Litteraturkompendium

DESIGNPROCESSEN

Texter:
Sasaki, H. (1950). Design process. I Swaffield (red.)*Theory in Landscape Architecture: A reader.* Philadelphia: University of Pennsylvania Press, ss. 35-37.

McHarg, I. (1967). An Ecological Method. I Swaffield (red.) *Theory in Landscape Architecture: A reader.* Philadelphia: University of Pennsylvania Press, ss. 38-43.

Lynch, K & Hack, G. (1984). The Art of Site Planning. I Swaffield (red.) *Theory in Landscape Architecture: A reader.* Philadelphia: University of Pennsylvania Press, ss. 37-38.

Utdrag ur: Lawson, B. (2005). *How Designers Think: The design process demysitified.* New York: Architectural Press.

DESIGN PROCESS (1950)

HIDEO SASAKI

It has been customary for landscape schools to teach by the method of projects and solutions. In the course of the normal school year, project-problems dealing with specific situations and falling within specific categories of landscape architecture have been assigned. Customarily, too, these problems have been scheduled haphazardly—perhaps a park, then a subdivision, next a civic center, and so on; or in the advanced years, Landscape Exchange Problems have been assigned as they were scheduled.

Under such a system, coordination of courses (such as construction to design) and the development of design theory in a logical sequence have been difficult if not impossible. Certain schools, therefore, have changed completely to an organized curriculum. The semester work is scheduled to a developmental scheme with all problems related one to another. This method has many obvious advantages.

However, the project-solution or the "case" method of teaching offers some advantages. The change of topics and, where Exchange Problems are used, the stimulation of competition contributes to the general interest and effectiveness of this method of teaching.

Certain facts point out ways and means of using the "case" method of teaching to good advantage. Upon analysis, it is evident that the solution of any given problem is not of primary import; what is of basic significance is the process of thinking which the student undergoes in arriving at a solution. Also, no matter what the given problem, the manifest solution of a particular problem can hardly ever be used to solve another. Conditions change with each new problem, and each solution is unique.

The thing basic to solving all of these problems is the *thinking process*—the critical thought process used in understanding and solving any given problem. Designing is essentially a process of relating all the operational factors into a comprehensive whole, including the factors of cost and effect.

Critical thinking applied to design involves, then: (1) research, to understand all the factors to be considered; (2) analysis, to establish the ideal operational relationship of all the factors; and (3) synthesis, to articulate the complex of relationships into a spatial organization.

Research used in this sense includes more than mere book reading. It involves both the primary and secondary research, and is of three types—verbal, visual, and experimental.

Verbal research means reading and discussing. Although recent books on landscape architectural subjects have been scarce, numerous books on art and architecture are available. Also, written materials on social and philosophical matters help in understanding basic problems of environmental planning.

Visual research consists of activities of a passive nature—namely, looking at photographs, sketches, and work executed in the field. Some schools are more favorably located for field inspection, but inspiration from the vernacular—grain elevators, high tension lines, cultivated fields, etc.—must not be overlooked.

Experimental research is the manipulative activity used to discover new aesthetic possibilities of materials, construction methods, and spatial relationships. A basic understanding of pure design of form, color, and texture, and of space relationships, is a necessity before designs of high quality can be produced. For example, a *collage* problem where amorphous materials (that is, materials having no form in themselves) are taken and arranged in a composition isolates the factor of relationships. This compels the students to think only in terms of relationships and not of objects. In a problem of an abstract space composition, the complex factors of utility are temporarily avoided and pure space relationships are studied. These exercises train the mind and the eye to grasp the fundamental principles of design. And these qualities of proportion, balance, contrast, etc., of pure design are essential in the environment to satisfy the affective nature of human beings.

The second phase of the process of designing is analysis. Given any problem, a systematic analysis of factors involved is necessary before a "design-form" can be articulated. While the experienced and talented designer may be able to perform the analyses quickly and may mentally visualize a synthesis which he can proceed to put directly on paper, the student designer nearly always finds it helpful to make some sort of graphic representation of each phase.

For example, to solve a building problem, the student may approach the problem first by making an abstract "relational" diagram. Such a study considers only the ideal relationships of the various functions involved, such as the kitchen being related to the eating areas, the bath to the bedrooms, etc. Sizes, shapes, location or any other "practical" considerations are temporarily set aside.

The next process may be a "space" or a "sequential" diagram. This analysis attempts to place the various functions in space, i.e., in their order of location in space according to the contributing influences of site, situation, function, etc.

Circulation may be the next consideration. A system which is convenient and operative is worked out in diagrammatic form.

Each problem, of course, will call for a different set of analyses. Moreover, rigid "categorization" is neither necessary nor in itself guarantees a good solution. Factors nearly always have more than one relationship. The process of analysis, therefore, must be multi-ordinate. It is necessary to make as many analyses as there are types of relationships. Some of the more common types of analyses pertinent to landscape architectural planning are a priori scales according to the relative importance of factors, orientation and exposure studies, indoor-outdoor relationships, etc.

With these basic analyses, the student may now consider the "practical" details of sizes, shapes, materials, construction system, etc. The design-form which finally evolves from this critical thinking process will not likely be arbitrary or preconceived. Rather, it will be a functional expression consistent with structure and materials used, with little concern as to whether it is "modern" or "traditional."

It is this task of synthesis, of articulating all the factors into a design form, which distinguishes a designer from an engineer or a technician. Up to this point, imagination and taste had not entered into the process of designing. The skill of organizing the functional with the touch of aesthetic (proportion, sensitivity, drama, and all the other attributes associated with "beauty") is the particular quality of a designer. It is a moot question whether this quality can be taught. Although the process of research and analysis is molded quite readily by pedagogical efforts, the best that an instructor can hope for is that this genius of synthesis exists in each student in a potentiality great enough so that, with proper guidance and cultivation, it may be harnessed to an acceptable degree.

This process of critical thinking, involving research, analysis, and synthesis, increases fluidity of thinking. Since each problem is approached from an analytical point of view, the synthesis cuts across the archenemies of design, preconceptions and dogmas. Also, since each solution is considered a compromise of the ideal, a multitude of alternatives is offered. The designer, having a thorough understanding of the basic relationships, will have complete control of the problem while he experiments with the various alternatives.

In younger landscape architects' designs today the constructivists' and the expressionists' theories seem to be enjoying a position of dominance. This situation is undoubtedly the result of their fascination with forms and techniques developed by the contemporary arts and architecture movements. However, this need not be the finality of expression in landscape design.

As indicated, the expression of each problem will differ; and the expression developed in landscape architecture need not be imitative of its sister arts. Landscape expressions will resemble architectural expressions in so far as its problems are similar, but the valid and varied expressions of contemporary landscape architecture will evolve from the basic ingredients of its materials, methods, and functions.

Numerous examples of experimental projects which have led to new forms in environmental planning may be found, such as contour plowing, freeway traffic routes, Radburn and the greenbelt towns, etc. New concepts applied frankly to solving problems of functions create new forms.

A basic approach to design, then, plus problems of a more investigative and experimental nature are necessary in the educational institutions. Schools should teach students more than mere techniques of earning their bread and butter. The questioning and exploration of new ideas should be encouraged in educational institutions, since limitations are largely theoretical and consequences accountable only to semester grades. It is only then that the students will be provided with tools to forge new knowledge to meet existing and new situations and to contribute toward social progress in their professional life.

AN ECOLOGICAL METHOD (1967)

IAN MCHARG

In many cases a qualified statement is, if not the most propitious, at least the most prudent. In this case it would only be gratuitous. I believe that ecology provides the single indispensable basis for landscape architecture and regional planning. I would state in addition that it has now, and will increasingly have, a profound relevance for both city planning and architecture.

Where the landscape architect commands ecology he is the only bridge between the natural sciences and the planning and design professions, the proprietor of the most perceptive view of the natural world which science or art has provided. This can be at once his unique attribute, his passport to relevance and productive social utility. With the acquisition of this competence the sad image of ornamental horticulture, handmaiden to architecture after the fact, the caprice and arbitrariness of "clever" designs can be dismissed forever. In short, ecology offers emancipation to landscape architecture.

This is not the place for a scholarly article on ecology. We are interested in it selfishly, as those who can and must apply it. Our concern is for a method which has the power to reveal nature as process, containing intrinsic form.

Ecology is generally described as the study of the interactions of organisms and environment which includes other organisms. The particular interests of landscape architecture are focused only upon a part of this great, synoptic concern. This might better be defined as the study of physical and biological processes, as dynamic and interacting, responsive to laws, having limiting factors and exhibiting certain opportunities and constraints, employed in planning and design for human use. At this juncture two possibilities present themselves. The first is to attempt to present a general theory of ecology and the planning processes. This is a venture which I long to undertake, but this is not the time nor place to attempt it. The other alternative is to present a method which has been tested empirically at many scales from a continent, a major region, a river basin, physiographic regions, subregional areas, and a metropolitan region town to a single city.[1] In every case, I submit, it has been triumphantly revelatory.

First, it is necessary to submit a proposition to this effect: that the place, the plants, animals, and men upon it are only comprehensible in terms of physical and biological evolution. Written on the place and upon its inhabitants lies mute all physical, biological, and cultural history awaiting to be understood by those who can read it. It is thus necessary to begin at the beginning if we are to understand the place, the man, or his co-tenants of this phenomenal universe. This is the prerequisite for intelligent intervention and adaptation. So let us begin at the beginning. We start with historical geology. The place, any place, can only be understood through its physical evolution. What history of mountain building and ancient seas, uplifting, folding, sinking, erosion, and glaciation have passed here and left their marks? These explain its present form. Yet the effects of climate and later of plants and animals have interacted upon geological processes and these too lie mute in the record of the rocks. Both climate and geology can be invoked to interpret physiography, the current configuration of the place. Arctic differs from tropics, desert from delta, the Himalayas from the Gangetic Plain. The Appalachian Plateau differs from the Ridge and Valley Province and all of these from the Piedmont and the Coastal Plain. If one now knows historical geology, climate, and physiography then the water regimen becomes comprehensible—the pattern of rivers and aquifers, their physical properties and relative abundance, oscillation between flood and drought. Rivers are young or old, they vary by orders; their pattern and distribution, as for aquifers, is directly consequential upon geology, climate, and physiography.

Knowing the foregoing and the prior history of plant evolution, we can now comprehend the nature and pattern of soils. As plants are highly selective to environmental factors, by identifying physiographic, climatic zones and soils we can perceive order and predictability in the distribution of constituent plant communities. Indeed, the plant communities are more perceptive to environmental variables than we can be with available data, and we can thus infer environmental factors from the presence of plants. Animals are fundamentally plant-related so that given the preceding information, with the addition of the stage of succession of the plant communities and their age, it is possible both to understand and to predict the species, abundance or scarcity of wild animal populations. If there are no acorns there will be no squirrels; an old forest will have few deer; an early succession can support many. Resources also exist where they do for good and sufficient reasons—coal, iron, limestone, productive soils, water in relative abundance, transportation routes, fall lines, and the termini of water transport. And so the land use map becomes comprehensible when viewed through this perspective.

The information so acquired is a gross ecological inventory and contains the data bank for all further investigations. The next task is the interpretation of these data to analyze existing and propose future human land use and management. The first objective is the inventory of unique or scarce phenomena, the technique for which Philip Lewis[2] is renowned. In this all sites of unique scenic, geological, ecological, or historical importance are located. Enlarging this category we can interpret the geological data to locate economic minerals. Geology, climate, and physiography will locate dependable water resources. Physiography will reveal slope and exposure which, with soil and water, can be used to locate areas suitable for agriculture by types; the foregoing, with the addition of plant communities, will reveal intrinsic suitabilities for both forestry and recreation. The entire body of data can be examined to reveal sites for urbanization, industry, transportation routes, indeed any human land-using activity. This interpretive sequence would produce a body of analytical material but the end product for a region would include a map of unique sites, the location of economic minerals, the location of water resources, a slope and exposure map, a map of agricultural suitabilities by types, a similar map for forestry, one each for recreation and urbanization.

These maps of intrinsic suitability would indicate highest and best uses for the entire study area. But this is not enough. These are single uses ascribed to discrete areas. In the forest there are likely to be dominant or co-dominant trees and other subordinate species. We must seek to prescribe all coexistent, compatible uses which may occupy each area. To this end it is necessary to develop a matrix in which all possible land uses are shown on each coordinate. Each is then examined against all others to determine the degree of compatibility or incompatibility. As an example, a single area of forest may be managed for forestry, either hardwood or pulp; it may be utilized for water management objectives; it may fulfill an erosion control function; it can be managed for wildlife and hunting, recreation, and for villages and hamlets. Here we have not land use in the normal sense but *communities* of land uses. The end product would be a map of present and prospective land uses, in communities of compatibilities, with dominants, co-dominants and subordinates derived from an understanding of nature as a process responsive to laws, having limiting factors, constituting a value system, and exhibiting opportunities and constraints to human use.

Now this is not a plan. It does not contain any information of demand. This last is the province of the regional scientist, the econometrician, the economic planner. The work is thus divided between the natural scientist, regional planner-landscape architect who nterprets the land and its resources, and the economics-based planner who determines lemand, locational preferences, investment and fiscal policies. If demand information is available, then the formulation of a plan is possible, and the demand components can be allocated for urban growth, for the nature and form of the metropolis, for the pattern of regional growth.

So what has our method revealed? First, it allows us to understand nature as process nsofar as the natural sciences permit. Second, it reveals causality. The place is because. Next t permits us to interpret natural processes as resources, to prescribe and even to predict for prospective land uses, not singly but in compatible communities. Finally, given information on demand and investment, we are enabled to produce a plan for a continent or a few hundred acres based upon natural process. That is not a small accomplishment.

You might well agree that this is a valuable and perhaps even indispensable method for regional planning but is it as valuable for landscape architecture? I say that any project, save a small garden or the raddled heart of a city where nature has long gone, which is undertaken without a full comprehension and employment of natural process as form-giver is suspect at best and capriciously irrelevant at worst. I submit that the ecological method is the sine qua non for all landscape architecture.

Yet, I hear you say, those who doubt, that the method may be extremely valuable for regional rural problems, but can it enter the city and reveal a comparable utility? Yes, indeed it can but in crossing this threshold the method changes. When used to examine metropolitan growth the data remains the same but the interpretation is focused upon the overwhelming demand for urban land uses and it is oriented to the prohibitions and permissiveness exhibited by natural process to urbanization on the one hand and the presence of locational and resource factors which one would select for satisfactory urban environments on the other. But the litany remains the same: historical geology, climate, physiography, the water regimen, soils, plants, animals, and land use. This is the source from which the interpretation is made although the grain becomes finer.

Yet you say, the method has not entered the city proper; you feel that it is still a device for protecting natural process against the blind despoliation of ignorance and Philistinism. But the method can enter the city and we can proceed with our now familiar body of information to examine the city in an ecological way. We have explained that the place was "because" and to explain "because," all of physical and biological evolution as well. To do this we make a distinction between the "given" and "made" forms. The former is a natural landscape identity, the latter is the accumulation of the adaptations to the given form which constitute the present city. Rio is different from New Orleans, Kansas City from Lima, Amsterdam from San Francisco, because. By employing the ecological method we can discern the reason for the location of the city, comprehend its natural form, discern those elements of identity which are critical and expressive, both those of physiography and vegetation, and develop a program for the preservation and enhancement of that identity. The method is equally applicable when one confronts the made form. The successive stages of urbanization are examined as adaptations to the environment, some of which are successful, some not. Some enter the inventory of resources and contribute to the *genius loci*. As for the given form, this method allows us to perceive the elements of identity in the scale of values. One can then prepare a comprehensive landscape plan for a city and feed the elements of identity, natural process, and the palette for formal expression into the comprehensive planning process.

You still demur. The method has not yet entered into the putrid parts of the city. It needs rivers and palisades, hill and valleys, woodlands and parkland. When will it confront slums and overcrowding, congestion and pollution, anarchy and ugliness? Indeed the method can enter into the very heart of the city and by so doing may save us from the melancholy criteria of economic determinism which have proven so disappointing to the orthodoxy of city planning or the alternative of unbridled "design" which haunts architecture. But here again we must be selective as we return to the source in ecology. We will find little that is applicable in energy system ecology, analysis of food pyramids, relations defined in terms of predator-prey, competition, or those other analytical devices so efficacious for plant and animal ecology. But we can well turn to an ecological model which contains multifaceted criteria for measuring ecosystems and we can select health as an encompassing criterion. The model is my own and as such it is suspect for I am not an ecologist, but each of the parts is the product of a distinguished ecologist.[3] Let us hope that the assembly of the constituents does not diminish their veracity, for they have compelling value.

	retrogression		*evolution*
	simplicity		complexity
	uniformity		diversity
ill-health	independence	health	interdependence (symbiosis)
	instability		stability (steady state)
	low number of species		high number of species
	high entropy		low entropy

The most obvious example is life and death. Life is the evolution of a single egg into the complexity of the organism. Death is the retrogression of a complex organism into a few simple elements. If this model is true, it allows us to examine a city, neighborhood, community institution, family, city plan, architectural or landscape design in these terms. This model suggests that any system moving toward simplicity, uniformity, instability with a low number of species and high entropy is retrogressing; any system moving in that direction is moving toward ill health.

Conversely, complexity, diversity, stability (steady state), with a high number of species and low entropy are indicators of health and systems moving in this direction are evolving. As a simple application let us map, in tones on transparencies, statistics of all physical disease, all mental disease, and all social disease. If we also map income, age of population, density, ethnicity, and quality of the physical environment we have on the one hand discerned the environment of health, the environment of pathology and we have accumulated the data which allow interpretation of the social and physical environmental components of health and pathology. Moreover, we have the other criteria of the model which permit examination from different directions. If this model is true and the method good, it may be the greatest contribution of the ecological method to diagnosis and prescription for the city.

But, you say, all this may be very fine but landscape architects are finally designers—when will you speak to ecology and design? I will. Lou Kahn, the most perceptive of men, foresaw the ecological method even through these intractable, inert materials which he infuses with life when he spoke of "existence will," the will to be. The place is because. It is and is in the process of becoming. This we must be able to read, and ecology provides the language. By being, the place or the creature has form. Form and process are indivisible aspects of a single phenomenon. The ecological method allows one to understand form as an explicit point in evolutionary process. Again, Lou Kahn has made clear to us the distinction between form and design. Cup is form and begins from the cupped hand. Design is the creation of the cup, transmuted by the artist, but never denying its formal origins. As a profession, landscape architecture has exploited a pliant earth, tractable and docile plants to make much that is arbitrary, capricious, and inconsequential. We could not see the cupped hand as giving form to the cup, the earth and its processes as giving form to our works. The ecological method is then also the perception of form, an insight to the given form, implication for the made form which is to say design, and this, for landscape architects, may be its greatest gift.

THE ART OF SITE PLANNING (1984)

KEVIN LYNCH AND GARY HACK

To summarize, there are eight stages in the typical site planning cycle in which the designer is properly involved. (But often, alas, the designer has little to do with the first and the last.) Beyond this cycle of events, of course, other actors are engaged in other actions: the consideration and approval of plans, for example, or the securing of financing. Nevertheless, the stages of site planning proper are

1. defining the problem;
2. programming and the analysis of site and user;
3. schematic design and the preliminary cost estimate;
4. developed design and detailed costing;
5. contract documents;

6. bidding and contracting;
7. construction; and
8. occupation and management.

Reciting these stages makes them sound logical and linear, but the recital is only conventional; the real process is looping and cyclical. Knowledge of a later phase influences conduct of an earlier one, and early decisions are later reworked. Site design is a process of learning in which a coherent system of form, client, program, and site gradually emerges. Even after decisions are made and building begins—even after the site is occupied—the feedback from experience continues to modify the plan. . . . The designer thinks that her organization will have an absolute, permanent influence on all later occupants. In reality, this is only partly so, since whatever she does will soon undergo some modification. Every site has a long history that bears on its present. Every site will have a long future, over which the designer exerts only partial control. The new site form is one episode in a continuous interplay of space and people. Sooner or later, it will be succeeded by another cycle of adaptation.

Some critics assert that our physical settings determine the quality of our lives. That view collapses under careful scrutiny, and then it is a natural reaction to say that the spatial environment has no critical bearing on human satisfaction. Each extreme view rests on the fallacies of the other. Organism and environment interact, and environment is both social and physical. You cannot predict the happiness of anyone from the landscape he lives in (although you might predict his unhappiness), but neither can you predict what he will do or feel without knowing his landscape and others he has experienced. People and their habitat coexist.[1] As humans multiply and their technology comes to dominate the earth, the conscious organization of the land becomes more important to the quality of life. Pollution impairs the living system, and some of our technical feats threaten all life. Careless disturbance of the landscape harms us; skilled siting enhances us. Well-organized, productive living space is a resource for humanity, just as are energy, air, and water.

Site planning, then, is the organization of the external physical environment to accommodate human behavior. It deals with the qualities and locations of structures, land, activities, and living things. It creates a pattern of those elements in space and time, which will be subject to continuous future management and change. The technical output—the grading plans, utility layouts, survey locations, planting plans, sketches, diagrams, and specifications—are simply a conventional way of specifying this complex organization.

Some maps of the design process

Many writers have tried to chart a route through the process from beginning to end. The common idea behind all these 'maps' of the design process is that it consists of a sequence of distinct and identifiable activities which occur in some predictable and identifiably logical order. This seems at first sight to be quite a sensible way of analysing design. Logically it seems that the designer must do a number of things in order to progress from the first stages of getting a problem to the final stages of defining a solution. Unfortunately, as we shall see, these assumptions turn out to be rather rash. Indeed Lewis Carroll's Queen may well have made rather a good designer with her apparently ridiculous suggestion that the sentence should precede the evidence!

However, let us proceed to examine some of these maps in order to see how useful they are. The first map we might examine is that laid out for use by architects in the RIBA *Architectural Practice* *and Management Handbook* (1965). The handbook tells us that the design process may be divided into four phases:

Phase 1 assimilation
The accumulation and ordering of general information and information specifically related to the problem in hand.

Phase 2 general study
The investigation of the nature of the problem.
The investigation of possible solutions or means of solution.

Phase 3 development
The development and refinement of one or more of the tentative solutions isolated during phase 2.

Phase 4 communication
The communication of one or more solutions to people inside or outside the design team.

However, a more detailed reading of the RIBA handbook reveals that these four phases are not necessarily sequential although it may seem logical that the overall development of a design will progress from phase 1 to phase 4. To see how this might actually work, however, we shall examine the transitions between the phases.

Actually, it is quite difficult for the designer to know what information to gather in phase 1 until there has been some investigation of the problem in phase 2. With the introduction of systematic design methods into design education it became fashionable to require students to prepare reports accompanying their designs. Frequently such reports contain a great deal of information, slavishly gathered at the beginning of the project. As a regular reader of such reports, I have become used to testing this information to see how it has had an impact on the design. In fact, students are often unable to point to any material effect on their solutions for quite large sections of their gathered data. One of the dangers here is that since gathering information is rather less mentally demanding than solving problems there is always a temptation to put off the transition from phase 1 to phase 2. Professional designers are unlikely to succumb to this temptation since they need to earn their living, but students often do, and such a map often serves only to encourage unproductive procrastination!

The detailed development of solutions (phase 3) rarely goes smoothly to one inevitable conclusion. In fact such work often reveals the weaknesses in the designer's understanding of the problem and grasp of all the relevant information. In other words there is a need to return to phase 2 activities!

Even more sobering is the experience common to all designers, that when they show possible solutions to their clients (phase 4) only then will the clients see that they have described the problem badly (phase 1).

We could go on analysing the map in this way, but the general lesson would remain the same. Although it may seem logical that the activities listed here should be performed in the order shown by the map, the reality is much more confused. What the map does is to tell us that designers have to gather information about a problem, study it, devise a solution and draw it, though not necessarily in that order. The RIBA handbook is very honest here in declaring that there are likely to be unpredictable jumps between the four phases. What it does not tell us is how often or in what way these jumps are made (Fig. 3.1).

If we turn on through the pages of the RIBA handbook there is yet another, much larger scale map to be found. Because of its immense detail this 'Plan of Work', as it is called, looks much more promising at first sight. The plan of work consists of twelve stages described as a logical course of action:

A Inception
B Feasibility
C Outline proposals
D Scheme design
E Detail design
F Production information
G Bills of quantities
H Tender action
J Project planning
K Operations on site
L Completion
M Feed-back

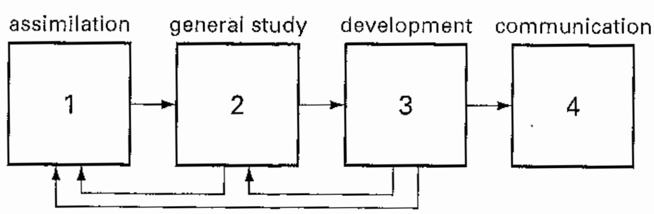

Figure 3.1
A map of the design process according to the RIBA plan of work

The handbook rather revealingly also shows a simplified version in what it describes as 'usual terminology':

A–B Briefing
C–D Sketch plans
E–H Working drawings
J–M Site operations

From this we can see the plan of work for what it really is; a description not of the process but of the products of that process. It tells us not how the architect works but, what must be produced in terms of feasibility reports, sketch plans and production drawings. Further, it also details the services provided by the architect in terms of obtaining planning approval and supervising the construction of the building.

Architects used to be paid their fees according to a standard level and pattern which formed part of the Conditions of Engagement for Architects. Today fees are a matter of negotiation between architects and their clients and both the level of their remuneration and the pattern of payments is very variable. However, it remains the case that an architectural project may last for a long time, often many years, and thus architects, if they are to be solvent, need payments before the end of their work. Historically, then, the RIBA plan of work was used to determine agreed stages of work which could attract staged payments. So the plan of work may also be seen as part of a business transaction; it tells clients what they will get, and describes what architects must do. It does not necessarily tell us how it is done.

The plan of work also describes what the other members of the design team (quantity surveyor, engineers etc.) will do, and how they will relate to the architect; with the architect clearly portrayed as the manager and leader of this team. This further reveals the plan of work to be part of the architectural profession's propaganda exercise to stake a claim as leader of the multi-disciplinary building design team. Again this is now by no means a commonly shared view of the architect's role! None of this should be taken as criticism of the RIBA plan of work, which probably performs its functions quite adequately, but in the end we probably learn from it more about the history of the role of the RIBA than about the nature of architectural design processes.

Two academics, Tom Markus (1969b) and Tom Maver (1970) produced rather more elaborate maps of the architectural design process (Fig. 3.2). They argued that a complete picture of design

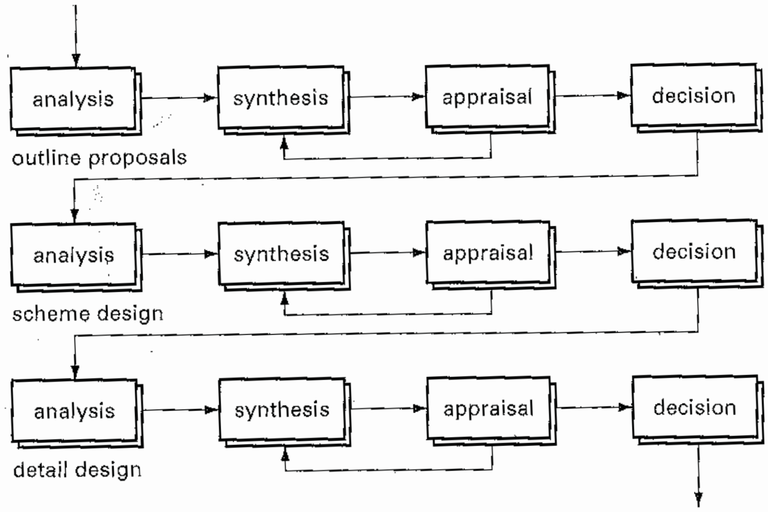

Figure 3.2
The Markus/Maver map of the design process

method requires both a 'decision sequence' and a 'design process' or 'morphology'. They suggest that we need to go through the decision sequence of analysis, synthesis, appraisal and decision at increasingly detailed levels of the design process (stages 2, 3, 4 and 5 in the RIBA handbook). Since the concepts of analysis, synthesis, and evaluation or appraisal occur frequently in the literature on design methodology it is worth attempting some rough definitions before examining these maps in more detail.

Analysis involves the exploration of relationships, looking for patterns in the information available, and the classification of objectives. Analysis is the ordering and structuring of the problem. Synthesis on the other hand is characterised by an attempt to move forward and create a response to the problem – the generation of solutions. Appraisal involves the critical evaluation of suggested solutions against the objectives identified in the analysis phase. To see how these three functions of analysis, synthesis and evaluation are related in practice we might examine the thoughts of a chess player deciding on the next move. The procedure suggests that first our player might analyse the current position on the board by studying all the relations between the pieces; the pieces that are being threatened and how, and which of the unoccupied squares remain unguarded. The next task would be to clarify objectives. Obviously the ultimate long-term object of the game is to win, but at this particular stage the priorities between attack or defence and between immediate or eventual gain have to be decided. The synthesis stage would be to suggest a move, which might emerge either as a complete idea or in parts, such as moving a particular piece, occupying a particular square or threatening a particular piece, and so on. This idea then needs evaluating against the objectives before finally deciding whether or not to make the particular move.

To return to the Markus/Maver map, we have already seen how maps of the design process may need to allow for return loops from an activity to that preceding it. The first move thought of by our chess player may on examination prove unwise, or even dangerous, and so it is with design. This accounts for the return loop in the Markus/Maver decision sequence from appraisal to synthesis, which in simple terms calls for the designer to have another idea since the previous one turned out to be inadequate.

The presence of this return loop in the diagram, however, raises another question. Why is it the only return loop? Might not the development of a solution suggest more analysis is needed? Even in the game of chess a proposed move may reveal a new problem and suggest that the original perception of the state of the game was incomplete and that further analysis is necessary. This is even more frequently the case in design where the problem is not totally described, as on a chess board. This was long ago recognised by John Page (1963) who warned the 1962 Conference on Design Methods at Manchester:

> In the majority of practical design situations, by the time you have produced this and found out that and made a synthesis, you realise you have forgotten to analyse something else here, and you have to go round the cycle and produce a modified synthesis, and so on.

So we are inevitably led to the conclusion that our map should actually show a return loop from each function to all preceding functions. However, there is yet another problem with this map (Fig. 3.3). It suggests, again apparently logically, that the designer proceeds from the general to the specific, from 'outline proposals' to 'detail design'. Actual study of the way designers work reveals this to be rather less clear than it may seem. Conventionally the Markus/Maver map of the design process for architects suggests that the early

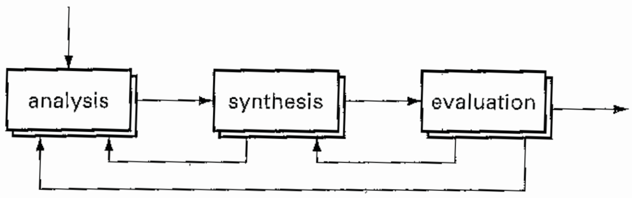

Figure 3.3
A generalised map of the design process

stages will be concerned with the overall organisation and disposition of spaces, and the later stages concerned with the selection of materials used in construction and detailing the junctions between them. In fact this turns out to be yet another example of what may seem logical from a superficial study but where reality is more messy. This is nicely put by the famous American architect Robert Venturi:

> We have a rule that says sometimes the detail wags the dog. You don't necessarily go from the general to the particular, but rather often you do detailing at the beginning very much to inform.
>
> (Lawson 1994b)

It is for this reason that Venturi is so unhappy about the increasing tendency in the United States to separate conceptual design from design development, even appointing different architects at the two stages. The use of the 'design and build' system in the United Kingdom has brought similar problems. At least one very successful and much admired architect, Eva Jiricna, has indicated that her design process is very much a matter beginning with what others would conventionally regard as detail. She likes to begin by choosing materials and drawing full size details of their junctions:

> In our office we usually start with full-size detail . . . if we have, for example, some ideas of what we are going to create with different junctions, then we can create a layout which would be good because certain materials only join in a certain way comfortably.
>
> (Lawson 1994b)

Clearly if this process works well for such a highly acclaimed architect we must take it seriously. The problem for the Markus/ Maver map, then, is just what constitutes 'outline' and what is meant by 'detail'. Experience suggests that this not only varies between designers but may well vary from project to project. What might seem a fundamental early decision on one project may seem a matter of detail which could be left to the end on another. Even if the design strategy itself is not driven by detail as in Eva Jiricna's case, it seems unrealistic to assume that the design process is inevitably one of considering increasing levels of detail.

The map, such as it is, no longer suggests any firm route through the whole process (Fig. 3.4). It rather resembles one of those chaotic party games where the players dash from one room of the house to another simply in order to discover where they must go next. It is about as much help in navigating a designer through the process as a diagram showing how to walk would be to a one-year-old child. Knowing that design consists of analysis, synthesis and

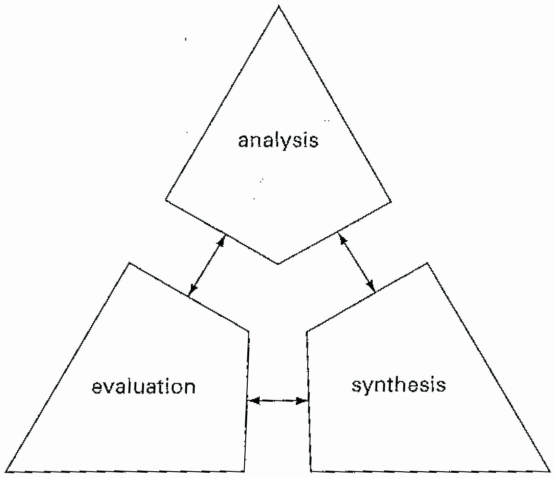

Figure 3.4
A more honest graphical representation of the design process

evaluation linked in an iterative cycle will no more enable you to design than knowing the movements of breaststroke will prevent you from sinking in a swimming pool. You will just have to put it all together for yourself.

Are these maps accurate?

We could continue to explore maps of the design process since a considerable number have been developed. Maps of the design process similar to those already discussed for architecture have been proposed for the engineering design process (Asimow 1962) and (Rosenstein, Rathbone and Schneerer 1964), the industrial design process (Archer 1969) and, even, town planning (Levin 1966). These rather abstract maps from such varying fields of design show a considerable degree of agreement, which suggests that perhaps Sydney Gregory was right all along, perhaps the design process is the *same in all fields*. Well unfortunately none of the writers quoted here offer any evidence that designers actually follow their maps, so we need to be cautious.

These maps, then, tend to be both theoretical and prescriptive. They seem to have been derived more by thinking about design than by experimentally observing it, and characteristically they are logical and systematic. There is a danger with this approach, since writers on design methodology do not necessarily always make the best designers. It seems reasonable to suppose that our best designers are more likely to spend their time designing than writing about methodology. If this is true then it would be much more interesting to know how very good designers actually work than to know what a design methodologist thinks they should do! One compensating factor here is that most academic writers are also involved in teaching design, and thus have many years of experience of observing their students. However, that also begs the question as to whether students might design differently to the way experienced practitioners work.

Some empirical studies

All these questions suggest that some hard evidence is required rather than just relying on logical thought. In recent years we have indeed begun to study design in a more organised and scientific way. Studies in which designers are put under the microscope have been, and continue to be, conducted and from this research we are gradually learning something of the subtleties of design as it is actually practised. We next examine some of this work, but before we begin a word of caution is necessary. Conducting empirical work on the design process is notoriously difficult. The design process, by definition, takes place inside our heads. True we may see designers drawing while they think, but their drawings may not always reveal the whole of their thought process. That thought process is not always one which the designers themselves would be used to analysing and making explicit. There are many experimental techniques we can use to overcome these problems, but any one experiment on the nature of the design process is likely to be flawed in some way. By putting all this work together, however, a general picture of the way designers think is gradually emerging.

A laboratory study of design students

Some years ago I was interested in the general question of cognitive style in the design process and how it was acquired. As first a student of architecture and then a student of psychology I began to feel that my fellow students shared some common ways of thinking but that the architects seemed to think in distinctly different ways to the psychologists. Two very specific questions then developed out of this general interest. Were these differences real or not and, if real, did they reflect the different nature of people who became architects as opposed to psychologists or did they reflect the different nature of their jobs?

A series of experimental situations was therefore devised in which the subjects would solve design-like problems under laboratory conditions with no other distractions (Lawson 1972). It was, of course, vital that no specialist technical knowledge was necessary to solve the problems to avoid giving any advantage to the architect subjects over the others. In one experiment the subjects had to complete a design using a number of modular coloured wooden blocks. They were given more blocks than they actually needed, and the design problem required a single storey arrangement of three modular bays by four bays. The vertical faces of the blocks were coloured red and blue and, on each occasion the subject was required to make the perimeter wall of the final arrangement either as red or as blue as possible (Fig. 3.5).

The task was made more complex by the introduction of some 'hidden' rules governing allowed relationships between some of the blocks. This meant that some combinations of blocks would be allowed whilst others would not. These rules were changed for each problem, and the subjects knew that some rules were in operation but were not told what they were. Thus this abstract problem is in reality a very simplified design situation where a physical three-dimensional solution has to achieve certain stated performance objectives while obeying a relational structure which is not entirely explicit at the outset.

In order not to intimidate the subjects, they were left alone to solve the problems with a computer setting each problem and

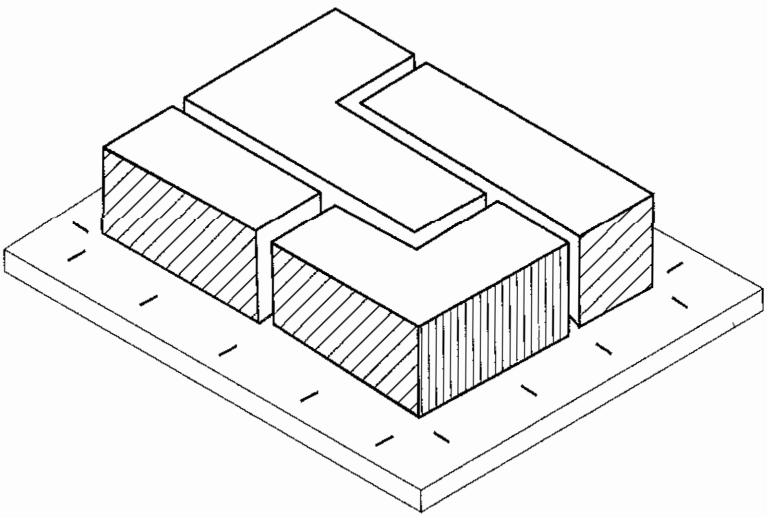

Figure 3.5
A laboratory experiment to investigate the design process

telling them, when they asked, whether their proposed solution was an allowed combination or not. In addition, unknown to the subjects the computer was able to record and analyse their problem-solving strategy. Initially two groups of subjects were used comprising final year students of architecture and postgraduate science students (Lawson 1979b).

The two groups showed quite consistent and strikingly different strategies. Although this problem is simple compared with most real design problems there are still over 6000 possible answers. Clearly the immediate task facing the subjects was how to narrow this number down and search for a good solution. The scientists adopted a technique of trying out a series of designs which used as many different blocks and combinations of blocks as possible as quickly as possible. Thus they tried to maximise the information available to them about the allowed combinations. If they could discover the rule governing which combinations of blocks were allowed they could then search for an arrangement which would optimise the required colour around the design. By contrast, the architects selected their blocks in order to achieve the appropriately coloured perimeter. If this proved not to be an acceptable combination, then the next most favourably coloured block combination would be substituted and so on until an acceptable solution was discovered.

The essential difference between these two strategies is that while the scientists focused their attention on understanding the underlying rules, the architects were obsessed with achieving the desired result. Thus we might describe the scientists as having a problem-focused strategy and the architects as having a solution-focused strategy.

Thus we had the beginnings of an answer to our first question. It does indeed look as if the cognitive style of the architects and the scientists was consistently different. To address the second question a further run of the experiment was necessary. Here the subjects were school pupils at the end of their study immediately before going to university, and university students at the very beginning of the first year of a degree in architecture. Both these groups were much less good at solving all the problems and neither group showed any consistent common strategy. The answer, then, to the second question appeared to be that it is the educational experience of their respective degree courses which makes the science and architecture students think the way they do, rather than some inherent cognitive style.

The behaviour of the architect and scientist groups seems sensible when related to the educational style of their respected courses. The architects are taught through a series of design studies and receive criticism about the solution they come up with rather than the method. They are not asked to understand problems or analyse situations. As in the real professional world the solution is everything and the process is not examined! By comparison scientists are taught theoretically. They are taught that science proceeds through a method which is made explicit and which can be replicated by others. Psychologists, in particular, because of the rather 'soft' nature of their science are taught to be very careful indeed over their methodology.

However, this is perhaps too simple an explanation. Although their performance was no better overall, both groups of design students showed greater skill than their peers in actually forming the three-dimensional solutions. They appeared to have greater spatial ability and to be more interested in simply playing around with the blocks. Is it possible that the respective educational systems used for science and architecture simply reinforce an interest in the abstract or the concrete? These experiments do not enable us to answer this question. However, they are also very limited in their ability to model the actual design process so for further progress we need to turn to more realistic investigations.

The results of this experiment also further question the division between analysis and synthesis seen in the maps of design earlier in this chapter. What is clear from this data, is that the more experienced final year architecture students consistently used a strategy of analysis through synthesis. They learned about the problem through attempts to create solutions rather than through deliberate and separate study of the problem itself.

Some more realistic experiments

In a slightly more realistic experiment, experienced designers were asked to redesign a bathroom for speculatively built houses (Eastman 1970). The subjects here were allowed to draw and talk about what they were doing and all this data was recorded and analysed. From these protocols Eastman showed how the designers explored the problem through a series of attempts to create solutions. There is no meaningful division to be found between analysis and synthesis in these protocols but rather a simultaneous learning about the nature of the problem and the range of possible solutions. The designers were supplied with an existing bathroom design together with some potential clients' criticisms of the apparent waste of space. Thus some parts of the problem, such as the need to reorganise the facilities so as to give a greater feeling of spaciousness and luxury, were quite clearly stated. However the designers discovered much more about the problem as they critically evaluated their own solutions. One of Eastman's protocols shows how a designer came to identify the problem of shielding the toilet from the bath for reasons of privacy. Later this becomes part of a much more subtle requirement as he decided that the client would not like one of his designs which seems deliberately to hide the toilet, the toilet then was to be shielded but not hidden. This subtle requirement was not thought out in the abstract and stated in advance of synthesis but discovered as a result of manipulating solutions.

Using a similar approach, Akin asked architects to design rather more complex buildings than Eastman's bathroom. He observed and recorded the subjects' comments in a series of protocols (Akin 1986). In fact, Akin specifically set out to 'disaggregate' the design process, or break it down into its constituent parts. Even given this interventionist attack on the problem, Akin failed to identify analysis and synthesis as meaningfully discrete components of design. Akin actually found that his designers were constantly both generating new goals and redefining constraints. Thus, for Akin, analysis is a part of all phases of design and synthesis begins very early in the process.

Interviews with designers

So far we have looked at the results of experiments in which designers are asked to design under experimental conditions. These conditions can never actually model the real design studio, so an alternative research method of interviewing designers about their methods allows them to describe how they work under normal conditions. Of course this research method is also flawed since we are dependent on the designers actually telling the truth! Whilst it is quite unlikely that they would deliberately mislead us, nevertheless memory can easily play tricks and designers may well convince themselves in retrospect that their process was more logical and efficient than was actually the case. One of the advantages of the interview is that we can sometimes persuade very good designers to allow us to interview them whereas, sadly, many of the laboratory experiments are carried out on students who are easily accessible to research workers!

The primary generator

Some years ago a research student and colleague of mine, Jane Darke, interviewed some well-known British architects about their intentions when designing local authority housing. The architects first discussed their views on housing in general and how they saw the problems of designing such housing, and then discussed the history of a particular housing scheme in London. The design of housing under these conditions presents an extremely complex problem. The range of legislative and economic controls, the subtle social requirements and the demands of London sites all interact to generate a highly constrained situation. Faced with all this complexity Darke shows how the architects tended to latch on to a relatively simple idea very early in the design process (Darke 1978). This idea, or primary generator as Darke calls it, may be to create a mews-like street or leave as much open space as possible and so on. For example, one architect described how 'we assumed a terrace would be the best way of doing it . . . and the whole exercise, formally speaking, was to find a way of making a terrace continuous so that you can use space in the most efficient way . . .'. Thus a very simple idea is used to narrow down the range of possible solutions, and the designer is then able rapidly to construct and analyse a scheme. Here again we see this very close, perhaps inseparable, relation between analysis and synthesis. Darke however used her empirically gained evidence to propose a new kind of map which had some parallels with a more theoretical proposition (Hillier, Musgrove and O'Sullivan 1972). Instead of analysis–synthesis Darke's map reads generator–conjecture–analysis (Fig. 3.6). In plain language, first decide what you think might be an important aspect of the problem, develop a crude design on this basis and then examine it to see what else you can discover about the problem.

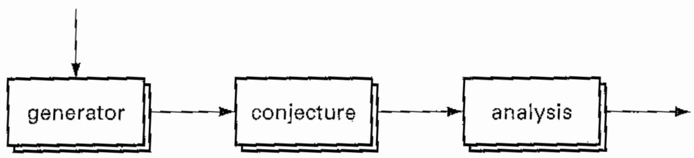

Figure 3.6
Jane Darke's map of the process

Further evidence supporting the idea of the primary generator has been collected more recently using experimental observation and analysis of the drawings produced by designers (Rowe 1987). When reporting one of these case studies in detail, Rowe describes his analysis of a series of design drawings and detects lines of reasoning which are based on some synthetic and highly formative design idea rather than on analysis of the problem:

> Involving the a priori use of an organising principle or model to direct the decision making process.

These early ideas, primary generators or organising principles sometimes have an influence which stretches throughout the whole design process and is detectable in the solution. However, it is also sometimes the case that designers gradually achieve a sufficiently good understanding of their problem to reject the early thoughts through which their knowledge was gained. Nevertheless this rejection can be surprisingly difficult to achieve. Rowe (1987) records the 'tenacity with which designers will cling to major design ideas and themes in the face of what, at times, might seem insurmountable odds'. Often these very ideas themselves create difficulties which may be organisational or technical, so it seems on the face of it odd that they are not rejected more readily. However, early anchors can be reassuring and if the designer succeeds in overcoming such difficulties and the original ideas were good, we are quite likely to recognise this as an act of great creativity. For example, Jorn Utzon's famous design for Sydney Opera House was based on geometrical ideas which could only be realised after overcoming considerable technical problems both of structure and cladding. Unfortunately, we are not all as creative as Utzon, and it is frequently the case that design students create more problems than they solve by selecting impractical or inappropriate primary generators.

We return to these ideas again in a later section but before we leave Darke's work it is worth noting some other evidence that she presents with little comment but which even further calls into question the value of design process maps. One of the architects interviewed was explicit about his method of obtaining a design brief (stages A and B in the RIBA handbook):

> A brief comes about through essentially an ongoing relationship between what is possible in architecture and what you want to do, and everything you do modifies your idea of what is possible . . . you can't start with a brief and (then) design, you have to start designing and briefing simultaneously, because the two activities are completely interrelated.
>
> (Darke 1978)

This must also ring very true to any architect who has designed for a committee client. I have found that one of the most effective ways of making apparent the disparate needs of groups in multi-user buildings such as hospitals is to present the client committee with a sketch design. Clients often seem to find it easier to communicate their wishes by reacting to and criticising a proposed design, than by trying to draw up an abstract comprehensive performance specification.

This discussion has oversimplified reality by implicitly suggesting that primary generators are always to be found in the singular. In fact, as Rowe points out, it is the reconciling and resolving of two or more such ideas which characterises design protocols. However, we must leave further discussion of this complication, and of the rejecting or resolving of primary generators, until a later chapter.

In summary

This chapter has examined the design process as a sequence of activities and found the idea rather unconvincing. Certainly it is reasonable to argue that for design to take place a number of things must happen. Usually there must be a brief assembled, the designer must study and understand the requirements, produce one or more solutions, test them against some explicit or implicit criteria, and communicate the design to clients and constructors. The idea, however, that these activities occur in that order, or even that they are identifiable separate events seems very questionable. It seems more likely that design is a process in which problem and solution emerge together. Often the problem may not even be fully understood without some acceptable solution to illustrate it. In fact, clients often find it easier to describe their problems by referring to existing solutions which they know of. This is all very confusing, but it remains one of the many characteristics of design that it so challenging and interesting to do and study.

Our final attempt at a map of the design process shows this negotiation between problem and solution with each seen as a reflection of the other (Fig. 3.7). The activities of analysis, synthesis and evaluation are certainly involved in this negotiation but the map does not indicate any starting and finishing points or the direction of flow from one activity to another. However, this map should not be read too literally since any visually understandable

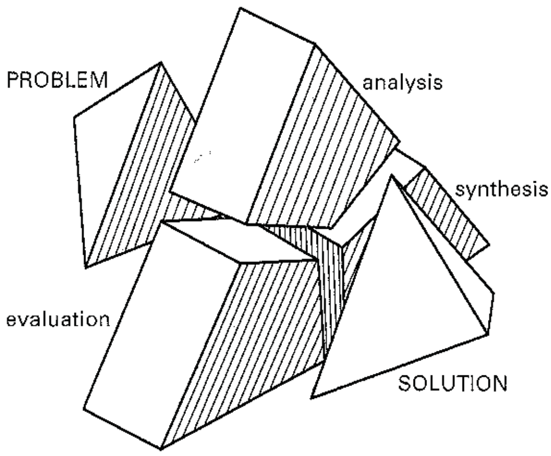

Figure 3.7
The design process seen as a negotiation between problem and solution through the three activities of analysis, synthesis and evaluation

diagram is probably far too much of a simplification of what is clearly a highly complex mental process.

In the next section of this book we explore the nature of design problems and their solutions in order to get a better understanding of just why designers think the way they do.

References

Akin, O. (1986). *Psychology of architectural design*. London, Pion.
Archer, L. B. (1969). The structure of the design process. *Design Methods in Architecture*. London, Lund Humphries.
Asimow, M. (1962). *Introduction to Design*. Englewood Cliffs, Prentice Hall.
Darke, J. (1978). The primary generator and the design process. *New Directions in Environmental Design Research: procedings of EDRA 9*. Washington, EDRA. 325–337.
Eastman, C. M. (1970). On the analysis of the intuitive design process. *Emerging Methods in Environmental Design and Planning*. Cambridge Mass, MIT Press.
Gregory, S. A. (1966). *The Design Method*. London, Butterworths.
Hillier, B., Musgrove, J. et al. (1972). Knowledge and design. *Environmental Design: research and practice EDRA 3*. University of California.
Jones, J. C. (1966). Design methods reviewed. *The Design Method*. London, Butterworths.
Jones, J. C. (1970). *Design Methods: seeds of human futures*. New York, John Wiley.
Lawson, B. R. (1972). Problem Solving in Architectural Design. University of Aston in Birmingham.
Lawson, B. R. (1979b). "Cognitive strategies in architectural design." *Ergonomics* 22(1): 59–68.
Lawson, B. R. (1994b). *Design in Mind*. Oxford, Butterworth Architecture.
Levin, P. H. (1966). "The design process in planning." *Town Planning Review* 37(1).