

Tools for Ideas

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Tools for Ideas

AN INTRODUCTION TO ARCHITECTURAL DESIGN

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Preface

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This book is based on a metaphor: “design tools”. Perhaps the most immediate way of describing design would be in terms of the individual activities carried out in the process of designing. However, by looking at this process through the lens of “design tools”, it is possible to distance oneself from personal working methods. This book is not written from the point of view of an architect trying to justify his design approach or to present a specific design method. It is much more a view of the interplay between designers, the “tools” at their disposal and the “materials” those tools will work upon.

Tools, in German, are *Werkzeuge*, objects that “create works”, and as such they are fundamental to all human tasks. This book will first undertake a survey of current knowledge about design, outline the essential terms and definitions as a basis for understanding and then describe the basic features of the design process. The second part of the book identifies the basic ideas behind “design tools” and describes the way they emerged and their specific qualities, in order to analyse their current significance as working “design tools” and to critically examine their use and future significance, especially with regard to the present digitalization of all tools. I hope that this procedure will make it possible to recognize and systematically explore the many planes of meaning involved in designing.

In the long years I have been working on this book I have been supported and encouraged from many quarters. My thanks go first of all to Prof. Jörg J. Kühn, who took me on for six years at the Design Institute of the Brandenburg Technical University in Cottbus, thus giving me the opportunity to conduct this work. The enthusiasm generated by the fresh start of what was then a young department gave me the courage to address fundamental design questions in a new way. Another first thank you goes to the editorial board of the internet architecture magazine *Cloud-Cuckoo-Land* [cloud-cuckoo.net], and especially its editor Prof. Dr. Eduard Führ, who triggered key stimuli for this work and accompanied its gestation with great interest in the early years in particular. My very special thanks go to the Berlin *Tagesspiegel* journalist Holger Wild, who has tried to teach me to write comprehensibly for over twelve years now, and Prof. Ralph Johannes, who spurred me on with research literature reference for many years and asked after my progress with unwavering patience.

I would like to thank all my friends, colleagues and students for inspiring conversations, tips on research literature, criticism and encouragement, especially Ulrich Ackva, Florian Aicher, Karyn Ball, Raimund Binder, Nicolau Brandão, Peter Böke, Axel Buether, Jorge Carvalho, Ariane Epars, Christian Federmair, Anton Graf, Matthias Gorenflos, Tobias Hammel, Dagmar Jäger, Cornelia Jöchner, Christian Keller, Nico Knebel, Gereon Legge, Claudia Modelmoog, Norbert Palz, Constanze A. Petrow, Jörg Petruschat, Ute Poerschke, Riklef Rambow, Hinrich Sachs, Eran Schaerf, Astrid Schmeing, Andreas Schwarz, Jürgen Schwinning, Melanie Semmer, Álvaro Siza, Sandra Staub, Peter Testa, Yvonne Wuebben and Ulrike Wulf-Rheidt.

Special thanks to everyone whose illustrations I have been allowed to use, they are mentioned in the relevant picture captions. As publisher's editor, Andreas Müller has supported the book farsightedly and with great commitment in the last eighteen months, and made a vital contribution to its success. It would not have achieved its present compelling form without his concentrated and productive criticism. Bernd Fischer has shown extraordinary commitment to the production and graphic design of the book, and captured its basic ideas outstandingly well. Our thanks to Michael Robinson for his fine, precise translation into English. Finally and above all I thank my parents, Martin and Elfriede Gänshirt, who supported me even when no one else did, and who ultimately made this book possible with their contribution to the printing and translation costs.

DESIGN AND RESEARCH

Ultimately, all theory means what points beyond it. Hans-Georg Gadamer (1986, p. 50)

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Architecture has featured as a fully accredited faculty at universities for some time now. Given the centuries-old history of these institutions, this is a new phenomenon whose significance has not been thoroughly explored to date, either by architects or the universities. Until a few decades ago, architectural design and construction were mainly taught at art academies, engineering schools, specialist colleges and technical colleges. In European countries where architecture has increasingly found its way on to university syllabuses since the mid eighties, many art colleges and technical colleges that used to run such courses have developed into fully-fledged universities. This acknowledges the assertion by artists and architects since the beginning of the modern age that they should be treated not just as specialist craftsmen, as artists and engineers, but also as scientists.

Unifying teaching by introducing bachelor's and master's courses is currently facing some European countries with great challenges, especially in the field of architecture. The question arises in the universities about the extent to which the introduction of new, strongly pre-structured courses threatens to restrict teachers' freedom to teach and students' freedom to learn. On the other hand, a longer period of practical experience between the bachelor's and master's courses, as is customary in the USA, would make it possible to accumulate the skills needed for design work. Certainly making courses internationally compatible promotes the mobility of both students and teachers. But it also demands new forms of design teaching devised to impart generally applicable subject matter, rather than ideas born of personal preference or local specifics.

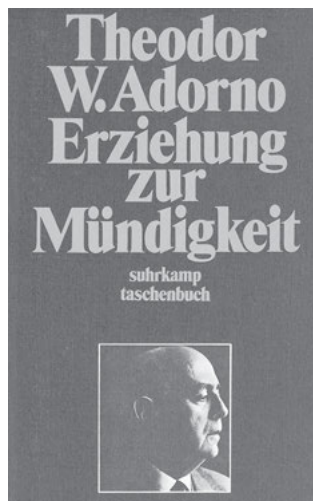
This process of unification necessitates the streamlining of study curricula, often at the expense of the "soft" subjects in architectural studies. Cultural and creative subject areas are gradually being displaced by technical and commercial subject areas. This tendency is a direct result of an economic climate that honours creative achievement only when money can be earned from it. The promise of creative self-realization inherent in all creative professions is a fundamental myth within this economic order adhered to by

designers, authors, fine artists, musicians and film makers alike. It remains to be seen to what degree the notion of a creative profession will be reflected in future study programmes.

Astonishingly enough, even today architects, and particularly those who see themselves as designers, make little of the original university idea of combining teaching and research. They are sceptical about a systematic analysis of fundamental questions relating to design, especially as research approaches appropriate to this particular activity are not yet anywhere near to being in place. It is not considered usual to do a doctorate as a so-called design architect, indeed it may even be seen as counter-productive. What really counts for designers and design teachers nowadays seems to be winning competitions and realizing projects.

There is a good reason for this: as many of the mental processes involved in design (or any other creative activity) happen subconsciously and can only be practised indirectly and in complex contexts, any research activity can only indirectly extend the skills needed for design. It creates knowledge that is of a fundamentally different kind to that of the design abilities of a particular person. For this reason, all architects working in academic fields should consider the objection raised by the German architect Egon Eiermann that in our profession academic achievement is of only little importance compared with the

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Jaspers 1946 (The Idea of the University), Adorno 1971 (Education for Maturity and Responsibility), Bourdieu 1984 (Homo Academicus): an idealistic, a theoretical and a socio-ethnographic view of the university

basic human attitude that should inform this profession from start to finish. (Eiermann 1994, p. 39) Theoretical knowledge and knowledge that informs actions are not the same thing, and one can often be applied to the other only with great difficulty. (Dörner 1989, p. 65) However, this “grey” knowledge (loc. cit., p. 304) can serve as a basis for talking about designing and building – it can produce “communicable, verifiable, discussable” (Karl Jaspers, after Saner 1970, p. 69) insights that in their turn can provide a basis for teaching. Design is so centrally significant in today’s society that research into it can no longer be neglected. The architect and journalist Wolfgang Bachmann wrote recently that “merely glancing out of the window shows us that we have reached a state of near-emergency regarding architectural design. Every expansion of the urban periphery, every business park reveals the absence of architectural design.” (Bachmann 2006)

TEACHING ARCHITECTURAL DESIGN

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The position of architects at universities and other architecture schools is primarily that of teaching staff. This is problematic from the outset. In his lecture *Taboos about the teaching profession*, Theodor Adorno described typical deficits associated with being a teacher: it is quite obvious that the teaching profession, compared with other academic professions such as lawyers or doctors, carries a certain aroma of something that is not wholly socially accepted. According to Adorno, teachers have perhaps subconsciously been perceived as cripples of a kind, as fundamentally immature people who have no function within actual life and the real reproductive processes of society. (cf. Adorno 1971, p. 71 ff.) Gregory Bateson is even more radical, expressing the suspicion that many teachers don't really have anything to say:

"Is it that teachers know that they carry the kiss of death which will turn to tastelessness whatever they touch or teach, and therefore they are wisely unwilling to touch or teach anything of real-life importance? Or is it that they carry the kiss of death because they dare not teach anything of real-life importance?" (Bateson 1979, p. 15)

But Adorno sees university teachers as exempt from this odium. He says it is significant that the teachers who enjoy the greatest respect are in fact those academics who still pursue productive research, or at least the idea and public perception of what that is, in other words those who are not trapped in the educational sphere, which is suspected of being secondary and illusory. Adorno cites the example of a university teacher who reflects that he was only able to educate his students because he never acted like a teacher. What makes a successful academic teacher is obviously based on the absence of any desire to influence, on not attempting to persuade. Not only from this point of view is academic research a factor that makes university teaching particularly credible and relevant. In architecture faculties it is the teacher's own designs and realized buildings that are generally regarded as being equivalent to academic research – rather than an analytical approach to the teacher's own activities or a theory of design derived from this. The general view is that the status and esteem of a university design teacher is measured by built designs, which have thus proved that they can be realised, are functionally useful and culturally valuable. But the quality of design teaching does not derive solely from the quality of what



Leonardo da Vinci: Old man seated, with vertebra studies, c. 1513, pen and ink, 15.2 x 21.3 cm, Windsor Castle, The Royal Collection 12579r

teachers have designed and built, but also from their ability to reflect on their own practice and transform its implicit practical knowledge into “communicable, verifiable, discussable” knowledge—as in Karl Jaspers’ previously quoted description of academic insight. Only this makes it teachable. In this respect, two deficits would signify a design teacher’s “immaturity”: not having proved the quality of their designs by building them, and not having ensured the quality of their teaching through systematic studies. Both have to be overcome, as “the demand for mental maturity seems evident in a democracy”. (Adorno 1971, p. 133)

Leonardo da Vinci had to overcome a comparable kind of—alleged or real—“immaturity” in his day. If in today's climate it is a lack of academic reflection that often marks the limitations of design teaching, in the social hierarchy of Leonardo's day, artists and architects were not rated much more highly than craftsmen, a status certainly not comparable with that of scholars. Leonardo's wish to be acknowledged as a scholar and not just as little more than a craftsman, as a “*uomo senza lettere*”, (Arasse 1997, p. 69) manifested itself in extended scientific research that he saw as the basis for his artistic work, and at the same time reinforced his claim for a higher social status. As the personification of the combination of artistic work, technical and architectural design and scientific research, Leonardo da Vinci became a

"figure symbolizing modern man". (Mittelstrass 1994, p. 159) Leonardo the *"projector"* (Schumacher 1981, p. 41) can serve as a model for architects who see themselves as generalists, as *"specialists in not specializing"* (Álvaro Siza) in a climate of an ever-increasing pressure to specialize. Leonardo, who as a left-hander was inclined towards spatial, pictorial, associative and simultaneous thinking, is worth renewed study to examine how art and technology, design and research, architecture and science can once more be brought together in an up-to-date way. Any teaching has an inherent tendency to simplify and abbreviate for the sake of presenting material more concisely, with the danger of consequently becoming dogmatic. If one follows the historic development of architecture teaching, it becomes clear that attempts were regularly made to break with this tendency and mount a counter-movement in order to return to reality. The attempts to incorporate current knowledge and working methods in teaching provided the most fruitful impetus for the further development of design teaching in the long term. One historic example is the English Arts and Crafts movement, which specifically linked art and craft, and still continues to be relevant today in the legacy of the Bauhaus and Hans Poelzig. The desire to create a direct and concrete link with reality became the basis for many innovations in Poelzig's role-plays or the material studies that László Moholy-Nagy conducted at the Bauhaus. In the course of the

enlightenment and industrialization, two parallel traditions with different focuses have developed in Europe since the French Revolution, one placing more emphasis on the artistic side of design and building, and the other on the engineering aspects. The artistic side was represented by the studios of the École des Beaux-Arts, which was founded in Paris in 1793 as successor to the Académie Royale d'Architecture. Design was taught at this school as an art, with each studio as a sworn company subordinated to an architectural personality and a hierarchy characterized by a traditional master-pupil relationship. This line of tradition can be



Students' workrooms in the faculty of architecture at Oporto University (FAUP), Álvaro Siza, 1986–1995

traced via the art colleges of our day down to the *units* of the British Architectural Association.

The other approach taught design from the perspective of the technical basis of architecture. This teaching was committed to the principles of enlightenment, modern science and ultimately the modern university. The corresponding institution, the École Polytechnique, was founded in 1794, a year after the École des Beaux-Arts, and thus also in the aftermath of the French Revolution and with the unbroken enthusiasm of the Enlightenment. The teachers at this school were obliged to write down the subject matter they taught and to justify it scientifically. (Pfammatter 1997) This led to publications including Jean-Nicolas-Louis Durand's famous and influential *Précis des leçons d'architecture données à l'École Polytechnique* (Paris 1802). Teaching no longer took place only in the studio, but also in lectures and seminars, and an effort was made to underpin design teaching with theoretical work. Here the principle of academic research was set against the master-pupil relationship of artistic training.

The students of the day were aware of the split into two educational systems, and thus also that they needed to concern themselves intensively with both aspects of building. Many trained under both systems, and occasionally, as in the case of Durand, also taught in both systems. This dichotomy between the artistic and technical-scientific aspects of architecture is still either poorly or wrongly understood and continues to be a cause of uncertainty in the self-perception of architects today. While some see themselves as functional-rational technicians at the service of their clients, with no responsibility for the project as a whole, others are happy to overlook the fact that scientific, technical and economic rationalities are part of the human culture with which we make this world habitable – or uninhabitable.

Architecture is more committed to concrete reality than to any theory. According to this notion, it is best placed at the opposite end of the scale to philosophy on the spectrum of faculties (what Jaspers terms the cosmos of the sciences and humanities). While philosophy sums up and evaluates the results of research work from a theoretical point of view, architecture is able to direct this summing up and evaluation towards concrete realization. Just as philosophy moves in a world of ideas *beyond* the exact sciences, architecture can make a contribution to relating the exact sciences to the concrete world we live in. The idea of a *Synthèse des Arts* as formulated by Le Corbusier would be extended in this way into a *Synthèse des Arts et des Sciences*.

Architecture's role in the university would then be not to complete the totality of the sciences, but actually to bring such a totality into being from the perspective of concrete realization. In order to achieve this, systematic research – the precise meaning of which is still to be defined – needs not only to be rated much more highly in architecture faculties, but also needs to be anchored within the self-comprehension of designing architects.

RESEARCH IN ARCHITECTURAL DESIGN

One of the most concise definitions of scientific research was proposed by the biologist Edward O. Wilson who says that natural science "is the organised, systematic enterprise that gathers knowledge about the world and condenses it into testable laws and principles". (Wilson 1998, p. 53) The natural sciences represent ideal academic activity employing criteria such as methodological rigour, repeatability, predictability and conclusive general validity. Gregory Bateson identifies the limitations of this ideal:

"Whenever we pride ourselves upon finding a newer, stricter way of thought or exposition [...] we lose something of the ability to think new thoughts. And equally, of course, whenever we rebel against the sterile rigidity of formal thought and exposition and let our ideas run wild, we likewise lose. As I see it, the advances in scientific thought come from a combination of loose and strict thinking, and this combination is the most precious tool of science" (Bateson 1972, p. 116 f.)

According to Bateson, the indispensable basis of scientific research is to be clear about the precise requirements when a problem is approached, as academic enquiry never proves anything. It simply sets up hypotheses that it either improves or refutes as the research proceeds (Bateson 1979, p. 37). It is only when the researcher is aware of what is required that it becomes possible to question it. In the *Book of Disquiet*, which Fernando Pessoa, the modernist Portuguese writer, attributes to his heteronym Bernardo Soares, a fragment of a sentence suddenly crops up between two longer sections, and without any further comment. It says: "... o sagrado instinto de não ter teorias." (... the sacred instinct to have no theories ...). (Pessoa 1991, p. 77) These words give a sense of the ideal view of an artist or scientist exposing him or herself to the totality of human existence, in an attempt to absorb the world without the filter of theoretical categories.



Symbol of scientific research: the microscope

Human freedom, which Karl Jaspers once characterized as an *"existence of freedom inaccessible to all research"*, (Jaspers 1946, p. 50) manifests itself above all in the creative act of design. One aim of this book is to describe the freedom of design, in the hope of making it more accessible, able to be experienced and communicable. What must be avoided at all costs is to constrain design in a predefined methodology. On the contrary, the world of design should be understood as open, and at the same time as complete in itself, as a realm containing a wide variety of

languages, and of forms of thought and work. This should contribute to a development that Wolfgang Welsch identifies in academic theory as a whole, where the artistic element is not just a programme for art, but also for its opposite pole, science itself. (Welsch 1988, p. 18 f.)

How do research and design relate to each other? What can research do for designers? Both activities produce knowledge, but of different kinds. Design, seen by many artists as a means of providing insight, can definitely not be replaced by research. Research, and scientific and technical research in particular, does contribute to the knowledge that may inform a design. But the process of design can claim to be scientific only to the extent that it is based on scientific insights. The relationship between design and science can be seen as analogous with the relationship between medical treatment and natural science: medical practice is based on scientific practices and insights, but itself is not a pure, but an applied science. Design is an art that is essentially compelled to rely on personal knowledge about actions and experience, one that goes beyond secured facts and beyond craft and technical knowledge. So, on the one hand, design is not a science in its own right, but draws on technical and scientific insights as well as artistic skill and ability. On the other hand design, although not a science, can be the object of systematic research.

Any research that addresses design is not so much concerned with isolating and analysing existing objects or repeatable phenomena for detailed study. Rather, it addresses the relationship between the thoughts and actions

of design, and the future, and inherently uncertain, realization of what has been designed. Such a “design science” goes beyond the academic disciplines of art, culture and engineering, and encompasses a sphere in which both scientific and artistic approaches are relevant. The problems of design, and thus also of an academic discipline for design, are of a fundamentally different structure to those of traditional academic disciplines. Horst Rittel also defined the categorical difference between an academic approach to design and traditional academic approaches by distinguishing between “tame” and “tricky” or “wicked” problems which because of their complex and contradictory nature can be neither unambiguously defined nor completely solved.

A scientific argument is normally abandoned when an irresolvable contradiction, a paradox is identified in its logical structure. In contrast to this, the activity of design is characterized by the problem that the designer is expected to devise acceptable solutions despite obvious contradictions. Any academic approach addressing design must therefore look for ways of identifying paradoxes, decoding their structure and significance and working with them productively. For example, it could do this, as Rittel suggests, by redefining the problems to be solved or as Vilém Flusser demonstrates, by looking for solutions on another level of meaning.

Research of this kind can support design and design teaching by constructing theory. One of its essential aims would be to make implicit knowledge from actions and experience “*communicable, verifiable, discussable*”. The architect’s ability to bring together different disciplines, scales and levels of consideration when designing and building is increasingly in demand in the sciences. Jürgen Mittelstrass writes that science is no longer interested in recognizing what holds the world together in its innermost workings, but in

the by no means less important and increasingly urgent task of holding the world together. (Mittelstrass 1994, p. 32) In this context, nothing less than a new translation of the Greek word *architekton* is proposed. The verb *arkhein* is usually translated as “to take the lead”, but its original meaning is simply “to begin, to rule”. The term *tekton* does iden-



tify the carpenter, and *tectonics* is also “*pertaining to building or construction*”. (Onions 1996, p. 906) But when these two concepts are related to architecture and science as a whole, their meaning is extended significantly. Being an architect would then mean not just being a master builder “lording it over the carpenters,” but means acting as an artist, engineer and scientist at the same time—*as someone who starts to fit individual parts together to form a harmonious whole.*

ARCHITECTURAL DESIGN

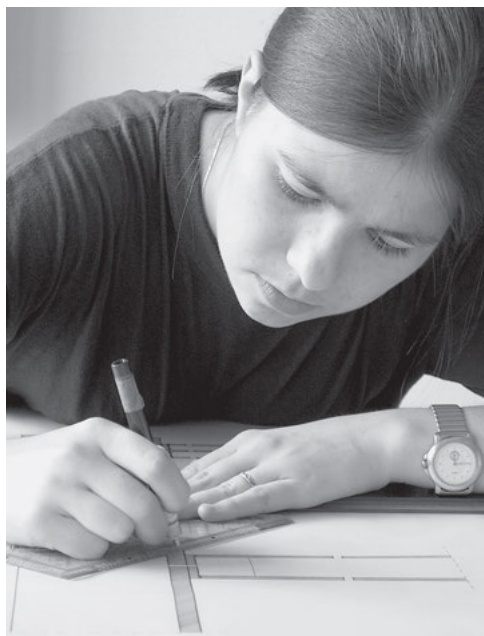
Of course there's a contradiction. It's within the contradictions and ambiguities that we must find our work. John Cage (after Mau 2000, p. 427)

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This book came into being as the result of a search for new ways of describing design. Design theories usually prescribe certain methods or systematic procedures, or they present the architectural elements from which a design could be devised. An attempt is made below to identify the aids and possible ways of acting available to design, to analyse them and to discover their potential for further critical development on a higher and at the same time more concrete level. The fact that it does not seem possible to formulate generally valid design methods – a dream of old, comparable with the medieval search for the philosophers' stone, or Modernism's search for a world formula that explains everything, or the search for software that would solve all communication problems – should not put us off trying to widen the boundaries within which design thinking can operate.

In the "horizontal section" through various areas of knowledge we are undertaking here, the level at which we are directing our attention is defined by two questions: "What is design?" followed by "What are the tools of design?" This process is related to the way architects work. When designing

and planning a building they link countless pieces of information from different disciplines without losing sight of the project as a whole. These thoughts started with approaches made to design theory by the designer Otl Aicher and the philosopher Vilém Flusser. Aicher's writings in particular have set new standards for the systematic discussion of design. Flusser's texts, above all his study of the *Geste des Machens* (Gesture of Making) (Flusser 1991) and of the relationships between tool, machine and apparatus, can be read as complementary, theoretically well-versed and deeper explorations of Aicher's less systematic approaches.



Architect drawing. Photograph: Marianne Kristen, 2002

To a certain extent, this book follows the structure of many works on engineering, in which the first part is devoted to the theoretical basis for the tools, usually developed by the particular author, and these are then described in detail in the second half – with the difference that in this book none of the tools are new, instead existing ones are considered anew. Here our fundamental concern is to see the whole picture. This corresponds with the approach taken by designers, who repeatedly make sure they have an overview of the context they are moving in, in order to set individual details and the whole, the design and its context, in a convincing relationship.

Two sentences in particular caught my attention, because they suggest a new view of design, and one determined neither stylistically nor ideologically. The first comes from Álvaro Siza, who declared in an interview:

"One should not make oneself the slave of one tool only. That is why I always work with proper drawings from the drawing board, with sketches and with models at the same time." (Bauwelt 1990, p. 1470)

Doubts about the fitness of the tools available can be noted here, and as a response to this, the idea of relativizing these as part of the everyday design work, and thus compensating for their deficiencies. And a second sentence struck me in Otl Aicher's book *analog und digital (analogous and digital)*: *"we must move from thinking to making and learn to think in a new way by making."* (Aicher 1991/1, p. 76) Aicher talks about the cultural and ideological limitations of thought, and thus also of design, and at the same time shows how these can be questioned by actual work.

Design processes are infinitely complicated and rich in detail, and hard to predict in terms of their crucial elements. Every individual designs differently. Everyone knows different things, sees things in different ways, thinks in different structures and follows different criteria, and expresses thoughts differently. Simple rules or compact theories of design, even if there were any, and even if they were right, would remain either too detailed or too general to be much help in day-to-day practice. But a theory is able to help formulate a range of questions, to think them through and differentiate them sufficiently in order to find appropriate answers to the questions raised in practice. A theory of this kind can place a large number of observed details in sensible contexts, make their mutual relationships and dependencies recognizable and help to draw a picture of architectural design that can always be



Exhibition gallery in the faculty of architecture at Oporto University (FAUP), Álvaro Siza, 1986–1995

corrected and differentiated further. Each question is at the same time a challenge to readers to reflect on their own way of working and formulate their personal responses.

Designers are working towards the future, looking at the relationship between what they are designing at a particular moment in the present and its future realization. Essentially the design process involves translating theory into practice. But the relationship between the original design idea and its future realization cannot be grasped with the same analytical rigour as problems in the natural or even the social sciences. On the contrary, the ability to deal with a lack of rigour reflectively is an essential skill for competent design.

Architects use the factual knowledge – classified by Aristotle as *episteme* – they have gained from the natural sciences for their work, but the work itself is based on abilities that would be called *poiesis* (Greek: making, manufacturing, producing) and *praxis* (Greek: acting, behaviour) in

Aristotle's terminology. While *poiesis* relates to the “*skilful craft knowledge*” (Gadamer 1998, p. 6) of *techné*, the basis of *praxis* is knowledge of another category that Aristotle calls *phronesis* and defines as “*directive, true behaviour based on reasons in the sphere of what is good and bad for man*”. (after Ebert 1995, p. 167)

Aristotle clarifies the distinction between these two categories by taking the example of the craftsman whose expertise, restricted to his trade and manufacturing skills (*poiesis*), he distinguishes from the architect's good and reasonable behaviour (*praxis*); he still knows what to do for the best when *techné* and its rules fail (cf. Nichomachean Ethics VI, 1141b 20). In this context, Aristotle mentions *architektonike* as a “*supreme art of direction*”. (Gadamer 1998, p. 12) The actual problem of design, it can be said now these definitions have been

established, is not just a question of *poiesis* and *techne* (expert manufacture), but above all of *praxis* and *phronesis* – that good and reasonable behaviour that grows out of *empeiria* (Greek: experience). Unlike the natural sciences, which see themselves as value-neutral, when dealing with design the question of value, whether the value of a piece of knowledge, of a skill, an action or a tool, is of central importance.

Designers addressing concrete problems thus find terse definitions by the book relatively unhelpful, what they need is differentiated knowledge of the possibilities for design action. In general, both classical architectural theory and current design theory discuss the role of criteria, examples and the results of design work. However, here we will discuss tools and cultural design techniques.

EXAMPLES, PRINCIPLES, THEORIES

A broad spectrum of specific knowledge is required for design, differing according to subject. All disciplines share general knowledge about the activity of designing that is regrettably seldom exchanged outside the individual subject areas. This survey concentrates on the sphere of architecture, and is complemented by references to related areas. The structure of the fields of knowledge laid down here also applies to other design disciplines.

What literature is currently available about design, and what part of it is of particular relevance to designers? There are enough design-related publications to fill entire libraries. It is not just architects, designers and engineers who are concerned with questions of design, so too are town planners and landscape architects, historians of architecture, technology and art, mathematicians, psychologists and neurologists, fine artists, musicians, managers and philosophers. This may be why the discourse on the subject is so little ordered or generally just loosely linked.

The wide range of research approaches available to design are presented for the English-speaking world by Groat and Wang in the book *Architectural Research Methods* (2002) and Laurel in *Design Research* (2003). Groat and Wang examine seven different research methods in detail, while Laurel collects several dozen independent pieces of research on the subject. She uses a matrix in which categories of methods, contexts, objects and spheres available for research intersect with the subject areas of person, form, process and action to show (Laurel 2003, p. 8 f.) that most of these studies touch on several themes and several categories. In this book we have simplified this and distinguish between three categories: views based on examples, on principles and on theories. These are arranged in several sub-groups in each category, on a scale from the general to the personal. Those publications most important for the current discourse are dealt with below, and some further 300 publications are listed in the bibliography.

WHAT ONE CAN DESIGN

Design approaches that are informed by *what* can be designed use concrete, realized examples and are generally not seen as design doctrine or design theory. As a rule such publications stress the artistic and visual aspects of architectural design. Their predecessors are the 19th century's portfolios and submissions. For many designers these are a favourite source of information.

Based on examples (what one can design)

Based on individual buildings (the making of ...)

Based on **typologies**

Based on styles, formal languages, genealogies, trends

Based on regions, countries or periods

Based on the œuvres of **individual designers**

Based on principles (how one can design)

Based on design teaching

Based on the **design process (methodology)**

Based on rules, **standards**, regulations

Based on building materials or construction methods

Based on **graphic representation**

Based on formal design principles

Based on an analysis of the **architectural elements**

Based on individual designers' working methods

Based on theories (how design can be accounted for)

Based on approaches from the **natural sciences**

Based on approaches from the life sciences

Based on approaches from the humanities or **cultural science**

Based on **social and political subjects**

Based on art, architectural and design theory

Approaches to design research (relating to architecture)

They are usually easy to consume, conveying straightforward and applicable examples that can be imitated without critical study and absorbed into the designer's own work without difficulty. In the worst cases, such literature can lure practitioners into superficial imitation. At best, when coupled with other questions, they provide insight into the deeper motivations behind design solutions.

Working on the basis of individual buildings makes it possible to show a design emerging in full detail. Fiederling's book (1975) does not do justice to its ambitious title *Theorie des Entwerfens* (Design Theory), as all it does is show how a design for a detached house is developed step by step. But Nägeli and Vallebuona (1992) demonstrate how a factory complex comes into being in exemplary fashion. In *The Making of Beaubourg*, Silver (1994) examines the "biography" of the Centre Pompidou by Piano and Rogers over a decade after its construction. Books by Foster (2000) and Behnisch and Durth (2005) do not just introduce the story of the buildings they have converted and the institutions they house, but also the political background to their design work. In many cases, publications addressing individual buildings are little more than self-presentations by building firms, architects and their clients.

Product design, for example, conducts intensive market and user-oriented design, both in advance of the design phase and afterwards as a subsequent evaluation by independent institutions. This is uncommon in the field of architecture. There are, however, studies based on **typological questions**, which select projects on the basis of certain functional criteria, impose some order on them and thus lay them open to comparison. For example, the *Floor Plan Manual: Housing* (Schneider 1994, 2004) offers numerous floor plans for homes at a scale of 1:200, complemented by sections, photographs and technical information to provide a good overview. Similar volumes are available for industrial buildings (Ackermann 1988, 1993, 1994) as well as for offices, high-rise buildings and museums. The Bechers' numerous books on the architecture of the mining industry, or Höfer's (2001, 2005) on interior design for public buildings make valuable contributions using the resources of documentary photography.

There are so many studies based on architectural trends, individual regions or particular periods that it would be go beyond the scope of this book to mention them individually. As with works on individual personalities, they shed light on the cultural, geographical and political contexts of design.