short report on eight types of design related research, leaving out of consideration its methodological approach. From time to time new debates flared up on whether and when designing and research by design may be labelled as scientific work and a design as the output of scientific research. The present book has been initiated to reflect on these questions and to discuss methods and criteria for 'scientific' design and design related research. Over time a number of new objectives were added. One of these was a comprehensive overview of design related research and study at the Faculty of Architecture in Delft. Another wish of many in the Faculty was to raise the academic status of design, developing a basis for equivalence between certain design outputs and other, more traditionally recognised scientific activities. Yet another objective, though not universally supported, was to develop a more rational basis for design. Multiple objectives often lead to a hybrid. Some people may find this book *is* a hybrid. But, it is much more! As far as we know it is unique in presenting such a rich blend of many different perspectives, methods, and ideologies. In essence, this is really a book on methodology in the sense that it explores a range of methods!

56.2 SHARED OBJECTIVES, DIFFERENT APPROACHES

This book shows that a considerable part of study and research at the Faculty of Architecture at Delft is centred on the description and analysis of plans. Such analyses and the comparison of designs with reference to concept, intent, function, form, structure and technique are the focus of the research programme in architectural and urban design. Objectivity, intersubjectivity and interpretations subject to personal preferences, are weighed differently per project. Pre-design research and the evaluation of existing buildings also represent an important field of study, as does the study of the way in which design solutions are generated. Exploring new construction techniques, product-development, IT and other tools to support and optimise briefing and design and complex multi-actor decision processes in the field of real estate and housing are included as well. Some of the questions being examined are:

- How does a designer generate a concept?
- What is the rôle of typology, model development, hypotheses and forecasts in this process?
- Is evaluation '*ex ante*' able to provide timely indications of strengths and weaknesses in a design?
- How can empirical research '*ex post*' contribute to the improvement of briefing documents and optimising of design?
- What are the (dis)similarities between design research, typological research, design study and study by design with reference to objectives, methodology, object and context, applicability in design processes and scientific character?

As this book has shown, many faculty members are searching for a better appreciation of design tools and of the effects of design decisions, as well as for the optimisation of the briefing process and of design itself. However, some clear differences in approach and strategy were identified.

Empirical research usually starts with a conscientious identification of the problem and objective. It is strongly focused on a careful description of reality, the exploration of theories and the testing of hypotheses. It also tends to develop practical recommendations for designers, planners and policy makers based on the pillars of reliability, validity, desirability and probability. All this is centred around general knowledge and the further development of a body of 'true' knowledge.

Design research - often in the form of (comparative) plan-analysis - is usually strongly descriptive and exploratory and less prescriptively. It is generally directed towards interpreting, understanding and explaining designs and the design tools used, both in itself and with reference to site characteristics and the social, cultural, historical, technical, ecological and economical context. It may be instrumental in evoking inspiration and ideas for a particular design.

Typological research is a particular form of design research, whereas it looks back and tries to explore a typology of design solutions, traced from precedents. But, it can also be a particular form of design study or study by design, whereas the focus is on designing new, yet non-existing types. The focus may vary from description to exploration and testing, from empirical and descriptive to normative and prescriptive.

Design study is an integrated part of the design process itself, whether the design is actually constructed or not. In the field of design methodology many authors discussed the well-known cycle of analysis, synthesis, (simulation) and evaluation. This cycle may be applied to the design task as a whole or to a decomposition into sub-problems. Although the focus is mainly on a particular, context-related design solutions, design studies may explore new possibilities with generic applicability, new knowledge and a better understanding of probabilities and desirabilities.

Study by Design – elsewhere called *Inquiry by Design* or *Research by Design* - tries to generate knowledge and new insights by studying transformations of a design or design interventions in an existing situation. Generally, this type of study also features a strong exploratory characteristic. The first step is to generate new design variations using design itself as the process for the study. Hence the term 'means oriented study' is used in contrast to the more common goal-oriented approach. Then the implications of these variations are studied, whether or not leading to adaptations or completely different solutions. As such new concepts may be developed as well as a better understanding of the impact of different design decisions.

Design may differ sharply from study and research with reference to its product aimed at (a plan or building- versus research based scientific knowledge), its focus (searching for new possibilities - versus searching for desirabilities and probabilities) and its character (normative, based on personal preferences, views and ideology, versus empirical, based on facts). However, in practice the difference is often one of degree rather than kind. Particularly in design study and study by design, studying and designing are alternate processes. Both are employed interactively and iteratively, in order to arrive at a solution of high quality. In different phases and to varying degrees, what is possible, what is desirable and what is probable receives thus more or less attention. In the first instance, in moving to an improved design, contextual knowledge is more important than general knowledge. But, the opposite may be true as well. Starting a design process may evoke new problem statements and research questions, merging study and design to a strongly integrated process.

56.3 STUDENTS' WAYS TO STUDY AND RESEARCH

The task of academics is to research and teach. The Faculty of Architecture at Delft has always been a Design School, focusing on design driven education. While the proportion of non-design disciplines, such as real-estate and project management, asset management and the social sciences has increased in the curriculum, a considerable amount of knowledge is still taught in design studios within the master-pupil tradition. In this process, the teacher inspires the student through the demonstration and discussion of design. While the moments shared in this traditional teaching approach are too valuable to loose, it has become clear that there is a great deal to be said about design and the process of designing. This book aims to stimulate such an approach. In retrospect it presents a wide variety of opinions, design strategies and research methods. From strongly contrasting positions it demonstrates how research, study and design may be linked to one another. In this way, the book should become a valuable tool for the teaching of architectural, urban and technical design. Not only to teach students how to include research data and analysis in their design process, but also to guide them to contribute more consciously and effectively through their design projects to the research objectives of the Faculty. By using the book at different stages of their development and working through it with different faculty members, students may reach deeper levels of understanding. By being presented with the juxtaposition of contrasting points of view, students may experience a positive, creative tension, which facilitates learning. However, although the book shows a lot about *how* faculty members are doing research, in a strict sense it is not a text book on research methodology. For a clear understanding and developing of skills in designing research, different types of research (review of literature, survey, case study, experiment, content analysis of documents and plans, secondary analysis of existing data and so on), research methods and techniques such as interviewing and observation techniques, methods of data-collection and (statistical) data-analysis, this book should be used in combination with more traditional textbooks on research methodology. To ensure that this book becomes an effective textbook in itself and to achieve the same high standards as leading books on research methodology and techniques, it is proposed to hone this book on the basis of feedback from our students.

56.4 CONTINUATION OF THE METHODOLOGY DEBATE

The contrasts and complementarities in terms of strategy and methodology presented in this volume will provide a sound basis for further scientific debate in the area. Cross-references will help the reader in finding different opinions on the same subject. Being informed about the goals and techniques of peers will hopefully contribute significantly to the development of understanding and criticism, the deepening of knowledge and the raise of more inter-disciplinary compositions of research teams. For these reasons, it is intended to use the book as the basis of thematic discussion-meetings and study-seminars within the Faculty of Architecture in Delft. But, of course, 'Delft' also wants to contribute to the international debate and to receive feedback from the international peer group. Although this book originates from our inner circle, we are strongly aware of the leading discussions in many other architectural schools, both in Europe and in the United States. There, too, is a request for a stronger clarification of the issue of architectural and design research as a condition to maintain the status as academic institution. See for instance the book of H. Dunin-Woyseth and J. Michl (2001) *'Towards a disciplinary identity of the making professions'* of the Oslo School of Architecture and the ongoing discussions within the Design Research Society. Whereas we hope that *'Ways to Study and Research'* has shown that design as a field of inquiry has matured to an autonomous discipline, international exchange of ideas and methods will undoubtedly deepen our common knowledge and explore new insights. Furthermore, we are very open to inspiring debates with scholars from other fields of knowledge. So spontaneous reactions on the book are most welcome!