masterly, correct and magnificent
What this book is not
This book is not intended to explain how the ‘design elite’, as Larson (1993) calls them, go about designing buildings. There are plenty of books by and about leading architects which seek to do this. However, these books do not seem to be much help to the beginning student facing that dreadful blank screen or sheet of paper.
This is not because these eminent people or their biographers are deliberately setting out to mislead anyone. No-one would expect a great musician’s musical biography to pay much attention to chords and finger exercises. Yet chords and finger exercises, or their equivalent, are essential parts of the preparation for any skilled performance, and architecture is a very skilled performance indeed.

What this book is
Sir Henry Wotton (1686), who gave the English-speaking world its most popular architectural cliché, ‘commodity, firmness and delight’, also gave his readers much practical advice. In writing about staircases, he says that what he is providing is a set of ‘vulgar cautions’, that is, advice designed to help people not to make elementary mistakes. This book is a book of ‘vulgar cautions’ for beginning architecture students.
The approach taken throughout will be found to differ from those of some other writers, partly because design is a large subject and will look different from different points of view, partly because of its resolutely practical viewpoint, and partly as a consequence of differences in values.

Extract from Chapter 1 Introduction
PROFESSOR TOM HEATH (1931–1998)
A graduate of the University of Sydney (B.Arch 1954), (M.Bld Science 1966), (M.Arch [Research] 1980), Tom Heath joined prominent Sydney firm of McConnel Smith and Johnson where he was a director for 15 years. In 1979, he left the practice to become Dean of the Faculty of Built Environment and Professor and Head of the School of Architecture Interior and Industrial Design at QIT, then QUT in Brisbane until 1990. He then became University Research Professor of Design and Director of the Research Concentration in Design and Construction Studies at QUT. At the same time he was editor of the RAIA journal Architecture Australia from 1980–1990. Heath was highly respected as an architectural theorist and wrote three books and over 200 papers on the theory of design. *Method in Architecture* (Wiley 1984) and *What if Anything is an Architect?* (Architecture Media Aust 1991), was followed by *Learning Architecture / Teaching Architecture: A Guide for the Perplexed* which was completed shortly before his death. His role as editor of Architecture Australia gave him the opportunity to be heard by the profession at large and through his editorials, he was a prominent voice. He was a foundation and active member of the Environmental Design Research Association (USA) and was inducted into the Design Institute of Australia Hall of Fame in 2007. His often perceived eccentric ways of a bow tie wearing academic, concealed an intensely private man who eschewed convention. His contribution to QUT was recognised by the establishment of the Tom Heath Gallery within the QUT Art Museum.

Robert Riddel
Extract from Encyclopedia of Australian Architecture (CUP)

References
LEARNING
ARCHITECTURE
TEACHING
ARCHITECTURE

a guide for the perplexed

TOM HEATH

illustrations by Ray Jones

denarius design books
# CONTENTS

<table>
<thead>
<tr>
<th>ACKNOWLEDGEMENTS</th>
<th>iv</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOREWORD</td>
<td>v</td>
</tr>
<tr>
<td>Amos Rapoport</td>
<td></td>
</tr>
<tr>
<td>TOM HEATH AND THE BOOK</td>
<td>xi</td>
</tr>
<tr>
<td>Wolfgang Preiser, Andrew Seidel, John Simpson, Gordon Holden, Phillip Follent</td>
<td></td>
</tr>
</tbody>
</table>

## 1 INTRODUCTION  1

## 2 THE PLAN IS THE GENERATOR  31

2.1 Introduction 33  
2.2 Rooms and how to design them 41  
2.3 Marvels and mysteries of the site 58  
2.4 Arrangement 73  
2.5 Putting it together 89

## 3 THE MATERIALS OF CONSTRUCTION  111

3.1 The idea of technology 113  
3.2 Load and support 131  
3.3 Energy and building 159  
3.4 Services 188  
3.5 The nature of materials 211

## 4 MASTERLY, CORRECT AND MAGNIFICENT  255

4.1 Introduction 257  
4.2 Order and complexity 273  
4.3 Symbolism, expression and style 303  
4.4 Sources of form 326  
4.5 Space and time 342  
4.6 Mass and surface 377

## 5 TEACHING ARCHITECTURE  425

5.1 The ideology of architectural education 427  
5.2 The theory of architectural education 458  
5.3 Teaching design: the studio 507

## REFERENCES  552

## EXPANDED CONTENTS  565
ACKNOWLEDGEMENTS

The manuscript of this book was completed by my husband Tom Heath shortly before his death. In the process of producing and publishing the book, I was immensely grateful to receive valuable advice, encouragement and assistance from Tom’s friends and colleagues, and would like to specifically thank Amos Rapoport, Andrew Seidel, Wolfgang Preiser, Gordon Holden, Vesna Popovic, Jill Franz, John Simpson, Ian Close and Harry Nicolson.

I would also like to thank the following individuals and friends whose generosity in providing advice, encouragement and support was greatly appreciated: Derek and Tim Heath, Janet and Bill Conrad, Phillip Follent, Peter Beiers, Izabella Chabrowska and Angelo Kakoulidis.

I express my gratitude for the support given to me by Conrad Gargett Architecture, and by Peter Lavery and Vice-Chancellor Peter Coaldrake, both of Queensland University of Technology.

Special thanks to Ray Jones for his elegant illustrations throughout, and also to Jennifer Marchant, Heather Buchanan, Janelle Fenner, YE Ng and others for their assistance in the production of the book. The illustrations in Chapter 2 are based on original sketches by the late Paula Whitman.
foreword
There have been various responses to a sense of dissatisfaction with architecture and architectural education. Some new fields have emerged to suggest solutions (e.g. Environment-Behaviour Studies, Design Methods and Participation). In my own field of Environment-Behaviour Studies, two attitudes can be identified. The majority tries for improvements within the existing paradigm, hoping to improve architecture, the profession and education incrementally – through a greater emphasis on research and users. I am a minority (possibly of one) and argue for a radical change, for a redefinition of architecture (as a science-based profession not an art) and hence of the nature of design and education. As a result I rejected the core of architectural education, the studio, and have refused to teach studio or be involved with it for 40 years. Since my 1983 article about the topic I have become even more radical.

What then am I doing writing a foreword for a book on how beginning students in the studio might learn better and be taught more effectively?

What follows is an answer to that question.

I begin by admitting that my position is totally unrealistic (although, I believe, essential). Effectively, I have given up on architecture as it is. Tom Heath was ever the architect, and took a realistic position. While aware of the more radical positions, he believed that through research and incremental change things could be improved. In fact, Tom Heath and I had great debates when we met at conferences and late into the night when I stayed with him during visits to Brisbane and QUT. It was something we both enjoyed.

It was clear that anything Tom said had to be taken seriously – it was always the result of careful thought and thorough knowledge. This applies specially to this book which presents the full development of his ideas about how to improve studio education and bring it and the profession closer – a goal dear to Tom’s heart, reflecting who he was.

After many years as a director of a large Sydney practice (McConnell, Smith and Johnson), i.e. deeply involved professionally, he moved to academia. He became University Research Professor of Design at QUT, and became equally involved in academia. He did research and
not only taught and mentored students but thought deeply about teaching and learning. He also published, both papers and books. One was *Method in Architecture* (1983) in which he dealt with some of the theoretical issues explicitly omitted in this book although as he points out, these inevitably appear in the last chapter addressed to teachers. The second was *What, if anything, is an Architect?* (1991). In the present book he draws on his deep familiarity with both academia and the profession.

Another important thing: as an undergraduate, Tom Heath had been influenced by Andersonian philosophy. As a result he could approach issues intellectually, be analytical and develop a clear, logical argument. At the same time he managed to avoid the jargon, obfuscation and fashionable verbiage that marrs many philosophical and architectural writings. In this book the clarity of thought is matched by the crystalline clarity of expression: the use of simple language, a concise and very structured, easy to follow argument. This makes it of great benefit to read it, even if one disagrees with it, or parts of it.

One important aspect of research and scholarship is the extent to which it stimulates thought, questions, reactions and challenges readers (if they disagree) to formulate equally clear, cogent, logical and well-supported counterarguments. Consider two recent quotations from a single issue of the journal *Science* (Vol 326, Issue 5951, 16 October 2009). In the first (p336) a paper is described as ‘one of the most important – not because it is right – I think it is a little wrong – but because it acted as a catalyst to get people thinking’. The second, on pp368-369, reviewing a book says that ‘...fruitfully forces us to think in new ways about…’

*Learning Architecture / Teaching Architecture: A Guide for the Perplexed* does that extremely well, as I will elaborate below.

I think of architecture as dealing with two major questions. The first is what should be done, i.e. what should any given environment be to be supportive of its users, and *why* – providing the research-based evidence for the decision. Then follows the second question – *how* should that environment be given material expression. I regard the first question as more important, but underemphasised, especially in the studio. Heath explicitly addresses only the second
question which of course remains essential (and it is the second question with which studio
is currently largely concerned). Since not much is said about the first question, a major
point of potential disagreement with my position disappears, because my concern is with
how the first question can be made dominant, or at least given more emphasis.

Heath does an outstanding job in dealing with how to improve the way studio deals with
the second question. He uses a most unusual and interesting approach by approaching the
issue from two directions: first looking at how students best learn (the bulk of the book)
using many research findings and, second, how particular ways of teaching could help.

It is a thoughtful, sophisticated, superbly reasoned and clearly expressed account of how
architects approach design. It makes explicit what is typically either left implicit or
obfuscated. It challenges the reader, student or teacher to think – to think hard, clearly and
explicitly about what is being said and advocated, and about the nature of the evidence
used. Ultimately that is what education (as opposed to training) is all about. It poses a major
challenge for someone to write as good a book about the what and why of architecture as
this is about the how, and about how a better job can be done in teaching and learning that
aspect of architecture (and how the two can be brought together).

For me, reading is a form of dialogue with the author. Publications that I own (and student
work) are much annotated – usually in red ink. As a result, when I retired, my PhD students
gave me a red roller-ball pen. I still use it – and it was extensively used on the manuscript
of this book.

These annotations showed me how this book has greatly clarified the nature of my position
– the points of agreement, of disagreement (and where these are most acute), and my
positions vis-a-vis the evidence cited. In effect, Learning Architecture / Teaching Architecture
provides guidance, a road-map as it were, of how and where to identify counter-arguments
and cite contrary evidence. It challenges one to construct what one hopes would be an
equally clear, logical and well-reasoned argument (not an easy task).
From the first paragraph of Chapter 1, Heath clearly states his position, his starting point, his goals; the route followed and the decision points en route become clear as he proceeds point by point, using short, pithy, clear sections. One’s own thinking becomes structured and clear rather than global and inchoate.

In a book on the genetic bases of human behaviour by W.R. Clark and M. Grunstein (Are we Hard Wired? p239), it is said about a paper that it can be praised, rejected, welcomed or damned, depending on one’s position, but it cannot be ignored.

Neither can A Guide for the Perplexed be ignored, nor must it be. It is to be hoped that readers, whatever their position, will pay due attention and read it as though engaged in a high-level dialogue with someone very special.

Tom Heath died much too early. Personally I wish that he were still with us, and that he and I could continue to debate issues in person. This book, if read creatively and proactively, is the next best thing. We thus owe a debt of gratitude to his wife Sipen for the work she did to make this book available to us.

Amos Rapoport
It is an honor, indeed, to frame Tom Heath’s book.

I had the pleasure of meeting Tom first in 1972 in Leuven, Belgium, at a conference organized by the International Association of Empirical Aesthetics. Tom was a serious scholar in that topic area, and he contributed 3 books and over 200 articles to the field of architectural design theory over the span of 40 years. In Australian parlance, Tom was an aristocrat; i.e., a descendant of one of the early arrivals on that continent, and one with a distinguished record, both in architectural practice and academia.

Tom served as editor of *Architecture Australia* and was a founding member of the Environmental Design Research Association in the US. He served as Head of the School of Architecture, Interior and Industrial Design, as well as Dean of the Faculty of Built Environment at the Queensland University of Technology in Brisbane.

During my 11 lecture visits to Australia, I always made it a point to connect with Tom, whose vigorous academic pursuits and exemplary collegiate demeanor made him someone whom one would seek out to collaborate with. Starting in 1979 at the Educational Forum of Australian and New Zealand Schools of Architecture in Brisbane, Australia, I made the pilgrimage to Tom’s academic institution on many occasions, and had the privilege of staying at his Queenslander colonial style home.

The last time I met with Tom was at the 1996 annual conference of the Environmental Design Research Association in Salt Lake City. Were he still with us, he would have been an important contributor to our book *Designing for Designers: Learning from Schools of Architecture*.

I was sad to learn of his untimely death in 1998. It was an honor to have known Tom for so many years. We miss him. The present book is testimony to his serious commitment to scholarship in architectural education and to his critical mind set, which enabled him to separate fact from fiction in the field of architecture.

**Wolfgang F.E. Preiser**
Professor Emeritus of Architecture, University of Cincinnati
There are so many ways I want to describe Tom. I knew Tom over a period of about five years when I was a Visiting Professor for a part of each year at Queensland University of Technology. Tall, gaunt, always with a warm smile, enjoying a good joke, even a pun, he may have appeared to some as the quintessential patrician completely at home with tea, scones and cricket. Yet, I rarely saw him that way. He was thoroughly the gentleman and always a gentle man. I saw a dedicated teacher and a thorough intellect. He approached ideas, colleagues and students alike with thought, analysis, caring, humor and, I must add, a twinkle.

Tom believed it is now architecture’s turn. Well, so he mentioned to me. I’ll explain.

Today we nearly all think of physicians as a practicing scientist. But they were not always that way. In the 1930s, penicillin underwent one of the first random-trial drug testing protocols, introducing scientific experimentation, external to the daily event seen in a physician’s practice, into the knowledge base of physicians. However, we know that many general practitioners still do not understand the statistics that underpin the vast majority of the healing regimes they prescribe. It has been nearly eighty years and the progress has been very slowly evolutionary. Resistance to change is great. Yet, slowly, the practice of medicine has been changing from a practice-based knowledge to a research- or science-based knowledge. Some might call it glacially evolutionary.

In management education, the 1940s saw a turning point due to many developments occurring during and perhaps because of World War II. Management education was changing from practice-based faculty-member knowledge to research-developed knowledge. While some may lament that the pendulum has swung too far (and perhaps stuck), we nonetheless view management education today as research-based. We daily hear about metrics, research results and demographics in marketing and take them for granted. The seat-of-the-pants management approach is probably very much alive but its credence is severely diminished when confronted by contrary research results.

Tom believed that it is now architecture’s turn to begin the movement from a practice-based profession and discipline to an evidence-, research- and knowledge-based profession and
discipline. It is architecture’s turn to add to its glorification of designer-stars respect for measurable accomplishments and applications. It is architecture’s turn to change faculties from consisting primarily of successful practitioners to faculties consisting of researchers who can bring their research to bear on the practice of making better architecture and on improving the lives of those who inhabit those environments.

Like medicine and management before, Tom Heath believed this slow evolutionary process, even with its potentially significant flaws, had begun and he wanted to be one to leave a lasting contribution to such glacially hasty events. His first three books on method, the profession and aesthetics certainly made a mark.*

Yet, this book may be the most lasting. It will certainly be the most controversial. It was intended to provide entering architecture students with practical and fundamental knowledge that others before them have learned. The idea is that, if these approaches can be passed down, not forcibly rediscovered by every student, then the student’s intellect would be freed to move on to more challenging questions, to attain greater heights. Tom, after all, viewed the world as an intellectual would, trying to make sense of it through a process of both rational and creative thought. Through his career as an architect, a hospital programmer and designer, an editor of professional magazines, and as an academic, he mastered a highly rational approach.

This did not always please everyone, of course. Architects are taught to value, even revere, the grand art of the designer. But Tom knew that art history must be different from architectural history. And art and architecture could not be only examined similarly. After all, no one lives or works in a sculpture. Intellectually Tom knew that architecture can become its own form of art, but just as science was added to the art of medical practice and, with all the research in management, the art of the charismatic leader remains highly elusive to thorough examination, Tom also knew that as projects have become more and more complex and will continue to do so in future, art will remain in architecture but escalating rational abilities will be increasingly required.
I don’t think Tom would have described it as a conflict between the studio method of teaching architecture and the seminar. After all, anything can be done in either setting. His concern was just the growing need within the profession of architecture for increasingly substantive and rigorously developed knowledge for use in practice.

He probably knew that devotees of the studio method might have a problem with this book. Such devotees might argue that nothing should be explained and that the value of the architect was to discover or invent knowledge as appropriate to a project. Tom would disagree. He could not understand how standing on the shoulders of others, unless there was a good reason to ignore precedent and the knowledge of others, could be viewed as anything but positive.

To the student of architecture, use this book. It will save you time and free you to go further. Yet, nothing should be completely unexamined. If you have good reason to circumvent the principals stated here, then you know what to do.

To the practicing architect, you may enjoy this too. It may be a refresher you’d like to have in the office.

To the professor of architectural design, is there a way you could use this book to help your students move more quickly onto the complexity that is, after all, architecture?

To everyone else, enjoy this book. This may give you a clue about the simpler aspects of the problem architects face.

This book is a concluding contribution for Tom due in large part to the efforts of Sipen and a beginning contribution for this continuing discussion.

Tom was right. It is beginning to be architecture’s turn. To paraphrase The New York Times, those few architects who emerge to the level of fashionistas will remain on pedestals. At any given time there are 9-12 such people in the world.
The greatly innovative will realize that there is something in the future of architecture that will combine both the object and services into single packages. Yet, the overwhelmingly vast majority of successful, practicing architects will live fulfilling lives by providing professional services that honestly and directly try to improve the existences of those who utilize the environments they create.

It is to that last group that this book is dedicated.

Andrew D. Seidel
Editor-in-Chief
Journal of Architectural and Planning Research
Toronto

Tom Heath had a very distinguished career in the practice, analysis and teaching of architecture. This unique book is testament to a career long passion for all of the facets and idiosyncrasies of a profession which has been endlessly written about. Most of this writing is about so called architectural ‘heroes’ or ‘signature’ buildings.

This is not one of those books.

This book, perhaps essentially written for students of architecture, will, because of the substance of its message, scope and thoroughness, also appeal to practitioners of architecture. It has the potential to confirm already established philosophies but is capable of, and likely to, I believe, inspire new ones. Tom considered the work of an architect akin to that of a midwife – properly executed it resulted in a wonderful outcome.

I consider myself fortunate, indeed privileged, to have known Tom. He invited me to join the Editorial Panel of Architecture Australia during his term as Editor 1980-1990. We met frequently for very enjoyable and informative sessions in the billiard room of Old Government House at QUT Gardens Point Campus.

This very important building has recently undergone a programme of significant restoration and adaptive-reuse under the skilful direction of Sipen.

I recall very fondly enjoying many lunches with Tom at a favourite restaurant near QUT, during which we had such fun, we must have seemed to others in the restaurant, like naughty schoolboys in need of parental discipline. Although not aware at the time, I later realized that during such occasions, typical of the man, he was testing ideas being explored in the preparation for the book.

Tom was a very private man, seemingly rather shy in company but with a subtle and disarming sense of humour. He was popular with his architectural colleagues, artists and
scientists, all of whom considered him to be one of them. These relationships have informed the book and endowed it with a confidence of intellectual connection to all areas of creative endeavour.

In recognition of his contribution to QUT, The Tom Heath Gallery within The QUT Art Museum is named in his honour.

This is an important and scholarly book. I admire and commend Sipen for her vision and determination to give it life.

**John Simpson**
The publication of books, articles and conference papers about comprehensive architectural education appears to wax and wane over time. For some time now there seems to have been attention given both to narrow topics on the one hand and overall architectural programme structure and degrees of integration with education for other disciplines on the other – both rarely delving deeply into the detailed scope and curriculum of primary knowledge and skill needed to design buildings. We may be in what can be interpreted as a period of wane in comprehensiveness. So the timing of the release of this book which addresses what Tom Heath considered to be the essentials of architectural education is significant in that it may help fill a gap in current discourse.

This book provides primary knowledge to the student of architecture that directly addresses buildings and their embodied architectural ideas combined with added dimensions of down-to-earth information and advice on how to apply knowledge. Heath writes that the book is ‘for use in the studio, as a practical substitute for experience’. The need for greater attention to primary architectural knowledge has been noted in the past. In a QUT colloquium on the knowledge needs for architectural practice, Jennifer Taylor observed a worrying dominance in architectural debate of secondary knowledge over primary knowledge. She saw secondary knowledge drawn from literature and social theory as easily leading to obfuscation and confusion.

While clearly not targeted at professional architects, the scope of the book is consistent with Heath’s editorials in the profession’s journal Architecture Australia during the 1980’s which addressed a very wide range of architectural topics. These editorials and other papers gained a reputation for their wit and seriousness, their rationality and their capacity to pare-down the topic to its essentials. He could capture your thinking in the first paragraph or so with a thoughtfully positioned proposition that you accepted or rejected. If you accepted it, even partially, then the clarity and structure of the rational argument that followed would leave you with little room for a different conclusion. The content of this book is mostly true to Heath’s style. It clearly positions itself at the beginning and it is explicitly structured into obvious chapters each with subheading topics containing clear, rational discussion and
information. But it is different from past works in one important respect. The reader can go into the book at just about any point and gain something valuable from it, without needing to start at the beginning and follow a line of argument. This was clearly intended by Heath, perhaps motivated by his understanding of how students are likely to access knowledge.

Neville Quarry in the foreword to Heath’s *What if Anything is an Architect?* a compilation of editorials, felt that the writings could be grouped under the three headings of: Demolition, Excavation and Construction of architectural beliefs and theories. Accepting Quarry’s groupings, this book squarely sits as a ‘Construction’ although there is also some demolition of what Heath considers to be false beliefs…he couldn’t help himself!

I worked with Tom Heath for nearly twenty years during which I learned much from him about theories of education. I respected his writings and advocacy and I find myself still using some of his aphorisms such as ‘if you are not writing coherently then you are not thinking clearly’. I frequently sought his advice, which he gave generously, and I bounced ideas with him and gave him draft papers that I had written for review. On one occasion he returned a draft with his copious hand written notes all over it, including one part that said ‘bullshit’ followed by a statement of points as to why I needed to re-think the piece. I was pleased with this, because out of deference to a colleague he hadn’t used the stamp marked ‘bullshit’ that he used for student essays, something not politically correct these days. Although there will be different views held from Heath’s about learning and teaching architecture, I think the reader of this book will find that there is no nonsense in it.

Here are Tom Heath’s final thoughts about how to de-mystify architectural education, a cause to which he devoted a considerable part of his life. This is true Heath. I welcome it and recommend it for the perplexed.

It is to the credit of Sipen that this book is now available.

**Gordon Holden**  
Professor & Head, Architecture, Griffith University  
Queensland
On first hearing that Tom Heath had energetically and meticulously penned *Learning Architecture / Teaching Architecture* and being asked to contribute to the book, I felt both privileged and apprehensive. Tom at the end of his life had the deserved reputation of intellectual driver within the School of Architecture at Queensland University of Technology.

A five hundred page manuscript covering the wide gamut of issues embraced by learning and teaching architecture was bound to be a scholarly tome which would be difficult to appraise and honour here.

The manuscript thankfully offers refreshing reassurance from the very first page where Tom talks of ‘what the book is not’ and portrays it as book of ‘vulgar cautions’, and in a very easy-to-navigate format welcomes any teacher, student or those curious about architecture to want to read on.

The contentious and often opposing viewpoints surrounding architecture do not deter the author from either embarking on this ambitious undertaking nor proffering his own interpretations shaped and informed from his teaching experience. He confidently presents the pros and cons of various teaching tools and individual exercises alerting both teachers and students to the pitfalls of seemingly expeditious and easy learning modes.

He presents us with both the understandings and misunderstandings surrounding aesthetics, creativity, and inexpressibility as ideology, and even the ideologies of actually teaching architecture. His viewpoints are presented in bite size prose, well supported by references that allow the student and teacher to explore further. The book thus becomes the first and most important map (with many clues and links) to be scrutinised in the pursuit of a fulfilling architectural education.

Illustrated by Ray Jones, the book is an anthology of elegant, simple sketches akin to the itinerary for a ‘grand tour’ of influential and world renowned architecture. The buildings are thoughtfully chosen, some less well known and obscure but illustrating always the relevant message of adjoining text. They offer much more insight into seminal architectural
endeavour than could be gleaned through a haphazard sweep across the internet in search of short cuts to an architectural appreciation.

The manuscript was conceived almost a decade ago yet treatment of the theme ‘sustainability’ remains as relevant today despite the many changes that rapid technological advances have brought to the tackling of sustainable design. The tried and proven methods of passive design and thoughtful responses to local climatic conditions as well the appreciation of economic and political contexts influencing the processes of building are unequivocally articulated and thus ensure that this document provides a relevant and sound foundation for a student’s understanding of services and building technologies.

The book does not set out to be a curriculum for an architecture course however its thorough coverage of an extensive range of relevant topics along with suggested studio activities cannot help but form a basis for a credible and productive curriculum. If students and teachers did nothing more than to explore the many referenced authors and thereby reached their own conclusions about learning, teaching and aesthetic and creative appreciation they would build self-confidence in architectural discourse and expression that would serve them well in the company of experienced practitioners.

Tom Heath’s manuscript has turned into the most accessible of scholarly texts which dances with great agility from the pragmatic to the poetic and leaves the reader inspired.

I believe this book is destined to shape the lives of many a teacher and student and in turn, through their greater competencies, shape the better built environments of the future.

**Phillip Follent**
Queensland Government Architect
masterly, correct and magnificent
Palace of Assembly, Chandigarh (1950–65)
Le Corbusier
**Introduction**

**Aesthetics**

When he wrote that ‘Architecture is the masterly, correct and magnificent play of masses brought together under light’, Le Corbusier was making a statement about aesthetics. Aesthetics deals with the affective or emotional aspects of our response to situations. Most architects are concerned with people’s emotional responses to the overall qualities of their buildings: how they look, feel and sound. This chapter concentrates on the look of buildings, but other sensory modes should not be forgotten. Part of people’s emotional response also depends on their judgements about what Vitruvius called ‘propriety’ (I, II, 5–7), which today is often called ‘contextualism’. People expect the perceivable qualities of a building to be appropriate to its physical and social context.

**Talking about aesthetics**

Talking about aesthetics is not easy. There is a long philosophical tradition, but there is no well-established theoretical framework or vocabulary for discussing aesthetics in architectural teaching. Often the teacher has to rely on pointing with the finger and trust that the student makes the correct immediate observation and also grasps the general principal inherent in the example.

**The philosophical tradition**

Philosophers from Plato to the present have discussed aesthetics. This philosophical tradition is not very helpful, even if the teacher is familiar with it. Much of it is obscure. Much of it is speculative, and some of these speculations have been disproved by quite recent findings in psychology. For example, the belief that regular solids are absolutely beautiful, which originates with Plato (4.4.24), has been undermined by the work of Berlyne and his school (Berlyne 1960, 1971). Much of the best of it is concerned with the aesthetics of literature and is quite inapplicable to architecture, though efforts have been made to apply it. For these reasons, no attempt will be made here to summarise this

4.1.4

**Recent developments in aesthetics**

Since the mid-twentieth century a great deal of progress has been made in understanding people’s emotional responses to physical settings. Most of this work has been done by psychologists or by architects working within a psychological tradition, though some is purely theoretical. Landscape has been more studied than architecture or urbanism, but what has been found out about landscapes is often applicable to architecture. Much of this material is scattered through journals that architects seldom read. There are, however, some books that provide an introduction to this way of thinking, notably Arnheim’s *Art and Visual Perception* (1954, 1974, 2004) and *The Dynamics of Architectural Form* (1977), *Cognition and Environment* by Kaplan and Kaplan (1982), *Environmental Aesthetics* edited by Nasar (1988a) and Weber’s book previously mentioned (1995).

4.1.5

**The aim of this chapter**

The aim of this chapter is to introduce this psychological tradition in a systematic, though necessarily abbreviated, way. To do this, it is necessary to start with some basic theory, something that this book has elsewhere tried to avoid. Those who are impatient with theory can skip immediately to section 4.5, but if you do so you may find that you need to backtrack, since the framework of ideas in which the practical advice is set may be unfamiliar. The basic theory is set out in this section. In the following two sections this theory is related to traditional aesthetic theories and beliefs. The final two sections of the chapter deal with the application of this approach in the studio.

4.1.6

**Objections to aesthetics**

Many people, including some architectural teachers and students, reject the notion that aesthetics can be discussed and understood. Some of
this opposition is ideological and will be discussed in section 5.1 along with other ideological issues in architectural teaching and learning. However, there are also some common, conventional objections to any kind of aesthetic theories and principles.

**Is it all a matter of taste?**

According to a popular view, any kind of agreement on aesthetic issues is impossible because everyone likes different things. This sort of individualism is implied in calling aesthetics ‘subjective’. Taken at its face value, this kind of view is obviously false. Some records and books sell millions of copies. Some places are crowded with tourists who have paid large sums to visit them. Obviously there is widespread agreement on the value of things.

Against this argument, it may reasonably be objected that the aesthetic quality of very popular things or places is often low. However, research on ‘high’ art has found a considerable consensus, both on the ‘greatness’ of art works and on preference among the great works, although there was somewhat less consensus over preference (North and Hargreaves 1996). Any useful approach to aesthetics has to account for both agreement and disagreement.

**Conditioning**

People who favour the idea that ‘it’s all a matter of taste’ will often explain the fact that people do often like the same things by reference to ‘conditioning’. This argument is based on a complete misunderstanding of the work of Pavlov and Skinner. Conditioning is a form of involuntary learning produced by associating desired behaviour with either avoidance of some strong threat or the offering of some strong reward. *A Clockwork Orange* and *1984* notwithstanding, it is practically impossible to condition human beings under the conditions of ordinary life or even in jails or schools. Confusing *conditioning* with *learning* is a mistake. Learning can be corrected by subsequent experience.
4.1.9

**Persuasion**

Another explanation of shared likings is that they are produced by persuasion, particularly by advertising. It is true that many people can be relatively easily persuaded to ‘try’ things. However, if, when they try them, they do not *like* the result, it is much harder to get them to repeat the experience or to promote it through ‘word of mouth’ advertising. Persuasion is not a sufficient explanation.

4.1.10

**Imitation**

People are, however, very much influenced by example. Some well-known psychological experiments have shown how hard it is for individuals to go against the opinion of the majority or the opinion of authority figures whose authority they accept (Sutherland 1992, ch. 4). Imitation provides a partial explanation for aesthetic agreement, but also for aesthetic disagreement.

4.1.11

**Cultural learning**

A culture consists of habits or tendencies to act shared by members of a variety of social groups (Murdock 1956). By definition, cultures can be learned. They *must* be learned if the culture is to survive. Cultures thrive by imitation.

The culture in which we grow up directs our attention to learning some things, or establishing some habits, but not others. Our culture helps us to get through life by reducing the strain or our information-processing capacity. It also limits us, which is why cultural learning has been popularly confused with conditioning.

However, the limits imposed by culture are not unbreakable. People are quite capable of learning bits of cultures other than their native culture to which they may be exposed by travel or study. In fact, such ‘cultural borrowing’ was in the past the main cause of social change (Murdock 1956). Imitation is not wholly a mechanical process: it is often based on reasons and on judgement. It is these reasons and judgements which we have to seek in studying aesthetics.
Facts and values
Max Weber, the great sociologist, maintained that there is an absolute distinction between facts and values, and this has become the conventional wisdom (Giddens 1995). If this distinction holds, then there can of course be no discussion or explanation of values in terms of facts. Aesthetics is concerned with values and could therefore not be studied.

Throughout this book the point has repeatedly been made that facts are value-laden, and that in every aspect of design the constraints are values as much as they are facts. In discussing aesthetics, we go further: values are facts. (This point is expanded in Chapter 5.) What people feel in a given situation is as real, as objective, as bricks and mortar. In explaining this belief, and thus turning from criticism to theory building, we will begin with some well-established facts about values.

Aesthetic behaviour
Looking at things from a different angle often helps in the effort to overcome deeply rooted prejudices. In trying to overcome doubts about aesthetics, it may therefore be helpful to start with the history of things, rather than with theories of art. The things in question are the things that have a history: human artefacts.

The most noticeable thing about human artefacts in all their variety, right back to at least the New Stone Age, is that they are distinguished from naturally occurring objects by what David Pye (1964) called ‘useless work’. Thus, ‘useless work’ is of two kinds. First, things are made more regular or symmetrical, smoother, rounder or straighter than they need to be in order to be used successfully. Second, they are ornamented. The ornament may take the form of abstract patterns, or of representations of other things. These are basic forms of aesthetic behaviour that are found in all known cultures.

Making special
These forms of behaviour are found in the production of even the most utilitarian objects. One of the mistakes in many discussions of aesthetics
is to assume that aesthetic evaluation and aesthetic behaviour are confined to the production and consumption of what today we call ‘works of art’. On the contrary, what is being argued here is that aesthetic behaviour is so ordinary and commonplace that it passes unnoticed except in the most exaggerated examples.

However, exaggerated aesthetic behaviour is also early, common and universal. Dissanyake (1992, 1995) uses the term ‘making special’ as a general description of this use of the basic aesthetic behaviours for social emphasis and differentiation. Her examples are mainly drawn from self-adornment, dress and ritual, but the application of the idea to architecture is obvious. Rapoport (1982, 1990) made the same point with respect to architecture. Architecture is building ‘made special’ by a higher level of order and greater adornment. This does not, however, mean that architecture is order or adornment taken apart from building and the constraints of building.

**The roots of aesthetic behaviour**

The basic forms of aesthetic behaviour can be explained in terms of experimentally well-supported psychological theory. In the first decade of this century, the Gestalt school of psychologists investigated our perception of objects. They wanted to know how it is that we are able to tell ‘figure’ from ‘ground’, a person, let us say, from the wallpaper against which he or she is standing. In the course of this investigation, they discovered a number of ‘laws of perception’ that appear to hold for the majority of people everywhere, and are therefore probably part of our innate equipment. It should be noted that some scholars continue to reject the notion of innate abilities. They believe that everything, including the ability to learn, must be learned. Resolution of this controversy must await better investigation of the neurophysiology involved. Whether or not they are innate, it appears that the Gestalt ‘laws’ are for practical purposes universal.

**The Law of Pragnanz**

The most important of the Gestalt laws, in that it comprehends all the others, is the Law of Pragnanz, ‘the tendency to make perceptual
structures as clear as possible’, to quote Arnheim (1954, 1974, 2004). This produces two tendencies that might, superficially, appear to be opposed: ‘levelling’ and ‘sharpening’. To quote Arnheim again, ‘levelling is characterised by such devices as unification, enhancement of symmetry, reduction of structural features, repetition, dropping of non-fitting detail, elimination of obliqueness. Sharpening enhances differences, stresses obliqueness’. So the two forms of aesthetic behaviour that we find in the productive activity of every culture, simplification and ornament, turn out to be closely related to fundamental features of perception. Simplification ‘levels’ by the introduction of order. Ornament ‘sharpens’ by the introduction of variety or complexity. Order and complexity in architecture are the subject of section 4.2. Here the important point is that through aesthetic behaviour people remake the world in accordance with their own (mental) image.

**Misunderstanding of the Gestalt laws**

The significance of the discoveries of the Gestalt psychologists for architecture was perceived almost immediately. However, the emphasis of the Modern Movement on the importance of simple geometric forms in architecture distorted this perception. Both the Law of Pragnanz and the other more specific laws to be considered in the next section were misinterpreted as evidence for the view that simple geometric forms are the most beautiful. The levelling aspect of the laws was thus emphasised at the expense of sharpening. Levelling, however, is not an end in itself. It is biologically useful only in conjunction with sharpening. At the perceptual level and also at the cognitive level the mind operates so as to discard irrelevant information through levelling and thus to emphasise what is relevant through sharpening.

**Eye movements**

Studies of people’s eye movements when they are looking at works of art illustrate the Law of Pragnanz in action (see, for example, Solso 1994, ch. 6). The eyes do not, as is sometimes thought, scan systematically across the scene before them. Rather they jump about from one point
of high information content to another, returning most often to the areas that offer the most information. Thus, areas with more information get more than their share of attention and areas with less information get less than their share of attention.

**Arousal theory**

Further light on the links between perception and behaviour has come from psychological studies of arousal. Arousal theory began with the study of animal behaviour and was then extended to studies of people’s aesthetic reactions. The central discoveries are those of D.E. Berlyne, who investigated the link between information, arousal and preference (1960). The findings of a great deal of research by Berlyne and others over many years can be rather crudely summarised as follows. Too much stimulation, arising from too much information in the environment, leads to withdrawal and avoidance. Too little stimulation or information in the environment leads first to quiescence and even sleep and then to boredom and the search for stimulation. Between ‘too much’ and ‘too little’ there is no precise line of ‘just right’, but rather a broad range of tolerable conditions. The width of this range, and the location of its upper and lower bounds, varies between individuals and also for the same individual at different times. However, the important point is that within the tolerable or acceptable range of stimulation, people enjoy both increases and decreases in stimulation: ‘something interesting’ or ‘a chance to relax’. This has very important implications for architecture and environmental design in general. It points to the need for variety and choice in environments. A good environment for people is one that offers a range of different levels of stimulation, neither all high nor all low.

**Misunderstandings of arousal theory**

Arousal theory has been misunderstood in two ways. First, people seem to have great difficulty in accepting the notion of a range of acceptable conditions. Again and again, one finds people writing about an ‘ideal’ level of stimulation. It must be emphasised that even for an individual there is no such ideal level. It is not possible to optimise the amount of information or stimulation that an environment offers.
Second, just as Gestalt theory has often been wrongly used to justify the making of environments that are overly simple and geometric, arousal theory has sometimes been mistakenly used to justify the idea that the object of architecture is to make environments that are visually interesting and exciting. This involves a misunderstanding of the relationship between pleasure or preference and arousal. It is not necessary to make every building as interesting as possible.

**Arousal and preference**

The present understanding of the relationship between arousal and pleasure can be represented by the following diagram:

This diagram shows that arousal and liking or preference have no direct connection with each other. Rather, particular emotional states result from the combination of arousal and preference. The words in the four quadrants indicate common reactions to different combinations of arousal and preference: thus, for example, high arousal with high preference may be experienced as exciting, while low arousal with high preference is experienced as relaxing. This obviously raises the question of what determines preference. One answer is that preference at a given moment is determined first by the current objectives and current mental state of the individual and second by the element of choice.
4.1.22

**Individual differences**

Arousal theory provides a partial explanation of the differences in people’s preferences. People differ on the psychological dimension of introversion/extroversion. Introverts have a naturally high level of arousal and therefore avoid environmental stimulation. Extroverts have a naturally low level of arousal and therefore seek stimulation from the environment. Most people are in between. The differences are partly innate but they can be increased by environmental factors. Particular cultures or social groups may favour introverted or extroverted behaviour or attitudes.

There is also an age factor. The younger the person, the more likely they are to seek stimulation. This accounts for the great difficulty that many students have in believing that interestingness is not the only criterion in architectural aesthetics.

4.1.23

**Previous experience**

People’s preferences are also affected by their immediate past experiences. A person who has just had a fight with their boss or their lover will be in a high state of arousal, with strong negative feelings, and will be likely to prefer a calming environment. On the other hand, someone who has just sat through several hours of boring lectures may be ready for a period of stimulus-seeking – what Berlyne calls an ‘arousal jag’.

4.1.24

**Current goals**

People’s goals in their day-to-day life are, of course, very varied. However, Berlyne’s (1960) work suggests that they can be divided into specific goals, such as catching a train or writing an essay, and diversive goals, such as window-shopping, hiking or playing games. While the two may overlap, the pursuit of specific goals tends to reduce the desire for stimulation, while the pursuit of diversive goals increases it. This has implications for architecture that will be taken up in the next section.

4.1.25

**Stimulus seeking**

Rats will run mazes not only for food, water or sex but also to visit a
box in which the wallpaper changes regularly (Dember, Earl and Paradise 1957). They deliberately seek stimulation. As stated earlier, changes in the level of arousal are pleasant provided the absolute level of arousal remains within the acceptable level for the individual. Very early on, human beings learned to create situations that produce pleasurable changes in arousal. They invented art and sport. Aristotle (c. 330 BC) wrote of the spectators of tragedy being purged by terror and pity; horror movies and bungee-jumping serve similar purposes. Conversely, activities such as meditation or a visit to an art gallery are ways of reducing arousal.

**Choice**

Choice is obviously essential in environments that have to support diverse activities, such as tourism. Even in environments dedicated to specific activities, however, choice is desirable. People who are waiting may need distraction. As we have seen, people’s basic level of arousal and their immediate past experience affect their need for arousal. The next section considers how architecture can provide for choice.

**Criticisms of arousal theory**

Arousal theory has had an enormous influence on studies of aesthetics, but it has not gone uncriticised. As with Gestalt theory, arousal theory was associated with speculations about the detailed workings of the brain, which have since been shown to be wrong. However, also as with Gestalt theory, these speculations have nothing to do with the theory proper or the experimental evidence that supports it.

A more recent criticism is that arousal theory is inherently untestable (Konecni 1996). This criticism, however, refers to the detailed form of the relationship between arousal and preference. Even the critics agree that art, and by implication architecture and environmental design, is frequently used to improve mood (Breckler, Allen and Konecni 1985).

**Familiarity**

‘The familiar is pleasant.’ ‘The familiar is boring.’ In terms of arousal theory as set out above, both of these statements make sense. They also
make sense in terms of day-to-day experience. Experimentally, it is fairly well-established that overexposure to the same situation or similar situations tends to decrease preference (Martindale, Moore and West 1988). On the other hand, exposure to very unfamiliar situations may initially be stressful and perhaps unpleasant, but it can become more pleasant with repeated experience (Zajonc 1968). A famous architectural example is the change in attitudes to the Eiffel Tower, first seen as an eyesore but now the symbol of Paris (Benevolo 1971, pp. 112–17).

**Popular preferences**

A constant complaint of avant-garde architects is that clients and users prefer the conventional and the ordinary. How far is this true? In empirical aesthetics generally, the issue is a hotly debated one (Martindale 1996). So far as architecture is concerned, however, research has provided some helpful insights.

First, it appears that in the case of those building types of which people have a clear conception, or mental prototype, such as houses and perhaps churches, they do not prefer a design that strongly resembles the prototype. Rather, they will prefer something that differs somewhat from it (Purcell 1984). In fact, the general public prefers something that is, to use a phrase often heard in Australia, ‘a little bit different’.

The Kaplans (1982) have illustrated the relationship between familiarity and preference in a preference matrix as follows:

<table>
<thead>
<tr>
<th></th>
<th>Low Preference</th>
<th>High Preference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Familiarity</td>
<td>‘That’s weird’</td>
<td>‘Wow! That’s neat!’</td>
</tr>
<tr>
<td>High Familiarity</td>
<td>‘That old stuff again’</td>
<td>‘No place like home’</td>
</tr>
</tbody>
</table>

The similarity to the figure in 4.1.21 should be obvious.
In areas in which people do not have an existing mental prototype for the building type, it appears that their responses are much more open and flexible. The Sydney Opera House is, after all, a very unusual building, yet it was popular almost from the first with the general public, who had no preconceptions as to what an opera house should be like.

**Architects’ preferences**

However the news is not all good. While there is evidence that the general public is not rigidly conservative, the preferences of architects differ markedly from those of many clients and users (see, for example, Devlin and Nasar 1989). This difference is not solely a result of architectural education. It is already to be found in beginning architectural students (Purcell 1995). Their preference for unusual ‘high style’ buildings is already greater than that of a sample of the general student population. The reasons for this early divergence are not known; presumably they have to do with people’s reasons for choosing architecture as a career in the first place. Nevertheless, such differences between architects and architecture students on the one hand and the general population on the other can also be seen in the general context of what is sometimes called the ‘high culture’.

**The ‘high’ culture**

Controversy in aesthetics centres on the ‘high culture’ and ‘good taste’. It may be suggested that it is resistance to these institutions that provides the emotional foundations of aesthetic individualism and relativism. Yet in themselves they are harmless and natural developments of increases in specialisation and of individual choice.

Earlier it was pointed out that cultures serve to limit and direct our choices. Many modern cultures are very rich and plural. They offer many people far more opportunities than they can take up. People can choose between activities and these choices are directed partly by chance but also by enthusiasm. Ordinary observation shows us that people who pursue any activity enthusiastically change in predictable ways. They know more about that particular field, whether it be baseball or bird-watching or Sung vases. Because they have a wider range of knowledge
and experience, they are able to make finer distinctions and classifications, qualitatively and perhaps quantitatively. They thus have a richer conceptual framework for discussion among themselves, and are well equipped to bore outsiders whose choices have not included that particular activity.

**Good taste**

As a result of all this, the opinions of enthusiasts tend to converge. They may still disagree fiercely among themselves, but the disagreements are over increasingly fine and esoteric points. Agreed standards emerge, and common values. These values may be inexplicit and conveyed largely by arm-waving and pointing to certain acknowledged masterpieces. This is still largely the case in architecture. On the other hand, values can be made explicit, in which case criticism flourishes and the field develops rapidly.

The previous paragraph described the development of connoisseurship. In time, the knowledge and values that have been developed by enthusiasts may come to be formalised and passed on by formal teaching of some kind. Schools of architecture or art are founded. At this point, the content of this teaching become the ‘high culture’ of that cultural group and the convergent opinions of the experts become ‘good taste’. Some modern critics, particularly those known as ‘deconstructionists’, have attacked such cultural traditions. They assert that it is no longer possible for old traditions to extend themselves or new ones to form. In fact, however, it is easy to observe not only the continuation of established traditions but also the formation of new ‘high cultures’ and of associated standards of good taste.

**The dictatorship of taste**

Unfortunately, the ‘high culture’ and ‘good taste’ have an inherent tendency to become both conservative and compulsory. Historically, access to the ‘high culture’ and the acquisition of ‘good taste’ have been possible only to the wealthy and powerful. They have thus become badges of status or ‘cultural capital’ (Stevens 1995) and people aspire to them and are forced to acquire them even though they may care nothing
for piano concertos or patinated bronzes or whatever the relevant categories of artefact or performance may be.

It is in this way that the persistent association between ‘it’s good’ (aesthetically) and ‘you ought to like it’ (because it will enhance your social status) arises. It is at least partly because of this element of compulsion, it may be suggested, that people often react strongly against the ‘high culture’ and ‘good taste’ and adopt relativist and subjectivist views, exemplified by such statements as ‘Beauty is in the eye of the beholder’ and ‘It’s all a matter of taste’.

**The culture of architecture**

Like it or not, architects as a special-interest group will develop a professional culture. Since architecture is considered to be one of the arts in most modern societies, this professional culture will include elements of connoisseurship and ‘good taste’ which to some extent are also part of the ‘high culture’ of the society as a whole.

One of the essential activities of architecture schools is to transmit the professional culture of architecture, including its aesthetic component. This aesthetic component includes the very high status given to the aesthetic aspects of architecture. However, it is by no means necessarily the duty of architecture schools to transmit this professional culture uncritically. This general issue will be pursued further in Chapter 5. Here it should be noted that the struggle to make aesthetic issues explicit and discussable is an essential part of such criticism.

**An ethical problem**

The clash between popular taste and the high culture of architecture raises a question of ethics. Is the duty of the architect as a professional to aim at satisfying the client, the user and the general public, or is it to aim at advancing the art of architecture and contributing to the ‘high culture’? The practical possibilities of compromise are discussed in section 4.3. This is, however, an issue that divides both academics and the profession at large, and its broader implications will be taken up in section 5.1. For the present, it will be assumed that the high culture of architecture is both inevitable and ethically redeemable.
The aesthetic tradition of architecture

The Gestalt laws and arousal theory begin to suggest some basic principles that may guide design. However, it is as difficult to get from these principles, taken by themselves, to a design for an actual building, as it would be to get from Newton’s laws of motion directly to a motor car. The gap can only be bridged by the study of examples. Sections 4.2 and 4.3 explore the relationship of these principles, and other psychological findings not yet introduced, to the tradition of architectural aesthetics, both theoretical and applied.

Summary

The arguments of this section can be summarised as follows:

- ‘Levelling’ and ‘sharpening’ are fundamental universal tendencies of the human mind. They manifest themselves in all kinds of mental activity: perception, memory and cognition.

- These tendencies underlie basic aesthetic behaviour, which is to be found in the production and consumption of all artefacts, including of course buildings.

- Exaggerated forms of aesthetic behaviour, which produce ‘arts’, occur in two related ways. Levelling and sharpening are consciously used to ‘make special’ activities and artefacts that are important to a given social group. Religious rituals, for example, and the cathedrals that house them, express the importance of religion. Levelling and sharpening are also exploited to produce controlled, pleasurable variations in arousal.

- With the growth of specialisation, groups with highly specialised interests and knowledge appear. People who are specialist producers or consumers of aesthetic goods or art forms in modern societies exemplify this process. Because of their specialised knowledge and experience, their tastes tend to differ from those of other groups. This is true of architects and connoisseurs of architecture. In societies that are also egalitarian, this divergence of tastes poses problems, because, unlike the other arts, architecture affects a very wide range of people who have no choice in the matter.
Order and complexity

The perceptual basis of aesthetics

In this section, the tool-kit of the art of architecture is introduced. The use of these tools, like that of real physical tools, must be appropriate. It should not be assumed that if a particular tool is used the result will be good. Nevertheless, knowing one’s tools is a good starting point.

The two main categories of aesthetic tools are, as implied in the previous section, tools for ‘levelling’ and tools for ‘sharpening’. Levelling generally reduces the amount of information in a situation, increases redundancy, and creates unity or order. Sharpening generally increases the amount of information in a situation, decreases redundancy, and creates variety or complexity. The focus in this section is on ways of producing perceptual order and complexity. Applications are discussed more fully in 4.5 and 4.6.

Unfortunately, it has been necessary to introduce a good many technical terms in this section. This is because of the lack of ordinary language for aesthetic terms. So far as possible, illustrations have been provided to show what these technical terms mean. Some effort of understanding will still be necessary.

Understanding through examples

Throughout this section and the next, examples will be given to illustrate the principles being explained. However, in order to get an understanding of the principles, it is essential to apply them yourself to the analysis of other examples. The best examples to choose for this will be buildings that you like and admire. Ask yourself which principles have been used in each case. How exactly have they been used? Do they account sufficiently for the strengths and weaknesses of the design? If not, what else is involved? Such analysis is hard work, but it is the only way to active understanding. Without active understanding, tools will be misapplied.
Unity

Introductory books on architecture written in the Beaux-Arts tradition often stress the importance of the unity of the composition. In terms of Gestalt psychology, giving a building unity is equivalent to ‘sharpening’ it, or strengthening its figure-quality in relation to its surroundings or the ‘ground’. Of course, this may not always be a primary objective: in a historic setting, or a natural environment, camouflage, or at least some balance between the figure and the ground, may be sought. However, the principles involved are the same in either case. So far, only the general Law of Pragnanz has been considered. Now it is necessary to introduce the other, specific Gestalt laws which define ‘figure-quality’.

The other Gestalt laws

There are four original Gestalt laws of visual organisation that are relevant to architecture. There are also two rules that have been more recently proposed and do not yet have the status of laws. The four laws are: the law of closure; the law of good continuation; the law of proximity; and the law of similarity. The two rules are: the rule of common region; and the rule of connectedness.

The law of closure

The law of closure states that any part of the visual field that is surrounded by a closed contour will be perceived as ‘figure’ standing out from the ‘ground’. Contours are created by abrupt changes in brightness, colour or texture. Therefore, the more the building contrasts with its background in these respects, the stronger will be its figure quality.

Our visual system is very good at completing contours on the basis on partial information (Fig 4.1), and this is the basis of many well-known optical illusions. Most of these illusions depend on information about changes of direction, or corners, being provided. It follows that ‘sharpening’ the corners by adding ornament to them will increase the strength of the contour. The contour itself can be strengthened further by adding parallel lines to it. Mouldings around contours and various forms of ornament at corners are traditional architectural devices (Fig. 4.2).
The law of good continuation

Good continuation is a harder concept to grasp than closure. It may be thought of as the predictability of one part of the contour on the basis of the other parts. Straight lines or smooth curves have better continuation than zig-zag lines. Oblique angles or right angles have better continuation than acute angles.

Good continuation can apply to the whole form of a building or an element as well as to its contours. It is the psychological drive to extend or complete directional shapes that gives skyscrapers their vertical thrust and buildings such as Mendelsohn’s Shocken department store (Fig. 4.3) or Wright’s Guggenheim Museum (Fig. 4.4) their sweeping power.
The law of proximity

Visual elements that are close together tend to form a group. This law applies to groupings of buildings rather than single buildings. For symbolic reasons, it is often desired to unify a group of buildings that house related activities. Le Corbusier’s government complex at Chandigarh in India (Fig. 4.5) has often been criticised because it lacks visual unity; the buildings are simply too far apart. The most obvious architectural examples of the use of the law of proximity are to be found in the arrangement of windows. A particularly striking example is the grouping of small windows in the entrance façade of Le Corbusier’s chapel at Ronchamp (Fig. 4.6).

The law of similarity

Visual elements that are similar tend to form groups. This applies whether the similarity is of shape, tone, colour or texture. This law is of the greatest importance in architecture. It is the basis for a wide range of unifying devices.

Self-similarity strengthens the visual unity of a building. Self-similarity of shape is achieved through symmetry (see 4.2.11) and through the use of proportional systems (see 4.2.29). Uniformity of tone, colour and texture likewise produces self-similarity. If a building has strong self-similarity or unity, while at the same time contrasting with its surroundings, it will have high figure quality. (It should be noted that self-similarity here does not have the same meaning as in mathematics.)
The rule of common region

Draw two free shapes at random on a sheet of paper. While their shape and position may not connect them in any way, the boundaries of the sheet of paper define a ‘common region’ which ensures that they will be perceived as having some relationship (Fig. 4.7). The relationship can be strengthened by drawing a third shape that contains the two original ones.

This rule is often applied in the design of façades, particularly in the grouping of windows (Fig. 4.8). ‘Regions’ may be defined by linear projections or recesses or by lines or fields of contrasting colour or texture.

The rule of connectedness

Once again, draw two shapes at random. Now draw a single line connecting them. Again, the visual connection between them is strengthened. This rule is also often used in architecture. Elements such as windows may be visually connected by linear mouldings such as string courses (Fig. 4.9).

Symmetry

When architects use the word ‘symmetry’ they usually mean bilateral symmetry or symmetry about a vertical axis. This is certainly a very common architectural device, but it is not the only kind of symmetry or the only one used in architecture. Symmetry is a complex subject, whether it is treated mathematically (Weyl 1952; March and Steadman 1971) or primarily from the point of view of pattern and ornament.
(Jones 1856, 1982; Stevens 1980). For example, there are seven different kinds of ‘band symmetry’ (Fig. 4.10), or patterns that can be used to make a strip of ornament like a frieze, and seventeen kinds of patterns that can be used to cover a surface such as a tiled floor. Here only the four basic operations that generate symmetrical patterns are introduced, with examples of their applications in architecture. A further exploration of symmetry is an excellent topic for an early studio (see 5.3.)
Translation

Translation is the simplest of the symmetry-generating operations. The ‘motif’ or basic element of the pattern is moved in a straight line, horizontally, vertically or diagonally. This operation is repeated, with a constant distance of movement, to generate the pattern. The motif can be any shape at all. Rows of windows are simple examples of translational symmetry (Fig. 4.11).

Rotation

In the case of rotation, the motif is moved around a fixed centre. The rose windows of Gothic cathedrals illustrate rotational symmetry (Fig. 4.12).
4.2.14

**Reflection**

The operation of reflection consists in forming a mirror image of the motif about a generating line (Fig. 4.13). The generating line may be vertical, horizontal or oblique. Bilateral symmetry is generated by reflection; its use in architecture has already been noted.

![Reflection](image1.png)

Figure 4.13
Reflection – Salk Institute (1959–65)
Louis I Khan

4.2.15

**Glide reflection**

Glide reflection involves a reflection followed by a translation. Glide reflections are often found in fabric and wallpaper designs. Architectural examples are rare, but not unknown (Fig. 4.14).

![Glide reflection](image2.png)

Figure 4.14
Glide reflection – Carpenter Centre (1956–63)
Le Corbusier

4.2.16

**Symmetry in plans**

All the forms of symmetry have been used in planning buildings that involve repetition of a basic grouping. Stevens (1980, p. 7) gives the example of the housing development at Pessac by Le Corbusier, which actually uses all four in the one development (Fig. 4.15). Other examples are given by March and Steadman (1971) and Ching (1979, 1996).
Proportion

Proportion is almost the only aspect of aesthetics commonly referred to in books on architecture. There are historical reasons for this, which are not necessarily good reasons. However, ideas about proportion are very deeply embedded in the culture of architecture, and this is the reason for discussing it at some length here. Proportion has three
aspects: technical, mystical and aesthetic. The technical aspect has long been superseded and is largely forgotten. However, it is necessary to understand it in order to avoid the trap of the mystical and to make good use of the aesthetic.

**Setting out the work**

It is difficult today to imagine how hard it was to set out a large building in ancient or even medieval times. There were no precise measuring instruments and no standardised measures. Precision could be achieved in levelling using ditches full of water, and in alignment using sight lines and plumb levels, but not in dimensions. There were *approximate* measures: the foot, the palm, the cubit and so on. However, these names meant what they said. One person’s foot differed from another’s, and even if it was possible to enforce a standard foot on the one job, it would not apply in ordering materials from a distance. Further, there was no way to make a dimensioned drawing in advance.

**Technical proportion**

It was much easier to take one part of the work, a column diameter, say, as a standard dimension, and then relate all the others to it as multiples or fractions (Fig. 4.16). The multiples and fractions could be arrived at geometrically, and somebody who knew the rules could derive the size of any building element from any other. So it was only necessary to cut a template of the column base and everything else followed. If the building dimensions were fixed, the size of the column base could be calculated from them.

This is what Vitruvius is talking about when he says, ‘Proportion is a correspondence among the measures of the members of the entire work, and of the whole to a certain part selected as a standard’ (10 BC, III, I, I). Proportion in this sense was not confined to the classical West. Similar systems are found in ancient China and India, and the technical use of proportional systems continued through the Renaissance and disappeared only gradually in the seventeenth and eighteenth centuries.
**Proportion and structure**

For the users of proportional systems, there were no separate structural calculations. Structural calculation as we know it was an invention of the nineteenth century. This does not mean that architects of the past were incapable of thinking critically about structural issues. Alberti (1486, 1988), for example, rejected the advice of ‘the ancients’ that the central opening in a colonnade should be ‘one quarter part’ wider than the rest. He said that this did not conform with the buildings he had measured, and that such a long lintel would be likely to crack under its own weight (book 7, ch. 6, p. 200).

**Proportion and appearance**

Just as it determined the sizes of structural members, so the proportional system established the overall appearance of the building. Here again, however, the results were not considered to be beyond criticism. Vitruvius warns of the need for adjustments to be made by eye in various circumstances (book VI, ch. II).

**Mysticism and proportion**

Given the number of things that proportional systems achieved simultaneously, it is hardly surprising that they should have been regarded as in some way magical. This mystical view of proportion was reinforced in the classical world by a tradition that began with the school of Pythagoras. According to legend, the scholars discovered the relationship between musical harmony and the length of string in stringed instruments. They certainly developed a theory that the universe was composed of numbers in harmonious patterns. Vitruvius illustrates this idea of a proportional harmony running through nature in his well-known discussion of the proportions of the human body (book III, I, 1–6). He draws the analogy with buildings and particularly temples.

Proportional systems were also linked with magic. A late classical author, Mercurius Trismegistus, wrote that Egyptian sculptors had made statues of such perfect proportions that they came to life, because so perfectly proportioned a body could not be without a soul. Even in the Renaissance, proportion retained these magical associations. It has been
suggested that this is the reason that Palladio is less clear in his text about the proportions of his buildings than one might wish (Yates 1966; Palladio 1570, 1965).

**Modern mysticism**

It might be expected that the mystical tradition of proportion would have died out along with the technical. On the contrary, it underwent a strong revival in the mid-nineteenth century. This revival seems to have been started in the 1850s by a German author, Zeising (Scholfield 1958). Zeising, like many writers after him, saw the ‘golden section’ ratio as underlying everything, both in nature and in art.

**What is the golden section?**

The golden section is easy to construct geometrically (Fig. 4.17). Draw a square. Find the mid-point of the base, and using it as a centre and the distance from that part to the top corner of the square as the radius, draw a circle. Extend the base of the square to meet the circle. Erect a perpendicular at that point and extend the top of the square to meet it. The resulting rectangle is a golden section rectangle and its sides are in the golden section ratio of 1:1.618.

This rectangle has the property of ‘nesting’ (Fig. 4.18). If you draw a square on the long side, you get another golden section rectangle. Similarly, if you draw a square inside the small rectangle in the original construction at either end, the remainder is another golden section rectangle. Thus, repeated constructions can generate a series of rectangles of the same shape but different sizes, all related to each other.

**The Fibonacci series**

For buildings that are set out with measuring tapes rather than by geometrical constructions, a ratio of 1:1.618 is clearly impractical. However, a whole-number approximation to the repetition of the golden section ratio is given by successive pairs of the Fibonacci series 0, 1, 1, 2, 3, 5, 8, 13, 21 ... The higher pairs of numbers give better approximations. The Fibonacci series is the basis of the Modulor, a system of proportion developed by Le Corbusier (1961) (Fig. 4.19).
The golden section in nature

The claims of the golden section to mystical power are often supported by assertions that the golden section itself and more especially the Fibonacci series are to be found in nature. The work of D’Arcy Wentworth Thompson is often quoted in support of this. Thompson (1917, 1961) did indeed carry out one of the very few serious investigations relevant to such claims. He examined the occurrence of logarithmic spirals in animals. There are many logarithmic spirals; the golden section is derived from one of them.

Thompson found that the logarithmic spiral ‘is characteristic of the horn, of the shell, and of all other organic forms in which ... each successive increment of growth is similar, and similarly magnified, and
similarly situated to its predecessor’ (p. 185). However, he points out that in the spiral forms of shells and horns it is possible to inscribe an infinite number of different logarithmic spirals. The golden section is in no way special. Nor does he support the idea that the logarithmic spiral is ‘the curve of life’, as it is sometimes described. On the contrary, he concludes expressly that ‘the logarithmic spiral is characteristic, not of the living tissues, but of the dead’ (p. 187). The regularity with which Thompson’s findings are misrepresented is a sign of the religious fervour that often seems to affect advocates of proportional systems.

The golden section in history

The historical evidence for the widespread use of the golden section is equally shaky. The geometrical construction was certainly known in ancient Greece, and was reintroduced to the West when the geometrical books of Euclid were translated from the Arabic in 1354. However, Scholfield (1958), whose history of proportion remains the most comprehensive and thorough, observes that ‘the importance of the golden section in the Renaissance has been much exaggerated, and the evidence for its use in Greek design is entirely indirect’ (p. 98). Scholfield concludes that, historically speaking, the golden section as an architectural device is a nineteenth-century invention.

Modern attempts to demonstrate the use of the golden section in earlier buildings have been severely criticised by Alexander (1959). Such demonstrations are usually based not on surveys of the actual buildings but on fitting geometrical constructions to small-scale photographs and drawings. Using these methods, it is easy to adjust the geometrical analysis to fit the theory.

The golden section and psychology

Is the golden section rectangle in fact a preferred shape? This question was the subject of some very early psychological experiments, carried out in the 1860s by Gustav Fechner. Fechner found a preference for the golden section rectangle, and his findings are often quoted. However, the range of opinion was quite wide and subsequent experiments have shown even wider ranges, or in some cases no marked preference for
the golden section at all (Zusne 1970). Recently, a special issue of the journal *Empirical Studies of the Arts* republished Fechner’s original study, together with a number of new experimental investigations (Höge 1997). None of the new experiments showed any significant preference for the golden section. Cross-cultural experiments have found preference for other shapes (Pickford 1972). Such critical findings are seldom referred to. Once again, there seems to be an element of deliberate misrepresentation among the advocates of the golden section. What may be guessed is that people generally prefer rectangles whose sides stand in a clear rational relationship: 1:1; 1:2; 1:3, 1:4. Beyond 1:4, directional dynamics replace relationship. On this hypothesis, which is certainly not proved, proportions between 1:1.4 and 1:1.6 will be liked because the sides are clearly unequal but have no obvious relationship. Dynamic shapes – that is, bands, strips or ribbons with proportions markedly greater than 1:4 – will also be liked provided that the dynamics are controlled (see 4.2.38).

**Proportion and self-symmetry**

The evidence that the golden section has any magical or universal properties is weak. This does not mean that it, or systems derived from it, such as the Modulor, are useless. Earlier it was pointed out that self-similarity strengthens the visual unity of a design. The use of the golden section, or other proportions that have similar nesting properties, such as the ratio of the side of a square to its diagonal, ensures the repetition of similar shapes at different scales and thus both the unity and the definition of the design.

**Visual complexity and buildings**

The perceived complexity of a building can be attributed to two aspects: its silhouette, and the articulation or subdivision of its façade. The two are not wholly independent. In accordance with the law of Pragnanz, changes in the profile such as symmetrical steps may generate ‘virtual’ subdivisions. However, a given profile can accommodate a wide variety of subdivisions. The perceived complexity of buildings depends very largely (but by no means solely) on the intrafigural variables as defined by Berlyne (1971): number of elements, variety of elements, asymmetry
of shape of elements and asymmetry of arrangement of elements. Apart from the number of elements, it will be seen that these variables are generally ways of breaking the law of similarity.

**Number of elements**

The complexity of a silhouette (Fig. 4.20) can be increased by increasing the number of facets or visible subdivisions of which it is composed. This involves increasing the number of sharp changes of direction, in the form of corners or re-entrant angles. Silhouette complexity can also be increased by adding ornamental projections.

Façade complexity (Fig. 4.21) can be increased by increasing the number of subdivisions. In a classical façade, this can be done by increasing the number of columns. In a curtain wall, increasing the number of framing elements has a similar effect. Similarly, increasing the number of openings in a masonry wall increases visual complexity.

However, there is a very definite limit to the increase in perceived complexity that can be achieved by these means.
Miller’s limit

Miller’s limit for the general population is given by the ‘magical number seven, plus or minus two’, to quote from the title of Miller’s famous paper (1956). More than about five or six things cease to be a specific number and become ‘a lot’. Thus, in some situations, more can actually be less. A large field of similar subdivisions may read simply as a single element covered by a uniform texture.

Architects have often intuitively respected Miller’s limit. Tripartition – dividing into three – is a very popular form of subdivision and was formerly one of the rules of thumb of classical architecture, applied both in massing (see 4.6) and in the details of, for example, the entablature (Fig. 4.22) (Tzonis and Lefaivre 1986). Miller’s limit can be evaded, but to do so requires an understanding of the interactions of order and complexity (see 4.2.47–49).

Variety of elements

Silhouette complexity can be increased by varying the size, slope and curvature of the building lines. Façade complexity can be increased by varying the shapes, colours, textures and internal complexity of the elements used. The classical tradition assigned different orders, Doric, Ionic and Corinthian, to different floors, and often systematically varied the pediments and other details of windows.

For both technical and practical reasons, the façades of many large modern buildings lack variety; the same elements are repeated indefinitely. Attempts have been made to overcome this by introducing arbitrary subdivisions or colour changes. Most such effects look like amateur fancy-dress.

Asymmetrical elements

Asymmetrical elements are unusual, because they are difficult to make and to assemble and therefore expensive. Nevertheless, both asymmetrical silhouette elements and asymmetrical façade elements have been used in certain periods, notably the Rococo and the Art Nouveau. A striking example that combines both is Gaudí’s Hotel Batllo
in Barcelona (Fig. 4.23). More recently, Frank Gehry has designed buildings that are irregular in silhouette and comprised of irregular elements (Fig. 4.24); it is noticeable that these complex set pieces are often ‘false fronts’ to more conventional buildings.

Asymmetry of arrangement

In contrast to the use of irregular elements, asymmetry of arrangement is extremely common. Its conscious use in the European architectural tradition begins with the Romantic Movement of the late eighteenth and early nineteenth centuries, and somewhat earlier in China and Japan. Even very tall buildings are now quite often asymmetrical in their design. The Sears Tower in Chicago was one of the earliest examples (Fig. 4.25).

It is perhaps not easy to see how asymmetry of arrangement can be combined with any kind of overall order. This question can be answered in terms of perceptual dynamics.

Perceptual dynamics

The Gestalt psychologists emphasised that perception is a dynamic, active process, not a static, mechanical one. This intuition has been supported by subsequent investigations. This internal, mental activity
is projected onto the perceived physical environment as perceptual ‘forces’. Many aspects of the visual arts can best be explained in terms of such ‘forces’ (Arnheim 1954, 1974, 2004). Architecture provides many clear examples.

Dynamics can be explained but not quantified. Neither will explanation alone give you a ‘feel’ for perceptual dynamics. This can only be acquired by the critical study of examples, with the aid of authors such as Arnheim (1977, 1988) and by persistent trial and error in your own work.

**Directions**

There is an inherent asymmetry in our experience of the world (Arnheim 1977). The vertical is privileged by the action of gravity, and this defines other directions. Vertical lines are stronger, more ‘visible’, than horizontal lines. All visual elements, even painted ones, have ‘weight’, an implicit tendency to move down within their frame of reference, whether it is a painting or a building façade.

Besides, as previously discussed (4.2.6), contour lines tend to continue themselves, and whole buildings can develop ‘direction’ if their proportion is much more than 2:1 in either the vertical or the horizontal direction. If such directions are emphasised, for example by lines of windows or by projecting columns or beams, the dynamic effect can be very strong.

**Controlling directional dynamics**

If such directional dynamics are not appropriately controlled, unfortunate visual effects can result. Columns that do not have a base or a capital tend to look weak, as if they might ‘punch’ through the surfaces above or below them. The only classical column that does not have a base is the Greek Doric (Fig. 4.26), which narrows more towards the top than the other orders. This narrowing creates an upward dynamic that balances the downward thrust. Similarly, traditional buildings have a projecting ‘basement’ to stop their junction with the ground, and a cornice at the top. Arnheim (1977) has pointed out that the lack of any basement makes the baptistery at Pisa (Fig. 4.27), with its strong decorative top, appear to be pushing out of the ground like a
giant head of asparagus. However, such dynamics can be ‘closed’ by recesses as well as projections.

What is important is breaking the line. Thus, many modern buildings, such as Le Corbusier’s Villa Savoye (Fig. 4.28), achieve a similar purpose by recessing the ground floor or the foundation, so that the building appears to ‘float’. Similarly, the dark underside of a projecting canopy is sometimes substituted for the traditional cornice to stop a vertical thrust that would otherwise run weakly off into space (Fig. 4.29). A less elegant solution is to use the blank or differently patterned mass of a plant room as a closing element. The spires of Gothic churches (Fig. 4.30) or of the Chrysler building offer another kind of solution; the converging lines create a visual focus sufficiently strong to ‘stop’ the vertical movement.

Horizontal dynamics can equally run weakly off into space. Stopping devices include changes in fenestration at or near the ends, and projections. Projecting stairs are often used as closing devices (Fig. 4.31). Visible returns such as those of sunshades or verandahs also seem to work as ‘stops’.

Figure 4.28
Villa Savoye (1928–29)
Le Corbusier

Figure 4.29
Sir Norman Foster

Figure 4.30
The spires of a Gothic cathedral: converging lines create a visual focus to ‘stop’ the vertical movement
Balance

Bilateral symmetry is the simplest form of balance. However, asymmetrical compositions can also be balanced if their visual weight is properly distributed (Fig. 4.32). Arnheim (1954, 1974, 2004) has identified a number of factors that contribute to the visual weight of an element. Those that are especially applicable to architectural elements are size, shape, direction, intrinsic interest, isolation and colour.

The larger an element is, the heavier it is. The stronger the gestalt of the shape, the heavier it is likely to appear. For reasons already discussed, vertical shapes are heavier than horizontal ones. ‘Intrinsic interest’ is equivalent to complexity of detail or amount of information. The more, the heavier. Isolated elements appear heavier than grouped elements. Colour is, as has previously been argued, an unreliable device in architecture; however, according to Arnheim, bright colours are heavier than dark ones.

Vertical balance

If you divide a vertical line in half by eye, the chances are that you will place the division too high. Similarly, the visual centre of a square or a taller rectangle is slightly above the geometric centre (Weber 1995) (Fig. 4.33). This partly accounts for the tendency of architects to divide tall buildings into segments that diminish in size towards the top, in both length and width. Besides, this device contributes to a vertical crescendo of visual interest and at the same time helps to stop the vertical thrust of the whole.
4.2.41

Centres

The visual centre of any shape is an important point aesthetically (Arnheim 1988). There is therefore an impulse to ‘fill’ it with some visible element. This impulse is stronger in the case of more compact shapes, such as the square, than in more elongated shapes. It is also stronger in the case of vertical shapes than in horizontal ones. Filling the centre makes for a static composition. Leaving it empty and balancing other elements around it creates greater tension and interest, but it is more difficult (Fig. 4.34). Finally, the centre can be weakened or even suppressed by subdividing the area with a strong directional emphasis.

Arnheim (1988) has treated the compositional task facing the architect as the resolution of a struggle between the grid, for example the structural grid, which is in principle endless, and the centre, which gives the building force and unity.

4.2.42

Forms of order

Balance is an interaction between elements that can produce order combined with more or less interest, depending on how it is used. It thus provides an introduction to the question of general systems of organisation, or forms of order. Here, Arnheim (1966) has again made a major contribution. He identifies four forms of order: homogeneity, coordination, hierarchy and accident. These forms of order can vary in their rationality and definition.

Rational and irrational order

Rational forms of order are those that conform to some ratio or rule. Symmetry and proportional systems are the main forms of rational order used in architecture. Rational forms of order rely on the law of similarity (4.2.8).

Irrational forms of order rely on the basic ordering principles of perception other than the law of similarity. Rational forms of order are sometimes described as ‘classical’ and irrational forms are sometimes described as ‘romantic’.
**Definition**

Definition is a term invented by Arnheim (1966); in his own words, it is ‘the extent to which the overall order is carried through in the parts’. If the same kind of ordering principle is used in the general massing of the building, in the elevations and in the critical details, and is carried through into the working drawings, then we have high definition. High definition is equivalent to ‘good detailing’ used as a term of aesthetic, not technical, approval in the architectural profession. Studio tasks are seldom carried through to the point at which definition becomes an issue.

**Homogeneity**

Homogeneity is an important tool of urbanism, but less important in the architecture of individual buildings. Homogeneity is achieved by giving all the visible elements some common quality, such as colour or texture. Traditional towns and villages often gain their apparent unity from homogeneity. ‘Planned’ cities, such as Canberra or Washington, may restrict the colours of buildings by regulation. In the architecture of individual buildings, homogeneous treatment of surfaces helps to form a background against which significant elements can be made to stand out.

**Coordination**

The principle of coordination is expressed in the saying ‘A place for everything and everything in its place’. Coordination is characteristic of furniture arrangement in most private houses, and of engineering design. The term ‘colour coordination’ implies that the relationship of the various colours has been considered to the extent that they do not interfere or clash with each other.

Coordination may be rational or irrational. Rational coordination in architecture is illustrated by the typical glass curtain wall (Fig. 4.35), or the layout of houses in a grid-plan suburban subdivision (Fig. 4.36). Vernacular buildings of many cultures display irrational coordination (Fig. 4.37); the placing of openings is considered, both practically and visually, but there is no overriding order.
Homogeneity is an inherently simple form of order. Coordination is also very limited in its complexity. Since every element is given equal importance, Miller’s limit applies to coordinated designs, however high their definition. For the same reason, coordination is an inexpressive form of organisation; no theme other than equality can be identified. It
is for this reason that coordination is the usual form of order found in the façades of ‘serviced space’ buildings. In order to cope with complexity of form and content, it is necessary to make use of hierarchy.

**Hierarchy**

Hierarchy is a form of order based on the dominance of some parts over others. A visual hierarchy can be created along any visually distinguishable dimension: size (larger and smaller); space (container and contained); tone (light and dark); colour (more or less saturated); sequence (earlier and later); and more. These dimensions can be combined to give a very obvious and powerful hierarchy. They can also be played against each other to produce secondary or counter-hierarchies.

Hierarchies can be rational or irrational. In rational hierarchies the intervals between the various parts are, perceptually at least, equal or related by some intuitively simple rule. Proportional systems generate rational hierarchies – elements of the same shape but different sizes. Rational hierarchies can also be generated by interlocking symmetries, as in a tartan pattern. The classical tradition in architecture is based on rational hierarchies: Palladio’s villas are paradigmatic examples (Fig. 4.38).

![Rational hierarchy – Villa Zeno Al Donegal Treviso (1558–1566) Andrea Palladio](image)
Irrational hierarchies are typical of the romantic tradition. Examples are found in the work of Arts and Crafts architects like Voysey and the early Lutyens. Le Corbusier’s chapel at Ronchamp (Fig. 4.39) is a good example of irrational hierarchy, as are many of the art galleries designed by Richard Meier. (Bear in mind that irrational as it is being used here refers only to visual organisation.)

Hierarchies may be of high or low definition. Rational hierarchies demand high definition: the order must be carried through in all the parts, otherwise the effect will be sloppy and careless. The work of the great Baroque architects, Michelangelo, Bernini and Borromini, illustrates high-definition rational hierarchy.

**Hierarchy and complexity**

Hierarchy can accommodate an almost indefinite amount of complexity. At each scale or level, Miller’s limit will apply; but each of the elements defined at one level can be further subdivided, and these subdivisions again subdivided. In a baroque interior, for example (Fig. 4.40), a wall may be divided by pilasters. Each division may contain an aedicule. Each aedicule may contain a niche. Each niche may contain a statue. Here, the hierarchy of scale runs one way, while the hierarchy of inherent complexity of elements runs the other way. The smallest elements are the most complex.
Similarly, in the irrational hierarchy of the Arts and Crafts-style English country-house (Fig. 4.41), elaborate roofs may dominate walls, while bays and towers dominate both and are themselves hierarchically composed in size, height and strength of visual organisation.

Hierarchy also opens the way for visual statements about what is important and what is not important. Hierarchy is the basic tool of expression.

**Accident**

Arnheim (1966) identifies ‘accident’ as the fourth form of order. It is a technical use of an ordinary language term. He defines accident as ‘irrational co-ordination with high definition’. Whether a separate term is needed is open to question. In this form of coordination, the overall order, though irrational, is very strong. There are high levels of homogeneity, closure and continuity, and considerable use of proximity to form groups of elements that may display irrational hierarchy. Within this overall order, the parts may be highly dissimilar in form, but each will also be characterised by a high level of irrational order.

Examples of accident are mainly to be found in gardens, particularly Japanese gardens. In architecture, accident may be seen in some Arts and Crafts window arrangements, which are indeed strongly
coordinated and highly defined. The work of Frank Gehry seems to aspire to accident as a form of organisation (see also 4.5.42).

Accident without hierarchy cannot control much complexity. The elements remain individual. However, accident is well suited to the organisation of complex sequential experiences, such as gardens, complex interiors, and picturesque urbanism. Here the hierarchy is one of time; succession provides a form of hierarchical order. This ‘story-telling’ element in accident makes it suitable for a narrative kind of expression: the arrangement of pavilions at an exhibition, for instance. In general, however, the experience of architecture is not a static one: exploration is involved.

**Exploration**

The impulse to explore is one of the key ideas of arousal theory. Exploration is governed by two opposing impulses: the desire to learn and the fear of the unknown. The trick in encouraging exploration is to make it appear that, without too much effort and without any danger of getting lost or trespassing, some new and interesting sight can be obtained. The Kaplans (S. Kaplan and R. Kaplan 1982) call this inviting quality ‘mystery’. Mystery in architecture is illustrated by a well-defined path that changes direction or level so that the distant view is cut off or partly cut off. The effect is strengthened if the change of direction is marked or framed by, say, a tower or an arch. Mystery is a form of complexity that involves not only perception but understanding and planning.

**Environmental preference**

The Kaplans (1982) summarise the factors that influence people’s environmental preference in a matrix or framework as follows:

<table>
<thead>
<tr>
<th></th>
<th>MAKING SENSE</th>
<th>INVOLVEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRESENT OR IMMEDIATE</td>
<td>Coherence</td>
<td>Complexity</td>
</tr>
<tr>
<td>FUTURE OR PROMISED</td>
<td>Legibility</td>
<td>Mystery</td>
</tr>
</tbody>
</table>
'Making sense' here is equivalent to feeling in control of the situation. ‘Involvement’ is the desire to look or to explore. This section has mainly been concerned with the present or immediate perceptual factors of coherence or order, and complexity. In the previous section, it was argued that because people’s needs differ, choice is an essential feature of a desirable environment. Present or immediate perceptual choice requires that the setting be able to be seen as either simple or complex. This sounds impossible, but it is easily achieved by the use of a hierarchical form of order in which the complexity is concentrated in the smaller and more detailed elements (see 4.2.49).

However, the preference grid also suggests that choices can be made about future actions. One can choose whether or not to ‘go and see’.

**Time and space**

Movement in time and space is an essential aspect of architecture. It is the theme of Giedion’s history *Space, Time and Architecture* (1941, 1949). The preference grid suggests that, just as preference in the immediately perceivable environment is influenced by coherence or order and complexity, so the tendency to explore is influenced by legibility and mystery. Legibility is associated with predictability. In a legible place or plan, the user will have little fear of getting lost. The visible parts of the setting imply ‘good continuation’ in the invisible. Mystery, on the other hand, offers the possibility of ‘something more’.

Different environmental intentions or goals call for different proportions of legibility and mystery. In 4.1.24 the distinction between specific goals, such as buying a carton of milk, and divergent goals, such as those of the tourist, was introduced. People in pursuit of specific goals will prefer a more legible environment, while people in pursuit of diverse goals will prefer a more mysterious one. No-one, however, likes being lost; the environment must always be basically legible.

**Disorder and ugliness**

Disorder, Arnheim (1977) has suggested, is not just lack of order. Simple lack of order will produce an homogeneous texture. *Disorder* results
from a clash of uncoordinated orders. Arnheim further identifies ‘ugliness’ as the consequence of disorder or of seriously damaged order. The ugliness of the modern city, for example, he sees as a consequence of the clash between the self-assertive orders of adjacent buildings. Arnheim (1977, ch. vi) argues strongly and convincingly against Venturi’s (1966) opinion that contradiction can be characteristic of aesthetically successful architecture.

Ugliness can be highly arousing. Stimulus seekers may seek ugliness. Freak shows have a following. Architecture, however, is permanent and public and to inflict ugliness on the public without their consent is, if not a crime, at least a misdemeanor. Recall the arousal/preference matrix shown in 4.1.21. Arousal is not always desirable.

**Form and content**

Experience is not solely a matter of perception. Even perception is not a matter of some kind of mechanical photographic process: perception organises, completes, and extends though imagination. The urge to explore requires imagination. Experience, however, also includes the interaction of the perceived present and the remembered past. What is perceived is understood and interpreted in terms of what is remembered.

This section has dealt with form. Form is what is perceived. It has perceptual order and perceptual complexity. However, understanding and interpretation, based on memory, add another level to experience: the content of the form. Content has its own order and its own variety. In fact, the evidence is that content has more influence than form on people’s responses to buildings. If the content and the form do not match, there is a clash of orders and ugliness of a more disturbing kind. The next section considers issues of content and of the relation between form and content, or *expression*. 
Symbolism, expression and style

Content and values

The previous section was about form. This section is about content and its relation to form. What is the content of architecture? This book, as explained in Chapter 1, is based on a constraint model of design. Constraints, it has been argued throughout, are the values of the actors concerned: architects, clients, users, the general public. On this basis, the content of architecture is the total of these constraints or values. Since these values largely originate outside architectural practice, this section takes a broader view of the context of architecture. It is aimed more at giving an understanding of the ways in which architecture develops in its social and historic context than at immediate practical application. Such an understanding is, however, necessary for the intelligent interpretation of past examples.

Symbolism

Something can be understood as a symbol of something else if it has characteristics or features that are in some way like those of the thing symbolised. Symbolism can be banal and obvious, such as a duck-shaped drive-in for, presumably, buying cooked duck (Venturi, Scott-Brown and Izenour 1972). Symbolism can also be subtle. Vitruvius tells us that the robust Doric column has the proportions of a man, the more slender Ionic those of a mature woman, and the Corinthian, which is the most slender of all, those of a young girl (10 BC, IV, I, 5–8). From this, it follows that different orders are appropriate to the temples of different gods, and to different kinds of public building. As this example from Vitruvius suggests, the more subtle the symbolism, the more background knowledge may be needed to interpret it correctly.

Signs

Symbols should not be confused with signs. The connection between a sign and the thing signified is arbitrary. There need be no likeness or common features between them. Words are signs of the things they
describe. The Red Cross is a sign of medical help; it has no analogy with medical help and is therefore not a symbol of it. A picture of a person in a nursing uniform *would* be a symbol of medical aid.

**Failures of symbolism**

When the knowledge necessary to interpret subtle symbolism is not shared, symbols can function only as signs or not at all. Attempts by some postmodern architects to use traditional architectural elements as symbols failed in this way. The people at whom they were aimed could not interpret them (Groat 1982).

Even symbolism that is understood may not be successful. Giant ducks or pineapples may be acceptable as sales outlets. Their crudity and directness fit the simple commercial activity. Is this true, however, of the French National Library, which takes the form of a group of gigantic open books? The issue here is one of what Vitruvius would have called ‘propriety’.

Such issues cannot be explored in detail here. The whole question of symbolism is a suitable one for discussion in the studio. A useful starting point is Lang’s paper ‘Symbolic aesthetics in architecture’ (1988). This section will go on to consider symbolism in the context of expression.

**Expression**

The process of establishing a match between the form of a building, the activities designed for, and people’s values in relation to those activities are here called ‘expression’. Symbolism and expression are often used to mean the same thing; here, however, symbolism is used to describe the relationship or match, and expression is the process by which it is achieved.

The importance of expression has already been indicated (4.2.55). If the visible form of a building contradicts people’s attitudes and values in relation to it, they will have difficulty in liking it and perhaps in using it.
Expression and content

At the beginning of this section, it was suggested that the content of a building is the total of the constraints or values involved. Clearly, however, not all of these constraints can be given equal weight visually, in some kind of coordinated order. Any attempt to do this would run up against Miller’s limit (see 4.2.32). Like all the other aspects of architecture discussed, the visual expression of the building’s content must be governed by hierarchy. Some things are more important than others and must accordingly be more visible.

There is an ethical issue involved in the expression of any hierarchy. As Arnheim puts it, ‘of necessity order is coercion’ (1977, p. 198). However, there is a great difference between an order arbitrarily imposed by an architect and an order that expresses the balance of values actually operating in the situation designed for.

Kinds of content

As a first step towards establishing the hierarchy of content for a particular design, it may be useful to consider what different kinds of content may need to be expressed. Five main types of content can be identified: propriety, function, behavioural cues, status and technology.

Content: propriety

The Vitruvian term ‘propriety’ has already been introduced. It is often demanded that a building should look like what it is. The most effective way of achieving this is to incorporate the essential elements of the popular conception, or prototype, of that kind of building (see 4.1.29). However, this will not work if there is no such prototype, or if the designer does not understand the prototype or does not know what the essential elements of the prototype are. Intuition is not a reliable guide here, and there has as yet been little research.

Content: function

In public buildings, particularly, it is often desirable that the form of a building convey information about how it is to be used. For example,
from the outside the entrance should be easily identified. In the interior, paths and changes of direction should be clearly marked, and the public areas distinguished from the private. The means of obtaining such objectives are largely those of 'levelling' and 'sharpening'.

**Content: behavioural cues**

Again, in public buildings rather than private, the appearance of the building can give people clues about the kind of behaviour that is expected. The issue is one of arousal level and amount of stimulation. In some buildings, law courts for example, formal controlled behaviour is expected and the setting usually reinforces this. In a nightclub, on the other hand, the objective is to encourage people to behave in uninhibited ways, and the setting is correspondingly stimulating.

**Content: status**

Buildings of all kinds are designed to express the status of the people or activities that they house. Since status is an hierarchical concept, it is mainly expressed through hierarchical forms of order (see 4.2.48).

**Technology as content**

One of the widely held beliefs of the Modern Movement was that technology, and particularly structure, should be expressed. This idea, which is still current, should not be accepted uncritically. The position taken here is that successful expression must be selective or hierarchical. The content emphasised should be important for the audience. Is technology important in this sense? It is arguable that it is not.

Like many ideas that have become conventional, this idea is best understood in terms of its origins. Disguising steel- or concrete-frame construction within the traditional forms of masonry buildings was common in the later part of the nineteenth century and in the early twentieth century. There were economic and aesthetic disadvantages in doing this. At the time, therefore, it made sense to argue against such disguises. Today, we might say, as Ruskin said in the nineteenth century, that the architect is not bound to exhibit structure, but 'that building will
generally be the noblest, which to an intelligent eye discovers the great secrets of its structure’ (1849, ch. ii, vii).

**Expression and style**

Expression and style are strongly linked. In a mature, established style, expression is easy, because on the one hand the techniques of expression are established and on the other hand the relevant audiences have learned stable prototypes for the common kinds of building (see 4.1.29). Architects can concentrate on refinements rather than having to work everything out from scratch. Their audience can ‘see’ quite subtle symbolism. Style is thus often seen as desirable.

The *honorific* use of ‘style’ follows. Things are said to be done with style or stylishly when the basic performance has been thoroughly mastered and results are obtained with apparently effortless elegance.

**Style and identity**

The word ‘style’ derives from the Latin *stylus*, a pen. It originally referred to the tricks of letter formation by which a writer could be identified. Later, it was extended to literary expression. The notion of the expression of identity as content runs through all the uses of ‘style’. Thus, people talk about the style of an individual, the style of a group or school, the style of an institution, the style of a geographic region, natural styles and historic styles. Because style is such a widely used and important idea in aesthetics, it is explored here in some detail.

**Style defined**

Archaeologists use style in artefacts both to identify past cultures and to trace their development over time and their geographical spread. Therefore, they have given special attention to the definition of style. According to one such definition, a group of buildings can be said to have a common style if (1) each of the buildings has a (large) number of features in common with all the others, (2) each of the common features is found in a (large) number of the buildings in the group, and (3) no single feature is found in every building of the group (Davis 1990).
4.3.16

**Common features**

The foregoing definition of style can be illustrated by reference to Frank Lloyd Wright’s ‘prairie’ houses. Some of the features that recur in these houses are:

- a ‘pinwheel’ plan, in which the axes are offset
- hierarchical massing, rising to a dominant central chimney
- strong horizontal lines, with bands of roof, casement windows and solid wall
- deep roof overhangs achieved by the use of concealed steel framing
- use of decorative lead-lighting in geometric patterns in the windows
- stained timber structure and trim.

This is not a complete list. Hildebrand (1991) lists thirteen features that characterise Wright’s house style. However, it indicates the main kinds of features that go to make up style, whether it is an individual, a regional or a national style: organisation of the plan, scale, massing, division of the façade including proportion, technology, and the use of materials and ornamental detail.

4.3.17

**Computers and style**

A mature architectural style involves the arrangement of a limited set of features according to a limited set of organising rules or principles. It is thus possible to program a computer to design in accordance with an established style (Mitchell 1990). This is much easier to do if the style in question is based on a rational form of order (see 4.2.43) such as a proportional system (see 4.2.17). It is for this reason that the villas of Palladio were the first group of buildings to have their style transferred to a computer program (Stiny and Mitchell 1978a, 1978b). A computer programmed with these stylistic rules is able to generate not only the Palladian villas that already exist but also others that are not to be found in Palladio’s works but are recognisably Palladian (Mitchell 1990).

This achievement, which has since been repeated in studies of the styles of other architects, has important implications for the understanding of style. It also has implications for education and practice, though these are not so far-reaching as Mitchell (1990) argues. Some doubts and
questions about the stylistic, or ‘grammatical’, approach to design arise from thinking about how styles develop and are maintained. This issue will be pursued in this section.

**Unselfconscious and conscious style**

Anyone who engages in productive work, whether it is carving wooden spoons or writing books or designing buildings, develops habits and tricks, like the tricks of letter formation which gave style its name. Some of these habits save time and effort. Others are just habits, which may do no good or even some harm but are too much trouble to unlearn. This is the unselfconscious element in style. People do not, however, engage in productive work in isolation. They learn their trade, by apprenticeship or in school. They produce for a market or an audience. Employers, rivals and co-workers criticise their work. Thus, besides developing unconscious habits, they make conscious choices. Successful practices are retained and unsuccessful ones discarded. An architect will consciously develop a set of solutions to recurring problems of planning, massing and the rest, and then stick to them.

All style thus includes both conscious and unconscious elements. Christopher Alexander (1964, 1974) has argued that unselfconscious processes of design and production produce better results than self-conscious processes. However, it seems unlikely that design or production were ever unselfconscious in this sense (see 4.3.30). Style is not just an unconscious manifestation of habit: it is also a conscious statement of identity.

**Style and self-assertion**

At the beginning of this chapter it was argued that aesthetic behaviour is a basic and commonplace form of behaviour, but that it operates at different levels. Aesthetic behaviour of a more elaborate kind is involved in ‘making special’ (4.1.14). Similarly, the habits and choices that produce style include aesthetic habits and choices, operating both consciously and unconsciously. The aesthetic aspects of style can also be exaggerated to make special or emphasise the importance, value or identity of an individual, an institution, a region or a nation.
4.3.20

**Individual style**

Dissanyake (1992) suggests that self-adornment (that is, making oneself special by aesthetic means) is the earliest form of aesthetic behaviour. The aesthetic style of an individual’s products or designs can likewise act both to make the products more desirable and to advertise them. Possession of a highly recognisable and desirable artefact can in turn add to the status of the owner. People would wait for many years for Frank Lloyd Wright to design a house for them.

It is not only in modern, urbanised, mechanised societies that a well-defined aesthetic style has commercial advantages. De Boer (1990) remarks that the Shipibo-Conibo Indians of South America, who are great potters, ‘constantly evaluate pottery for its propriety and beauty’, and the economic success of the potter depends on this evaluation. Architecture arises only in more specialised societies in which such evaluation is already well established. Personal style is part of an architect’s stock-in-trade.

4.3.21

**Is individual style necessary?**

It is probably difficult to avoid developing an individual style. Individual style is a kind of imitation. An architect who constantly imitated the work of others without much thought might fail to develop any personal style. For a thoughtful and original architect, *avoiding* an individual style may require conscious effort. Eero Saarinen prided himself on developing each design on its own terms, without preconceptions: ‘the style for the job’. Great architects sometimes change their style or develop more than one style, either because the problems facing them change or because they grow bored. Some examples (among many) are Lutyens, Wright, Le Corbusier and Alvar Aalto.

This suggests that a personal style is not something that the student should either pursue or avoid. At first, imitating the style of a master may be enough (see 4.4). If you continue to work thoughtfully, making careful choices, then your personal style will gradually develop.
Regional styles

In traditional societies, individuals develop their personal style within the overall limits set by a local or regional style. Like the style of an individual, the style of a region is the result of conscious choices, imitation and habit. Regional styles are also often supported by beliefs and symbolism that link them to the other values of the society.

Regional styles have been explained in terms of the climate, an explanation that goes back to Vitruvius (10 BC, vii, i), and of poverty and isolation, which limit the availability of materials and of new ideas. None of these explanations is adequate. These constraints undoubtedly limit the range of likely choices, but they are not sufficient to explain the choices that groups actually make (Rapoport 1969). Regional building styles are a part of a whole way of life, and when it is disrupted they disappear.

Ever since the beginning of the nineteenth century, rapid improvements in communications have been dissolving regional styles by giving access to new technology, new ideas and new ways of life. With improved communication, change speeds up. The visual harmony that a common style brings is disrupted, and this is seen as symbolic of all the upsets that come with change. Both locals and outsiders who value harmony, or merely the tourist dollars that a distinctive regional character can attract, may fight vigorously to preserve the regional style.

The preservation of regional styles is encouraged by the nostalgia for an idealised and largely non-existent rural past which is characteristic of technologically advanced countries (Rowe and Koetter 1978; Abels 1986). This idealisation can be seen in writers such as Alexander (1964, 1974) and Rudofsky (1964). Regional styles are in fact by no means necessarily well adapted to climate, cheap to build, or ‘environmentally friendly’ (Rapoport 1969). Nostalgic efforts to preserve a regional style that is not suited to changed ways of life can result in disneyfication and an unauthentic environment (Rowe and Koetter 1978). The Aga Khan, through his awards for regional Islamic architecture, has given focus to the debate over regional styles.
Schools and movements

A ‘school’ of architecture in the stylistic sense forms around a charismatic leader, or sometimes around a group of friends of different but complementary abilities. In the former case, disciples imitate the master; in the latter, members of the group imitate and stimulate each other. The formation of a school depends on close personal contact and the development of common ideals. Often schools in this sense develop in or focus on educational institutions. Examples are the school of Wagner in Vienna at the beginning of the twentieth century, and the Brutalist school in England in the mid-twentieth century (Banham 1966).

A movement often develops from a school. The focus of a movement, however, is no longer an individual or a small group but a set of common concerns, beliefs and ideals. There will be admired and imitated leaders, but close personal contact between or with them is not the driving force of the movement. The Modern Movement of approximately 1925 to 1965 was the major architectural movement of the twentieth century.

It is often difficult to tell the difference between a school or a movement and a fashion (see 4.3.45). Movements are also sometimes invented by critics to account for observed tendencies, even in cases where many of the architects concerned would deny that they had any ideals or intentions in common. This seems to have been the case with the ‘postmodernist’ movement in architecture, which was largely invented by the leading critic Charles Jencks (1977), in an heroic effort to make sense of the various reactions against the Modern Movement in the latter part of the twentieth century.

Institutional styles

The leaders of social institutions, when they commission buildings, want those buildings to express the central values of the institution, and symbolise its identity. This is a matter of propriety (see 4.3.8). In the Renaissance, churches and palaces, representing the two kinds of power, were different in style, though linked by the classical tradition. In
modern times, banks and department stores have developed their own styles. The more competitive institutions are with each other, the more likely they are to assert themselves through the style of their buildings. Fast-food outlets are an extreme example.

**Religion and style**

Religious buildings are institutional buildings in which symbolic and expressive aspects are dominant. The Gothic was the institutional style of the Christian church militant. It is for this reason that such buildings are often chosen to exemplify the *art* of architecture. However, religious buildings are not necessarily good guides to the teaching and learning of architecture just because of the intensity of the symbolism involved.

Religious activity is often ritual activity. It is idealised and abstracted. In museums one can see exquisitely made Chinese jade sacrificial knives, which were never used and never could have been used because they are so thin that the blade would have shattered. They represent the idea ‘knife’ in its formal perfection. This is a cross-cultural phenomenon; similar developments have been observed in ceremonial axes in highland New Guinea (Wiessner 1990).

Examples of this kind of abstraction can be found in architecture. The Doric temple of the archaic and subsequent periods is a stone representation of a timber structure. The sacred form has been reproduced, so far as possible, in a different and in many ways unsuitable medium. Similarly, Vitruvius (10 BC) emphasises that in temples there must be no deviation from ‘symmetry’ or the traditional rules of proportion; the proportional adjustments that he allows in other buildings have no place in the sacred.

These examples are important because they illustrate the fact that the balance between form and content, symbolism and symbolised, idea and ideal is always a precarious one. Nations are highly abstract institutions and attempts to create national styles have suffered from problems of balance.
National style

National style is not much discussed today. Regional style attracts more interest. Yet from the seventeenth century up to the Second World War national style was a subject of constant and passionate debate in architectural circles in many countries (see, for example, Etlin 1991). Further research is needed, but some reasons for this change can be suggested.

National style as a self-conscious form of political self-assertion was invented at the court of Louis XIV. Versailles was its first monument. By privileging certain architects, and by the creation of the Royal Academy of Architecture, a national ‘school’ of architecture was deliberately created. As a propaganda device it was wildly successful and was imitated by other centralised states across Europe.

Now, the thing to note about this is that at the beginning of Louis XIV’s reign France was highly unstable politically and barely consolidated into a nation. The assertion of national unity and identity therefore had a high political priority. Similarly, Italy in the period Etlin (1991) describes was still newly unified and that unity was seen to need material symbols.

At the beginning of the twenty-first century, the wealthy industrialised countries all seem comfortably established. They do not need expensive physical symbols of unity. Developing countries, which are often newly established and politically unstable, do sometimes see monuments as important. However, their monuments are monuments to modernisation and development: dams, hospitals and public buildings imitating those of the developed countries. This may change as these countries become richer and more stable. It is possible to see the Aga Khan’s awards as encouraging the development of a national architecture within Islam, rather than regional architecture in the strict sense, for example.
Historic styles

Architectural styles, like living things, are born. They grow, change, compete and die. Like living things, they exist in a complex relationship with their environment, although their environment is a cultural one rather than a national one. Drastic changes in the environment produce major extinctions and the emergence of new styles. Cultural changes that in the past produced changes in architectural style include the rise and fall of empires, the economic growth and collapse of regions, and the introduction of new technology. These things are the stuff of history. Historic styles are effects of historic changes.

Architectural history

History, however, requires historians. Without systematic classification and dating, the architectural past is just a lumber-room full of a mixture of antiques and junk. That is almost literally the way in which European architects saw the architecture of their own past until at least the seventeenth century. There was the architecture of ancient Rome, which was actually known as the Antique, and was regarded as a valuable source of inspiration. The work of ‘modern’ (that is, post-Renaissance) architects who had rediscovered the spirit of the antique was also valuable. The rest was junk.

This situation changed dramatically in the eighteenth century. The story is too complicated to tell here. A key factor was the rediscovery of Greek architecture, the best of which had for centuries been inaccessible; Greece was part of the Ottoman Empire. The realisation that Greek architecture was very different from Roman architecture undermined conventional beliefs in a way which today is quite hard to understand. It caused an historical controversy that made architectural history into a field of research as attractive and important as computer applications are today.

The battle of the styles

By the beginning of the nineteenth century, a wide range of European and Asiatic architectural styles had been studied, recorded and
published. Architects had already begun to imitate exotic styles, if at first mainly in garden structures appropriately known as ‘follies’.

In the commercial atmosphere of the first half of the nineteenth century, architects exploited this wealth of new and readily available ideas in an unprecedented display of aesthetic self-assertion. They sold themselves as experts on particular styles. They also pressed the idea that particular styles were appropriate for particular kinds of buildings, Gothic for churches, Renaissance for clubs and banks, Egyptian perhaps for funeral chapels. Gothic was held out as being a more appropriate national style for England and France than Greek or Roman or Renaissance ‘revival’. The battle of the styles was both a commercial and an ideological battle.

**Mere building**

This battle of the styles was one of several factors that gradually caused style to be seen as an optional extra, or as fancy-dress applied to a building, rather than arising from the whole circumstances of its design. Another important factor was the rise of the engineering profession and the accompanying separation of engineering from architecture. This began in France during the eighteenth century (Picon 1988). If architects and engineers were no longer the same, what they produced must also be different. Engineers, it was concluded, produced mere buildings; architects added the art of architecture. Echoes of this idea can still be found in Le Corbusier’s writings (1923, 1963), although he admits that there is an ‘engineers’ aesthetic’.

The separation of style and building was codified by an influential teacher and author, J.N.L. Durand. Durand taught at the Ecole Polytechnique in Paris, an engineering school established by Napoleon I. He published his lectures in two volumes in 1802–1805, and they were widely used as texts until the middle of the century. Durand provided his pupils with a method of planning a building and then cladding it with any one of a number of different styles (Hitchcock 1958, ch. 2).

These ideas are by no means dead today. Engineers treat them as conventional wisdom. The increasing complexity of technology and the
prevalence of lawsuits have also persuaded many architects to define themselves, as in the nineteenth century, as purveyors of artistic fancy-dress without responsibility for other aspects of building. Enthusiasts for designing with computers have revived the doctrine of Durand (see Mitchell 1990, pp. 149–51). One reason for discussing style at such length is to suggest that matters are not so simple.

The style for the age

Even in the nineteenth century, many architects and critics viewed the battle of the styles with alarm. They drew a different lesson from the emerging historical understanding of architecture. Previous historical periods had a cultural unity, an identity, which was expressed in the visible unity of historical styles. This kind of view is exemplified by Burckhardt’s *The Civilisation of the Renaissance*. But why was there no style of the nineteenth century? Was their own period one of adolescence, not yet able to form an identity of its own? This anxiety runs through all the great architectural writers of the period, from Viollet-le-Duc (1872, 1987) to Le Corbusier (1923, 1963).

The study of history had made architects much more self-conscious about style. Self-consciousness and anxiety go together. Unfortunately, the idea that one can take control of history and cause a style for the age to come into being by willing it was mistaken. Even more than the attempts to fabricate national styles, it was based on a confused notion of the processes by which styles change.

How styles change

Earlier, some reasons for the birth and death of styles were suggested. These reasons were obvious and dramatic ones. They were also mainly external to the culture and the system of production. Now it is time to look at the issue in more detail, in order to see why it is that the spontaneous emergence of regional and period styles is less likely today and in the foreseeable future than it was in the past.

At first, styles, like animal species, were seen as fixed. They were thought to be determined by climate and consequent differences in people’s
character and customs (Vitruvius 10 BC, VI, I). Then, attention shifted to catastrophic changes: the collapse of the Gothic style as a result of plague and depopulation, and the seeding of the Renaissance by refugees from the fall of Byzantium. At length, however, it came to be understood that evolution is just as important historically as revolution. Change is a continuous process. The rate of change varies; the kinds of change remain constant. The processes of change can be conveniently divided into variation, extrapolation, cultural borrowing, and invention (Murdock 1956).

**Variation**

In cultures in which things are mainly produced by hand, minor variation takes place all the time. The way a capital is carved or the pattern of paving can change because the craftsman is careless or bored (Boaz 1927, 1955). Such variations are unconscious or barely attended to. Conscious variations, of the kind which help to generate individual style (4.3.18–20) also take place. Sometimes a variation will be seen as an improvement and will be imitated until it becomes part of normal practice. Variation of detail in repeated elements within the one building adds richness to handcrafted architecture.

**Extrapolation**

Variations in current practice that normally go to make up a personal style or an institutional style may not be enough to give the desired competitive edge as competition increases. Not only the architect but also the audience can get bored with too much of the same sort of thing (Kubler 1962, pp. 80–82). It becomes necessary to do something more. The easy way to do something more is to exaggerate an existing trend. This is ‘extrapolation’. Extrapolation is directed variation. An elementary example is the contest for the title of tallest building which went on in New York at the time of the construction of the Chrysler and Empire State buildings.

**Martindale cycles**

Extrapolation produces the Martindale cycles (Martindale 1984, 1990). By careful historical and empirical analysis of a number of different arts
and styles, Martindale was able to demonstrate a recurrent pattern in their development. This pattern is to a considerable extent independent of changes in society outside the individual art form.

What happens is that, in order to distinguish themselves from others, producers, in our case architects, increase the ‘arousal potential’, information content or complexity of their work (see 4.1.19, 4.2.30). The main features of the style become more and more exaggerated. If it is an ornamental style, for example, ornament becomes progressively richer and covers more of the surface. Eventually, however, a point of diminishing returns is reached. The complication of the style is too great for people to cope with. Then a new, simplified style is invented.

This pattern fits the history of Western architecture quite well. Flamboyant Gothic is followed by the simplicity of the early Renaissance. Neoclassicism follows Baroque and Rococo. The Modern Movement follows Art Nouveau. From this point of view, ‘postmodernism’ is an elaboration of the Modern Movement. Extrapolation appears to be alive and well.

**Novelty and style**

The Martindale cycle in architecture raises an obvious question. How can simplicity substitute for increased complexity? There are two answers to this question. The first, in terms of arousal theory, is that novelty has very high arousal potential (Berlyne 1971). The second, in terms of Gestalt theory (see 4.1.16), is that figure–ground contrast produces ‘sharpening’; against a mass of highly ornamented buildings, a plain undecorated façade will stand out.

These two explanations become the same once it is realised that people’s past experience and expectations form a kind of background. What is novel will contradict these expectations and therefore ‘stand out’. An established style is a form of order, an order extending over time; innovation is a form of complexity. Dramatic changes of stylistic direction cannot, however, be understood in terms of variation or extrapolation. Cultural borrowing or invention must be involved.
4.3.37

**Cultural borrowing**

In the past, cultural borrowing was the major mechanism of cultural change (Murdock 1956). People travelled to trade and encountered other cultures. They saw new ways of doing things. Sometimes they brought the new idea home with them. Often, it got them into trouble, but sometimes it was accepted and spread by imitation. Cultural borrowing in this sense is still going on today; it is called ‘technology transfer’.

Cultural borrowing can also take place across time rather than space. People can borrow ideas from the past of their own culture or other cultures. This kind of borrowing is particularly common in the arts. Ancient Roman frescoes sometimes imitated the style of much earlier Greek works.

Architecture has been as much influenced by cultural borrowing as any other aspect of culture. Whatever view is taken of the battle of the styles, it was started by cultural borrowing across both space and time. Some negative effects of cultural borrowing were noted earlier in discussing regionalism. On the positive side, the Renaissance in architecture is also an example of cultural borrowing across time. With the growth of scholarship, communication and access to information, architects today have greater opportunities for cultural borrowing than ever before.

4.3.38

**Invention**

Inventions are made by combining ideas that do not normally belong together into a new whole (Murdock 1956). The Wright brothers’ first aeroplane is a classic example. It combined the wings and body of a glider, a car motor and a modified ship’s propeller.

Like aesthetic behaviour, inventive behaviour is so common that it is hardly noticed. People are always using things in ways for which they were not designed or intended. This change of context is the beginning of invention. It is when someone combines elements from several different contexts to solve some problem that invention becomes noticeable. If the problem is a common one, the invention will be a success. In architecture, the style of an individual may inspire a school or movement.
**Architectural invention**

Thoughtful architects constantly make inventions at the level of detail. Bruce Goff used cast glass ashtrays as glazing in the front door of his Ledbetter house (De Long 1988), a small change of context for a minor aesthetic effect. Such improvisations are common.

Major architectural inventions often combine elements derived from several different traditions with new technology. Frank Lloyd Wright’s prairie houses combine Beaux-Arts axial planning and pyramidal massing with ideas from the English ‘Queen Anne’ style, the American ‘stick’ style, and Japanese architecture, while making use of new steel and concrete technology (Hitchcock 1958).

Le Corbusier likewise often combined new technology with forms derived from traditional or past architecture, especially from observations made during his ‘Journey to the East’ (Le Corbusier 1989; Curtis 1986).

**Transitions**

Bringing together elements from different contexts into a new style is difficult. Even in the case of architectural geniuses like Wright and Le Corbusier there are transitional buildings that are, by comparison with their mature work, clumsy and unattractive. The same kind of hesitation and confusion can often be seen in periods of transition from one historical style to another. In general, new styles do not emerge and gain acceptance unless there is a strong demand for change.

**Demand for change**

Demand for change is fuelled by competition. This competition, it has been suggested, may be between architects, or institutions, or generations, or between established and emerging social groups. For example, Frank Lloyd Wright’s prairie houses were designed for the newly rich of the American Middle West; while Le Corbusier’s early clients were mostly avant-garde artists and patrons; both were groups that wanted to assert themselves.
Competition and conflict between generations of architects has been an increasingly important driving force of architectural change in modern times. The young defend themselves by rejecting the orthodoxy of the old. Le Corbusier’s ‘five points of the new architecture’ simply reversed current practice: flat roofs instead of pitched, horizontal ribbon windows instead of vertical casements, raising the building on stilts instead of attaching it firmly to the ground, and of course the free plan in which supports are separated from partitions. Similarly, the postmodernist revolt of the 1970s proceeded mainly by denying or rejecting stylistic conventions of the Modern Movement, by then the style of the established generation.

**The rate of change**

Despite the fact that it is said so often, it is true that change is accelerating. Better communication and increasing urbanisation increase competition. Today, the financial pages of newspapers talk of globalisation. Also, partly as a result of the increase in competition, change has been institutionalised. In science and technology, we have research; in the arts, the avant-garde; in business, management consultancies.

**Pluralism**

Change can be slowed by political repression. Diderot’s encyclopaedia details the types of house permitted for each social class in seventeenth-century France under the Ancien Régime (Elias 1964, 1983). The Japanese shogunate regulated the form and decoration of the houses of samurai, farmers and merchants. The lower classes in these hierarchical societies had to be kept in their place by controlling their self-expression.

Modern industrialised societies are relatively democratic and pluralist. The emergence and self-expression of institutions and groups are much less restricted than in the past. This political organisation corresponds to the high rates of change in modern societies. However, it does not support a clear, well-defined, widely held system of values. ‘Good taste’ (4.1.31) and the ‘high culture’ (4.1.32) are weakened and begin to break down.
The decline of style

The high rate of change combined with pluralism and democracy have largely dissolved the social basis of architectural style at any level above individual style. On the one hand, there are too many possibilities, and no acknowledged leaders, even within the culture of architecture itself. On the other hand, the demand for change is such that there is no time for regional styles, or schools or movements to develop and consolidate themselves. Even individual styles may have a short shelf-life.

There have been periods of confusion in architecture before. Major changes of style, like those that in science have been called ‘paradigm changes’ (Kuhn 1962), have shown similar symptoms. It seems, however, that, as writers such as Lyotard (1979) have argued, style and taste are disappearing and fashion is taking their place.

Fashion

A fashion is a wave of imitation. The idea is most strongly associated with dress, but there are fashions in everything: in government, in science, in architecture. Formerly, fashions began with the rulers, but now they can start anywhere. To say that something is a fashion is usually a criticism; it implies that there is no good reason why that particular behaviour should be imitated.

In industry, changes that are made to the appearance of a product without changing its technical performance are called ‘styling’. Styling originated with short-lived consumer products that may be subject to intensive competition because there is no significant difference in performance between different brands. A well-known example is the tail fin, which became a feature of cars in the 1950s. Introduced as a decorative variation, it appealed to customers presumably because, like the ‘streamlining’ of the thirties, its visual dynamics expressed speed and power. The original fin was imitated by other manufacturers, enlarged and emphasised. The fins grew bigger and bigger with succeeding models until at last they became absurd and lost their appeal.
It is easy to recognise in this little story a miniature Martindale cycle, beginning with a variation and proceeding by extrapolation until it collapses. Fashion is change for change’s sake, a product of short-term competition and stimulus-seeking. Its operating mechanisms are variation and extrapolation. Since architecture is concerned with the production of long-lasting goods, fashion in architecture has sometimes been condemned.

**Fashion in architecture**

Perhaps public architecture, the architecture of government and major institutions, should strive for an image of permanence. Commercial architecture cannot afford to do so. It is subject to much the same pressures as consumer products. Interiors of commercial buildings such as hotels, restaurants and stores are now commonly redecorated at regular intervals of only a few years. Here, and in the shopping mall and the theme park, architecture has become part of the entertainment industry. Even office buildings and major housing developments, constructed and financed by international companies, are given fashionable up-to-date images to attract investment from all over the world. As the practice of recycling buildings grows, the exteriors of old buildings are increasingly often ‘restyled’ to compete with new ones.

**In defence of fashion**

Architects are inclined to condemn such superficial transformations and to look down on colleagues who become involved with them. It is, however, unrealistic not to admit fashionable change in architecture. It should be recalled that the addition of ‘modern’ interiors and façades to existing buildings has been commonplace throughout the history of architecture. Many of the famous palaces of the Italian Renaissance are, in effect, false fronts: Michelangelo’s Palazzo dei Conservatori on the Campidoglio in Rome, for example (Ackerman 1986).

Further, as this and other examples suggest, the boundary between fashionable change and stylistic change is clear only with the benefit of hindsight. Fashionable change makes admirable camouflage for more radical experiments. While variation and extrapolation are the main
processes of architectural fashion, cultural borrowing is also common and invention is not excluded. A wave of imitation may be merely superficial, or it may be based on an intuitive recognition that a nagging problem has finally been successfully solved.

**Planned style**

It is all very well to defend fashion, but the unrestrained competition of a dozen fashions in one street is not only ugly but self-defeating. If you overload people’s capacity for information, they switch off. Without any coherent ground, no message can become figure. All the messages are equally lost (Nasar 1988b). For this reason, the planned imposition of a uniform style in selected urban areas has often been proposed and sometimes tried.

Architects are often opposed to such mandatory style, for ideological reasons (see 5.1). It is true that such a style cannot communicate anything in itself, since it is artificial, not the product of a long process of social choice and learning. Even if it is a ‘revival’, it communicates only nostalgia, since, as previously noted, the symbolism of past styles is generally not understood by the lay public.

What an imposed style can do is provide a neutral background for communication at the level of detail. Signs, decorative elements, shop-window displays, planting and street furniture, all the semi-fixed and unfixed elements of the built environment, as Rapoport (1982, 1990) calls them, take on significance and receive attention. In time, an imposed style can develop its own myths and meanings. A fascinating example is the ‘regional’ architecture of Santa Fe in the United States, which has no real historic roots. It was first the personal style of an immigrant architect, then the style of a local school, and finally enforced by regulation (Gleye 1994).

**Expression without style**

In the absence of any style, generally accepted or imposed, expression is still necessary. Groups and institutions still want to assert their identity and status. In a democratic and pluralist society, people have a greater
need than ever before to identify public buildings, to know where to go and how to behave in the settings they encounter (Rapoport 1982, 1990). If conventional means of expression, with all the complexities and subtleties that a shared set of conventions can convey, are unavailable because no convention exists, there is no use in architects trying to invent their own conventions. That is like inventing your own system of heraldry. However, it is still possible to achieve a good deal by using the inherent expressive possibilities of order and complexity, discussed in the previous section. The next section will suggest ways of going about this.

### Sources of form

#### Form and function

The task of shaping a building is often framed as one of giving form to function. Up to this point, this text has tried to avoid using the word ‘function’. There is too much cultural baggage attached to it, and, as several writers have pointed out, there is little agreement as to what it means (see, for example, Canter 1970; Arnheim 1977).

#### Function as a relation

This lack of agreement arises because function is a relation between things and people and not a feature of things themselves (Heath 1984). It is not like being a cow or being red. Something has a function "for" some person or group in relation to their purposes or values. A function is then a constraint, in the terms in which constraints have been defined (see 1.7). From this point of view there is no distinction between ‘form’ and ‘function’. Aesthetic constraints are ‘functions’. However, there are at least two other ways of looking at the distinction between form and function.

#### Other ways of looking at function

Function can be used as shorthand for ‘the set of non-aesthetic constraints to which an artefact is subject’. In the case of a building, this would include the behavioural, site and technical constraints. It can also
be used to mean the principle of operation or system that the artefact must embody. These two usages are not the same. A ‘function’ in the first sense can be met by many different ‘functions’ in the second. Escalators and lifts perform the same ‘function’ in the first sense by very different principles of operation.

**Does form follow function?**

Form does not follow function. Any principle of operation or system can be embodied in many different forms (Pye 1964). Even in natural objects, which, as Arnheim (1966) says, ‘are created by the very forces that constitute them’, the correspondence between system and form is far from complete (p. 203). The correspondence is still weaker in buildings. The connection between behaviour or technology and building form is loose, or, as Rapoport (1969) puts it, ‘of low criticality’.

Form does not follow any principle of operation. Neither is it determined by any set of non-aesthetic constraints. When they are not contradictory, such sets of constraints always in practice create a ‘zone of acceptable responses’ within which there is choice. The form, therefore, does not emerge spontaneously from the constraints. *Some* constraints directly determine some aspects of form. In order to bring out the relationship between constraint and form, it is necessary to expand on something that was said earlier about constraints.

**Forms and relations**

Chapter 1 introduced several ways of classifying constraints (1.17, 1.36, 1.52). One such distinction was between features or things that the building must have, and the required relations between these things. These two kinds of constraint can be called ‘form constraints’ and ‘system or relational constraints’.

Both kinds of constraints must be present in a description, or set of constraints, if it is to be of any use. A face, for example, consists of two eyes, a nose, a mouth and a large oval. These are the features of a face, its form constraints. However, a random arrangement of these elements is not a face. To make a face, the eyes must be above the nose and placed
symmetrically about its vertical axis; the nose in turn must be above the mouth and aligned with the short axis of the mouth, and they must all be contained within the large oval. These are relational constraints. Similarly, a set, even a complete set, of car parts is not a car; to be a car they must be assembled in the right relationships.

**Form constraints**

Form constraints are provided by features, elements, objects or things whose size and shape have been largely or wholly fixed by previous decisions. These previous decisions may have been made by others, for example by the manufacturers of building elements, furniture or equipment, or by regulating authorities or by the client. Or they may be earlier decisions of the designer that would involve too much backtracking to change (see 1.19–21). Form constraints are relatively rigid (see 1.48) but usually not very pervasive (see 1.45).

**Relational constraints**

Relational constraints limit the spatial relations between features such as furniture and equipment, rooms, room groupings and so on. Many examples of relational constraints are given in section 2.4. Relational constraints can produce Gordian knots (see 1.47) and are often pervasive, but they are in general quite flexible. Many different physical arrangements can satsisfie the same set of relational constraints. It is this inherent flexibility of relational constraints that gives the designer the freedom to adapt the various parts of the building to each other and to some overall order, which is the form of the building.

**Levels and kinds**

The distinction between form constraints and relational constraints applies at every level from the worm’s eye view to the bird’s eye view (see 1.18). The design of rooms as described in 2.2 or the development of preliminary layouts as described in 2.4 provide architectural examples at different levels. The features or form constraints of the room are the required furniture and equipment; they are arranged in sequences or groupings, which are the relational constraints. The features or form
Constraints of a plan are the rooms, which are arranged according to the seven principles of arrangement (2.4.1), which are the relational constraints.

The distinction also applies to every kind of constraint. The examples given so far are from the group of constraints that are based in human activities. However, examples can also be given from technology and aesthetics. Structural constraints can be relational; for example, supports in a multi-storey building should be above one another. Structural decisions also generate form constraints; for example, it may be decided that the structure is to be a reinforced concrete frame with a certain bay size. Aesthetic constraints can be form constraints; constraints of propriety can fix the overall form and even many details of a building. The decision to use a proportional system can fix the shapes of the building parts. Equally, however, aesthetic constraints can be relational constraints: order is a relationship between parts.

**The designer’s share**

The main points made so far can be summarised as follows. A system of constraints always leaves an element of choice. Form does not emerge spontaneously from constraint. The inherent flexibility of relational constraints gives the designer freedom to adapt parts of the building to each other and to some overall order. To shape the building, the designer has to invent or adapt a form that matches the constraints, or, if you prefer, invent or adapt some form constraints. While the designer has freedom, this process is not arbitrary. It is important, as Arnheim says, that designers ‘realise where their imagination has freedom and where it is bound’ (1969, 1971, p. 316). The scope and limits of imaginative freedom can be brought out a little more clearly by considering two approaches or attitudes to form giving.

**Top-down and bottom-up**

There are two approaches to matching a form to a set of constraints: top-down and bottom-up. This same distinction has been made several times before in different ways: the bird’s eye view and the worm’s eye view, designing rooms on the basis of the activities to be housed (2.2.3)
or by assuming and testing a conventional size and shape (2.2.15), the
‘outside in’ and ‘inside out’ approaches to planning (2.5.3). These two
fundamental approaches, the one abstract and ideal, the other concrete
and specific, apply at every level of designing and both are necessary.
However, their scope and limits need to be understood.

4.4.11

Top-down: the bed of Procrustes

Procrustes was an ancient Greek bandit with the nasty habit of stretching
or cutting down his ‘guests’ to fit a bed frame which he happened to
have. The architect who adopts a top-down approach too soon or takes
it too far becomes a modern Procrustes. Miller’s limit (see 1.12) ensures
that if a top-down approach is adopted too early essential elements and
relationships will be overlooked. The top-down approach can deal only
with a generalised picture, consisting of a few, abstract elements. The
initial schema (1.10) or ‘picture of the problem’ may be top-down, but
it must be flexible. In general, the top-down approach should proceed
by exploring a range of possibilities rather than clinging to one. It was
on this ground that the popular notion of the ‘architectural concept’
was criticised (see 1.11).

4.4.12

Top-down: the fruits of experience

On the other hand, a simple building with only three or four main
elements may be able to be envisaged successfully with a top-down
approach from the start. Even in the case of a more complex building,
an architect with much experience of that building type may be able to
divide the task immediately into a manageable number of ‘chunks’, each
with its own complex internal structure. In either of these cases, the
architect’s initial schema may survive almost unaltered. It is this that
lends credibility to the notion of the ‘guiding concept’.

Often the tasks set for beginning designers are rather simple and focus
on formal invention. This may be a mistake, since it encourages the
‘conceptual’ view of designing and reinforces the beginner’s tendency
to adopt a ‘top-down’ approach exclusively.
**Bottom-up: the wood and the trees**

Those who see themselves as hard-headed and practical sometimes try to pursue a bottom-up process exclusively. They aim to solve the practical problems and let the aesthetics take care of themselves. This ignores the fact that aesthetic problems are practical problems. It also involves a mistake that is the opposite of the ‘guiding concept’ mistake. The process of ‘building up’ (see 1.43) cannot proceed without making small-scale decisions that fix or largely fix the forms of building elements. It is always necessary to switch from the bottom-up process of identifying parts and relations to the top-down processes of matching, ordering and organising. In general, it is easier and more reliable for the student to start with a manageable-sized group of parts rather than a complex whole. Even so, the task of matching forms to constraints cannot be put off for very long.

**The sources of form**

If you have to find a form and match it to the partial description given by a set of constraints, where is the form to come from? *Form comes only from form*. The history of architecture, and research into the practice of designers, shows that architects make use of many different sources of form. These can be divided broadly into existing buildings, geometry, technology, nature, and graphic play. Other authors give these categories different names or divide them differently: see, for example, Broadbent (1973, ch. 20), Lawson (1980, 1990, ch. 11) and Rowe (1987, pp. 80–91). Each of these categories deserves some further discussion.

**Buildings as sources**

This book has emphasised the use of existing buildings as aids to understanding and as sources of inspiration. It is easier to derive the form of a building from the form of another building than from anything else. It is also easier to adapt the form of a recent building of similar type. Most students recognise this and are quick to search through current journals for buildings whose forms they can adapt to their current task. Some teachers disapprove of this, though others make
educational use of it. Since it is unavoidable, it seems better to explore the constructive and educational uses of imitation.

**Imitation**

Imitation is central to the development of styles. However, the permissible uses of imitation are by no means obvious. On the one hand, current norms and values, and especially those of architecture schools (see 5.1), are very much opposed to direct or literal copying. It can lead to expulsion from the university for plagiarism, or to actions for breach of copyright. It is also of very little educational benefit, though even to make a correct copy requires some understanding of what is being copied.

On the other hand, there are famous historic buildings which are more or less literal copies of other, earlier buildings. Lord Burlington’s villa at Chiswick near London is a copy of Palladio’s Villa Rotunda. Also, it is obvious that the great majority of contemporary buildings are minor variations on a few types: look at suburban houses or city office buildings.

We would suggest that professionally and educationally acceptable imitation takes place at the level of style or type. Style, it will be remembered, consists of a ‘polythetic’ set of features, ranging from plan forms to ornamental details (4.3.15–16). A type similarly consists of a more or less standardised set of features and their characteristic relationships. In Chapter 2, various type-solutions for multi-storey buildings were discussed.

**Analogical design**

Imitating at the level of type and style is no more copying than making a landscape painting is copying nature. Analysis, abstraction and transformation are required in each case. First the features and the relationships between them that go to make up the type or style must be identified and understood. Then the relevant parts of the set can be adapted to the task in hand. Broadbent (1973), in his discussion of the derivation of architectural form, calls this kind of imitation ‘analogical
design’, and he rightly suggests that even the greatest architects usually begin their career with a period of imitation of this kind. The processes of analysis, abstraction and transformation involved have already been introduced but must now be revisited.

**Analysis and abstraction**

The general principles of analysing examples were introduced earlier. Here it is emphasised that representation, making drawings, is as essential to a good analysis as it is to a good design. For an architect, to understand is to draw. Whether the building being studied is in front of our eyes or pictured in the pages of a journal, diagrams and sketches are the tools of analysis. The essential features, such as the pattern of circulation, the size and shape of the major rooms, the room groupings and the structural system have to be grasped, represented diagrammatically, and related to the visible form.

To do this successfully, it is also necessary to analyse the form, looking separately at the massing and the façade articulation. ‘Massing’ is a traditional term for the overall visible geometry (see also 4.6). Façade articulation includes the externally visible structure, the use of materials, the arrangement and subdivision of openings, technically called ‘fenestration’, and ornament.

Such an analysis abstracts from and interprets the original, as the landscape painter does with the landscape. This process of abstraction makes it easier to generalise the example to other tasks, or to transform it into something new.

**Transformation**

The more the source material is transformed, the more original the result. Processes of transformation were discussed in the previous section. Of these processes, variation and extrapolation can be easily and consciously applied. Making minor changes of shape and arrangement, enlarging this or shrinking that, or exaggerating the other in purposive or playful ways will serve the end of exploring and exploiting a style without producing replicas. Such superficial
transformations can, as mentioned previously, be made by machines. They form useful exercises for the student, the equivalent of finger exercises and chords for the musician, but they do not lead to anything truly original. On the contrary, there is a real danger of being trapped by too narrow a set of tricks, or forming a personal style too soon. One way out of this is to extend the range of borrowing.

**Extending the range**

Cultural borrowing, it was earlier pointed out, has always been a major source of innovation. Even today, borrowings that come from further afield may be less easily recognised as imitations. They also often require more transformation to adapt them to the current task. Today, geographical distance has been compressed, but it is still possible to borrow from architecture that is remote in time. The past is by far the richest source, but educational attitudes to the past conflict.

**Relevance or classicism?**

There is a longstanding controversy in humanistic educational disciplines in general as to whether it is better to study current or historic examples. Recent examples are more relevant. Against this, it is argued that historic exemplars or ‘classic’ works have been identified and their exemplary characteristics illuminated by ‘the judgement of history’. They are thus superior as objects of study to recent examples which may have attracted only temporary attention as part of a short-lived fashion.

From the point of view of architectural education, this controversy seems empty. If classic examples alone are studied, their relevance to immediate tasks in the studio may not be clear. If recent or current examples alone are studied, teachers and students will lack any way of standing outside current fashion to criticise it. The students’ judgement and also their capacity to invent are likely to suffer. Some of the greatest architects of the twentieth century found inspiration in the remote past. Works by both Le Corbusier and Louis Kahn are often linked with their studies of Hadrian’s Villa, one of the greatest, if also most enigmatic, monuments of the Roman Empire (MacDonald and Pinto 1995).
Revivalism and eclecticism

The question is not whether the history of architecture should be a source of form but how it is to be used. Revivalism or literal copying of historical examples may not be exposed to legal penalties, but it is often technically difficult, since methods of production have changed. It is also almost always symbolically absurd, as the nineteenth-century critics of stylistic revival argued.

The obvious weaknesses of revivalism can be avoided by eclecticism, or borrowing from a variety of different historical sources. Sometimes eclectic works have a certain surreal charm. More often, the eclectic approach results in a jumble of parts, characteristic of the work of amateur designers/builders. It is only when ideas and elements from the past are transformed and combined inventively that works which are at once unified and original are produced.

Originality and invention

Deeply original works may be called inventions (4.3.38). Invention involves changes of context, not just in terms of time and place but in terms of meaning and purpose. Such radical transformations take time to evolve. The ability to make them successfully seems in most cases to depend on a memory stocked to overflowing with images that have been generalised, transformed and linked by Gestalt processes operating below the level of consciousness, as well as a certain amount of trial and error.

Once again, this amounts to saying that an important part of the designer’s skill comes from experience, and experience of a kind that formal education can only begin to provide. On this basis, beginning students should neither expect nor be expected to be very original. However, originality, or ‘creativity’, is a strong value for almost all students and some teachers (see 5.1). Borrowing from sources of form other than buildings avoids the difficulties and risks of historical and fashionable imitation. It also demands bolder transformations and should therefore in principle lead to greater originality.
Cubes, cones and spheres

Geometry and architecture are old friends. Geometry is the basis of proportional systems, which were discussed at length in 4.2. It is for this reason that Plato says in the Philebus that building is more of a science than most branches of knowledge (350 BC, 56b). Thus analogies between geometry and architecture are easy to draw.

There is another way of applying geometry to architecture, which was popularised in theory by Le Corbusier (1923) and to some extent also by his example. In the same passage from which the title of this chapter is taken, he says that ‘cubes, cones, spheres and pyramids ... are beautiful forms, the most beautiful forms’ (p. 31). He seems to have got this idea from another passage in Plato’s Philebus, in which Socrates is made to say that ‘a straight line, a curve, and the plane and solid figures that lathes, rulers and squares can make from them ... are not relatively beautiful: their nature is to be beautiful in any situation’ (Plato 350 BC, 51c). Recent successful examples of applying geometry to architecture include Kisho Kurokawa’s Ehime Prefectural Museum of General Science (Fig. 4.42).
Advantages of geometry as a source

Some advantages of proportional systems have already been discussed. Here it should be pointed out that there is no need to use ‘irrational’ nesting ratios to obtain these advantages. A simple square or cubical grid, such as Mies van der Rohe used to define all the main relationships for the campus of the Illinois Institute of Technology, works just as well.

Grids, irrational or rational, also provide handy decision rules. As was argued in Chapter 2, there is often no particular reason why a room should be made exactly one size or another. Since a building is dimensionally speaking the sum of its rooms, the overall size of a building is often still more vague. A grid settles such uncertainties: you choose the nearest grid line.

The arguments for using Phileban solids, as the geometric shapes that Le Corbusier praised are called, are similar but weaker. Rectangular solids are often practical shapes for buildings. Perceptually, the regular solids have very strong Gestalt, and are therefore suited to free-standing single-cell buildings that are of high symbolic importance. For such a building, there may be few constraints on the overall form, and the rule of thumb ‘use a Phileban solid’ may provide a starting point.

Disadvantages of geometry as a source

Proportional systems are always ‘top-down’, arbitrary and somewhat Procrustean (see 4.4.11). This is probably one reason why the movement for modular coordination of building products failed (Russell 1981). The constant repetition of similar shapes required was aesthetically speaking too restrictive. The use of the Phileban solids is even more restrictive. Using geometry as a primary source of form also often seems to produce buildings that are bland and diagrammatic. This may be because it encourages a ‘top-down’ perspective that neglects the detailed view and ignores the materiality of buildings (see 3.5.2).

Technology as a source of form

Technology as a source of form can be divided into building technology and engineering technology. Building technology as a source of form
overlaps with geometry. A structural grid is still a grid, and even if it is not so arbitrary as a proportional system, the final choice of grid dimension introduces an arbitrary element. The geometric forms of concrete shells and of tension structures such as tents have technical advantages, but formally speaking they have the same limitations as the Phileban solids. So-called ‘hi-tech’ structures involve decorative elaborations of structure, which may serve both to increase visual complexity and to symbolise up-to-dateness but are seldom economic (see also 4.3.12). Nevertheless, building technology continues to inspire many architects.

The connection of engineering structures such as grain silos with architecture is easy to make. In the early period of the Modern Movement, other products of engineering design such as cars, aeroplanes and especially ships were a favourite source of imagery (Le Corbusier 1923). There are fewer recent examples; the forms of vehicles are now mainly determined in wind tunnels, and are thus even more irrelevant to buildings. The popular analogy between the Sydney Opera House and sails on the surrounding harbour was almost certainly made up after the event; the real source is much more likely to have been Bartning’s Sternkirche (Sharp 1966, p. 73) or some other expressionist exemplar.

**Nature as source of form**

Nature in the form of the site is a common source of architectural inspiration. Le Corbusier’s first surviving sketches for the chapel at Ronchamp explore the scale and form of the building in relation to the site (Curtis 1980). Nature was also in the past the principal source of decorative motifs for architecture.

Nature has, however, seldom been a source of overall architectural form. Poetic analogies between Gothic cathedrals and forests do not stand up to historical investigation. The major exceptions are usually follies, such as the giant walk-in statue that Giambologna made in the garden of the Villa Pratolino, or the ‘ducks’ discussed in 4.3.2. There are also anecdotes of famous architects being influenced by observations of
nature. A crab shell picked up on Long Island Beach may have been one source for the roof form of the chapel at Ronchamp (Curtis 1980). However, such anecdotes are rare and often seem to have been made up after the event.

**Graphic play**

Next to imitation, graphic play is the commonest source of form for architecture. This is clear from the self reports of many leading architects, the care with which they often preserve rough preliminary sketches, and the analyses of such graphic material by historians, critics and researchers. Such graphic play occurs at many different scales and stages of the development of designs. Here we are concerned only with its use in exploring different formal possibilities in a highly abstracted, top-down way. Such explorations often start from one or another of the sources of form previously discussed. However, it does happen that the drawing itself becomes a source of form.

**Shapes in the clouds**

Leonardo da Vinci suggested that artists should develop their powers of imagination by looking for images in the markings on a stained plaster wall surface (Holt 1947, 1957, p. 283). Just so, an architect may be ‘doodling’, making an exploratory drawing, and suddenly see amidst the network of lines a quite unintended form that matches the constraints.

Such occurrences, which are often taken as evidence for mystical theories of inspiration, are in fact manifestations of the Law of Pragnanz (see 4.1.16). In struggling to make sense of a confused mass of lines, brain processes generate a possible organisation and project it onto the drawing. Similar processes occur when vision is blurred or distorted. James Thurber, who was extremely short-sighted, describes how once when he was forced to go out without his glasses he ‘saw’ an admiral in full dress uniform riding a monocycle along the street. In architecture, the question is not how such things happen perceptually, but how it comes about that such imaginative products match the constraints.
4.4.31

**Architectural examples**

Goldschmidt (1994b) gives two examples that illustrate the use of graphic play as a source of form. One is a statement by Alvar Aalto, certainly one of the most original architects of the mid-twentieth century. The other is a series of observations of a student at work.

In the passage that Goldschmidt quotes, Aalto says that in architecture the demands, or in our terms the constraints, are so numerous that a solution cannot be reached by rational methods. The term ‘rational methods’ here is equivalent to our use of *mechanical* methods; computational or mechanical methods are often confused with rational ones (see 5.1). The point is that, as Aalto says, this complexity ‘prevents the basic architectural idea from taking shape’. That is, a pure bottom-up approach will not generate form. Therefore, Aalto goes on to say, he proceeds in an ‘irrational’ way, producing what he describes as ‘abstract art’, that is, architectural doodling. From this, a ‘basic idea’, that is, a top-down, organising structure, would emerge.

The case of ‘Larry’ is, as Goldschmidt (1994b) shows, closely comparable. Larry, a student, produced a design that was judged by his teachers to be highly original and successful, the form of which was derived from a doodle which in turn was based on his signature. Even for the student, then, it would appear that graphic play is a useful tool in the shaping of buildings.

4.4.32

**The attraction of graphic play**

Such a process is likely to have strong appeal for students. It seems to offer the freedom and magical power which they hope to find in architecture as a profession, and to justify the ‘conceptual’ approach to designing that this text has rejected from the beginning (see 1.11). However, Goldschmidt (1994b) does not suggest that such cases are typical, but that they illustrate the process of visual thinking in an unusually pure form. Sadly, there are strong objections to relying to any great extent on graphic play as a source of form. A closer examination of the two examples will show why this is so.
Limitations of graphic play

The example of Larry illustrates the limitations of graphic play as a source of form particularly clearly. The task was a simple one, with only three main elements. Further, and more importantly, Larry had already produced a complete design, using geometry as a source of form. This earlier design was also judged by his teachers to be very good, but Larry himself was dissatisfied with it. Larry had therefore already developed a hierarchical mental structure for organising the constraints, and quite possibly had explored all the possible arrangements in this simple task. Since he was dissatisfied with his design, he must have been brooding over it and turning it over in his mind. Thus his transformative vision had relatively little to do.

In the case of Aalto, it must be remembered that at the time he wrote about his design practice he was already a very experienced architect. He had long practice in organising constraints mentally into groups or chunks. Second, he did not commence this projective phase until after he had thoroughly studied the complex mass of constraints, and no doubt produced many exploratory sketches of more concrete kinds. Third, he had a well-developed individual style, or tool-kit of type-solutions to various recurring problems. Once again, the work of organisation was not too great.

The apparent attractions of graphic play have to be seen in this light. The difficulty is not in finding forms but in matching them to the constraints. For graphic play to help at all, it has to come after all the hard work has been done. It is not a substitute for hard work. Even then, it is not reliable. The transforming vision may not come within the limits of the available time. Nor is there any evidence that such insights are either necessary or sufficient for the production of good architecture. A more pedestrian approach can do just as well, and does not exclude the possibility of a transforming vision. In fact, such insights are more likely to occur if you work methodically to shape your design using other sources.
4.4.34

**Modelling**

Playful use of materials such as clay or plasticine can in principle serve the same purpose as graphic play. However, it is slower and provides fewer opportunities for projection. Modelling also tends to produce unbuildable shapes. The expressionist architect Hermann Finsterlin relied largely on modelling for the development of his ideas, and produced schemes for very complex sculptured buildings. Unfortunately, as Sharp (1966) observed, his work ‘rested in obscurity for many years, largely because it was impossible to translate his architectural fantasies into buildings’. The technical situation has changed somewhat, as the work of Frank Gehry shows, but it remains true that very plastic shapes are expensive to build, and that modelling favours plastic shapes.

4.5

4.5.1

**Space and time**

**Introduction**

In the remainder of this chapter a pedestrian approach to shaping buildings is outlined. It is pedestrian in two senses: it is step by step, and it emphasises the point of view of the person walking around and through the buildings. This section considers form in the internal spaces of buildings. Section 4.6 discusses massing and the distant view of buildings, and also façade articulation and fenestration, with a brief glance at detail and ornament.

It will be noticed that the examples chosen to illustrate the points made are taken largely from the work of Frank Lloyd Wright and Le Corbusier, and also from other Modern Movement masters such as Mies van der Rohe and Alvar Aalto. There are three reasons for this. The first is that their work is exemplary. They were the inventors of many of the architectural ideas still in use today. The second is that there is an extensive critical literature about them, which can be drawn on. The third is that books and information on their work are readily available to students.

The advice that follows makes a number of assumptions. The first is that you have already done some analysis of relevant examples, with the aid
of the previous parts of this book. The second is that you have already generated a number of trial layouts as described in 2.5, and that these layouts make allowances for services as discussed in 3.4. The third is that for each layout you have given some thought to the structural system (3.2) and to design for energy control (3.3).

Conceptions of internal space

Rooms and their proportions were introduced quite briefly earlier. Now it is time to examine different aesthetic conceptions of internal space. Four main conceptions of internal space can be identified historically. In the first, the plan is conceived as an assembly of self-contained rooms which may be connected physically by doorways but are visually and aesthetically independent. In the second, rooms are linked visually and conceived aesthetically as a sequence. In the third, known as the ‘open plan’ or ‘free plan’, rooms are connected by openings so large that their individual identity is at the point of dissolving. In the fourth, the elementalist rooms are conceived of as subdivisions of a larger space, which remains dominant. This last conception shades into one in which the whole plan is conceived as a single space, and this in turn into one in which the whole building is thought of as an arrangement of planes in a three-dimensional grid. These latter approaches will be considered further when considering plan organisation (4.5.47–58) and massing (4.6).

Today, all the four main conceptions of internal space may be found in different parts of the one building. Each conception offers different aesthetic possibilities. The selection of a space conception for a particular space and the way in which the space is treated in detail must depend on the values attached to the activity housed. The space conceptions will therefore be discussed in terms of their dynamics (see 2.2.14) and the symbolic possibilities that arise from dynamics (Arnheim 1977).

Representing interior spaces

In order to develop your ideas about interior spaces, you will have to represent them. Drawing interiors is harder than drawing exteriors. This
is because our experience of interiors depends to a greater extent on peripheral vision, which extends almost to the vertical plane through our ears, and on head and eye movements. Perspectives have a fixed viewpoint and become obviously distorted if a wide-view angle is used; so they are not a very satisfactory way of picturing interiors. It is therefore, in most cases, just as good and much quicker to rely on plans and sectional elevations in the preliminary stages of design. If the treatment of the ceiling is important, a reflected ceiling plan will also be needed.

**Self-contained rooms**

The conception of a building as consisting spatially of self-contained rooms may seem old-fashioned. Nevertheless, most buildings still include a number of self-contained rooms. Some of these are service spaces of low status, which do not require any elaborate aesthetic consideration, certainly not at the stage of preliminary design. Closets and plant rooms are examples. However, the demand for comfort, privacy and security ensures that high-status self-contained rooms continue to be built. The offices of the powerful and the bedrooms and bathrooms of the rich are not the only examples. The ordinary hotel room and the private dining rooms of some restaurants also fall into this category. The discussion that follows deals with aspects of the design of such high-status rooms, particularly their spatial dynamics, adjunct spaces, openings, surface patterning and the planning of furniture.

**Dynamics of rectangular rooms**

For reasons discussed in 2.2.17, we will concentrate on rectangular rooms. Since the square is a useful plan shape for many purposes (2.2.15), it is a good place to start. A square plan is inherently centralised and static. The centre of the rooms is a strongly privileged position visually and therefore also symbolically. The centre of each wall is another privileged position, though somewhat less so than the centre of the room. The corners, because they are important in defining the space visually, are also privileged, though less than the centres of the
walls, because of their greater distance from the centre (Arnheim 1954, 1974, 2004). Furniture, fitting or openings placed in these privileged positions are thereby ‘made special’. Further, there is a strong impulse to fill these positions. The implicit order of a square room is thus a highly rational hierarchy.

As the shape of a self-contained room moves from square to rectangular, these dynamics change. The power of the centre of the plan is reduced, and the directional movement implied by the longer axis becomes more and more dominant. The centres of the long walls decline in importance and, as the diagonals lengthen, the corners also weaken. The centres of the end walls become the most privileged positions. This directional quality is clearly established in rooms where sides are in the proportion 4:3; proportions between this and the square tend to be weak and ambiguous. On the other hand, as the proportions exceed 2:1 the directional dynamic becomes increasingly hard to contain; the self-contained character of the space breaks down, and it becomes a corridor (see 4.5.26). Sometimes such dynamic effects may be deliberately sought. Similarly, the dynamic effects of irregular spaces vary according to their shapes.

**The third dimension**

Some practical aspects of room heights were discussed in 2.2.16. Minimum room heights are often fixed by regulation. Generally, the lower the ceiling, the stronger the sense of containment and of security or refuge (Hildebrand 1991). On the other hand, a ceiling that cannot be seen without deliberately looking up creates a sense of spaciousness and expansion. A rule of thumb for this latter condition is that the ceiling height should not be less than 2.1 metres (7 ft) + (long dimension of room × 0.25).

Vaults or domes are no longer necessary devices for spanning space. Their use is almost entirely aesthetic. The additional height given by a vaulted or domed ceiling and the dynamics of its convex shape increase the expansive, uplifting quality of the space below. A dome also places strong emphasis on the centre.
A study by Wools (1970) found that a sloping ceiling was rated as significantly more ‘friendly’ than a flat one. The effect of ceiling slope on friendliness outweighed that of windows and furniture arrangement. The ceiling sloped in one direction and the angle was quite steep, about 30 degrees.

**Exploiting the third dimension**

A single-storey building or a free-standing pavilion give unlimited scope for exploiting the expressive possibilities of ceiling treatments. Rooms can be extended into the roof space, or parts of the roof can be raised. In multi-storey buildings, ceiling heights are often restricted. There are four main ways round this.

The first method is to place the rooms of greatest expressive importance at the top. In Frank Lloyd Wright’s two-storey prairie houses, the main rooms are on the upper floor, not the ground floor, partly for this reason (Hildebrand 1991).

The second method is to vary the floor-to-floor height, concentrating the important rooms on a single tall floor. This is the method used in the palaces of the Renaissance and Baroque periods; the main rooms were arranged on the ‘piano nobile’, one floor above ground. This is also the method used in modern hotels, though there the principal floor is often the ground floor.

The third method is to take the important spaces through two or more storeys. This arrangement became common in nineteenth-century commercial buildings such as hotels and department stores, and is still to be seen in the atrium and the shopping mall. It is also sometimes found in the ‘living halls’ of late nineteenth-century country houses in England and America. Le Corbusier used it frequently in both public and private buildings. The disadvantage of this method is that the plan of the upper floors is severely constrained.

The fourth method is to accept changes of floor level on the upper floors. Again, this method was used in some nineteenth-century country houses.
Adjunct spaces

The box-like character of the self-contained room may be relieved by the vault or dome. It can also be enriched by adjunct spaces. An adjunct space is not a service space, such as a closet or a kitchenette. It is a secondary space attached to the main space but not wholly distinct from it. A niche is a small-scale example; an apse is similar but larger in scale.

In the classical tradition, adjunct spaces are usually located at privileged positions in the room and have an honorific purpose. They contain a statue, a tomb, an altar or a throne. In the romantic tradition, adjunct spaces become important elements of domestic architecture in such forms as inglenooks, bays and sitting alcoves. The miniature overall dimensions of these adjunct spaces enhance their character as a refuge within a refuge. Correspondingly, they are often placed in the corners of rooms or well off-centre rather than in the most dominant positions.

In order to achieve their purposes, adjunct spaces must be clearly defined. From within they should appear to be open to the larger space, but from outside enclosed and separate. In particular, the ceilings of adjunct spaces must be lower than the main ceiling. Otherwise the adjunct space is likely to read as an awkward extension of the main space rather than as a retreat within it. Similarly, the entrance to an adjunct space may need to be framed and emphasised like a doorway. Sometimes partial screens, openwork or glazed, are used to increase the sense of enclosure. Still clearer definition can be achieved by a change in floor level.

Openings

Practical constraints on the size and placing of openings have been discussed earlier (see 2.2.7; 3.3.25–26; 3.3.32–38). Here, some major aesthetic issues raised by the design of openings in self-contained rooms will be considered. These are issues of placing and dynamics, issues of lighting and outlook, and issues of scale and proportion.

It should be noted that, if the spatial conception of the self-contained room is to be retained, the sizes and locations of openings are constrained. Windows and doors must be fully contained by the
surrounding wall. Window walls, strip windows extending across a whole wall and vertical strip windows in corners usually belong to the open plan or the free-plan conceptions.

**Placing openings**

The placing of openings can reinforce or weaken the dynamics of the plan shape. Openings placed in privileged positions are ‘made special’ but also reinforce the visual importance of those positions. The placing of windows has also to be considered in relation to the external appearance (see 4.6).

If the placing of openings in a square room reinforces the plan dynamics, the effect will be extremely static and formal. The symbolism of such a room calls for formal behaviour on the part of its occupants. Today, such formality is not wanted for most rooms. Accordingly, square rooms are often entered near the corner and windows are asymmetrically placed. In the case of a room that occupies an outside corner, the diagonal axis may be strengthened and the centrality of the space weakened by placing a bay window on this corner.

In the case of a rectangular room, placing the entrance in the centre of one of the short sides will emphasise the dominance of the long axis and focus still more attention on the centre of the opposite wall. Again such intense focus on one position will be unsuitable in most modern rooms. Even in churches it is now often considered inappropriate to concentrate all attention on the altar and the priest. Placing doors and windows in the long rather than the short walls weakens the dominance of the long axis. Asymmetrical placing will weaken it still further, but will encourage the tendency, always present in long rooms, for the room to break up into visually distinct zones.

**Lighting and prospect**

Daylighting can be used to reinforce the dynamics of the plan or to weaken them. For example, if a square room is top-lit by a central roof light or oculus or by windows placed round the drum of a dome, its centrality will be strengthened. Similarly, in a long room the focus on
the ends will be increased if they are more strongly lit. In churches light is often focused on the altar.

Another kind of dynamic is created by gradients of lighting. Such gradients have a double symbolism. On the one hand, the progression from dark to light has the very literal and obvious meaning of enlightenment. On the other hand, relative (not total) darkness is associated with the refuge and security. Frank Lloyd Wright often placed a bay window or a row of glass doors at one end of a long room and a fireplace at the other; the fireplace belonged to the dark and refuge, the windows to the light and prospect (Hildebrand 1991).

Finally, windows are themselves centres of attention. The eye is drawn to the light. This attraction is increased if the window opens onto some pleasant prospect. Windows are thus in themselves powerful elements in room dynamics. To exploit their attraction to the full, it is necessary to give careful consideration to the control of glare. Sometimes, too, the attractiveness of windows may be counterproductive. If the intention is to focus attention on some other feature of the room, the aim must be to conceal the windows as far as possible. To return to the example of a church, the windows in churches are often placed in the entry wall, behind the viewer, or concealed in the roof or side walls so that the source of light is invisible. The problem is an acute one for art galleries, but the subject of art gallery lighting is beyond the scope of this book.

**Scale and proportion: doors**

The scale and proportion, or size and shape, of doors are today largely governed by convention. Doors are mass-produced in a limited range of sizes. The commonest is 2 m (6 ft 8 in) high and 800 mm (2 ft 8 in) wide. While a door only 450 mm (1 ft 6 in) wide will provide adequate access for a person, the conventional size has the merit of allowing for the movement of furniture. For ordinary rooms this will do, but a high-status room may demand something more. In public buildings larger doors are necessary for wheelchair access.

Within limits, the larger the doorway the grander and more dignified it is. On the other hand, a small, low doorway can create a sense of
intimacy. Rooms designed for the Japanese tea ceremony had doorways that could be entered only by stooping. The European classical system related the size of a door to the height of a room. Unfortunately, the rule that Palladio (1570, 1965) gives does not work for rooms less than about 3600 mm (12 ft) high. Applying the same principles to modern conditions, a rule of thumb for a dignified doorway is that its height should be 2 m (6 ft 8 in) or three-fifths of the height of the wall in which it is set, whichever is the greater, and its width should be half its height.

Scale and proportion: windows

Windows present more difficulties than doors because they have more demands to meet. Their primary purpose is lighting, though the amount of daylight is seldom a critical issue in high-status rooms. The demand for ventilation affects the subdivision of windows, which will be considered later (see 4.6). Like their placing, their sizes and proportions must be related to the demand for outlook. Finally, their proportions must be satisfactory from the outside as well as the inside.

Palladio’s rule for windows is still good for windows of moderate size: not more than one-quarter of the narrow dimension of the room in width or more than twice that in height. Because of the centrality of the square, square windows have a strong framing effect; a square window implies that there is something to look at through it.

Very small windows, less than 300 mm in their smaller dimension and no more than 600 mm in their larger, deny the lighting function and suggest a peephole: they invite looking out. Larger windows give a more expansive effect and are more common today. For glass doors or double doors, the rules given in 4.5.12 for doors in general can be used. For still larger windows, the same rule can be used for the head height; for the reasons given in 4.5.9 the maximum width of a window or group of windows in a self-contained room should not be more than three-quarters of the length of the wall in which it is set. Where the greatest dimension of a window is horizontal rather than vertical, the ratio of its width to its height should be 5:3 or greater; less is inclined to look like a squashed square. Bear in mind that these rules are only indicative.
They will serve as a very preliminary guide. The final proportions of windows must be judged in relation to the overall dynamics of the room and of the exterior.

**Surface subdivision**

The surfaces of internal walls are often subdivided, for both practical and aesthetic reasons. Joints are provided to cope with assembly or movement of parts. Other divisions are introduced to make maintenance easier and cheaper. Surface divisions can be used to increase the visual unity or interest of the room and to emphasise or weaken its dominant dynamics. The main technical issues have been discussed earlier, but some brief expansion is needed here before the more purely aesthetic issues can be addressed.

**Joints**

As was pointed out in Chapter 3, various structural movements will produce visible cracking if precautions are not taken to prevent or conceal it. Areas of concentration of stress, such as junctions between walls, or between walls and ceilings, are particularly likely to crack. Buildings in the classical tradition provided elaborate mouldings at these points, particularly at the wall/ceiling junction, which helped to conceal cracks. Doors and windows reduce the strength of the walls in which they are set and cracking often occurs over them as a result. Again in the classical tradition, the area about a door or window often included a secondary opening with a rich frame, or a decorative panel.

Also as explained in Chapter 3, finishing materials often come in relatively small sheets or pieces that must be jointed. Joints may also be needed to allow for differential movement of the finishing material and the supporting material. Traditional construction dealt with this by the use of cover moulds of various kinds.

Finally, areas of window have to be subdivided to provide for opening sections and sometimes also to limit glass sizes.

As part of a general rejection of ornament and emphasis on simple geometry, architects of the Modern Movement rejected mouldings of all
kinds, as expensive, unnecessary and unhygienic dust-gatherers. The results were sometimes unfortunate. Eventually new solutions to the old problems were worked out. Recessed joints were substituted for projecting mouldings. Doors and windows were carried from floor to ceiling so that movement could be accommodated in the joint between the window or door frame and the adjoining wall. All this took some time, however, and the legacy of visible cracks did little for the reputation of modern architecture.

**Wear and tear**

Some building surfaces suffer more wear and tear than others. Traditional construction made provision for these surfaces to be maintained more often, or covered with more durable material. Skirtings absorbed kicks and the blows of carelessly wielded cleaning equipment, as well as covering the joint between floor and wall. Chair rails or dadoes received the bumps from pieces of furniture pushed against the wall. In public buildings dadoes were often extended to shoulder height to allow for the abrasion caused by people brushing against the walls. In a related way, picture rails obviated the need for plugging walls to hang pictures, and patching them if the pictures were changed or moved.

In the heyday of the Modern Movement, skirtings were reduced to tiny cover moulds and dadoes were done away with altogether. Once again the results were often unsatisfactory. Substantial skirtings and dadoes have gradually returned, particularly in public buildings, though they are now often set flush with the wall rather than projecting from it.

**Subdivision and unity**

It sounds paradoxical to suggest that surface subdivision can increase the visual unity of a room. However, it can do so in four ways. It can strengthen the perceived solidity of the enclosing surfaces. It can strengthen the visibility of the defining corners. It can create a web of lines that reinforces the sense of enclosure. Finally, it can emphasise the inherent dynamics of the space.
The solidity of surfaces

If you stand close to a uniformly coloured smooth wall surface so that it fills your field of view, the lack of any visual focus weakens the surface perceptually, so that it appears insubstantial; alternatively, small flaws, if any, leap into prominence. The introduction of a small-scale pattern, such as those of many wallpapers, counters this effect, and thus actually strengthens the perceptual unity of the surface.

Defining corners

As previously noted, the corners are important in defining rooms visually. Ornamental borders in flooring materials, decorative skirtings, heavy cornices, borders in ceiling decoration, and pilasters or other decorative features in the corners between walls all serve to strengthen these visually important locations.

Webs of lines

The horizontal bands of skirtings, dadoes and picture rails unify the room according to the rule of connectedness (see 4.2.10). Often these or additional lines are used to link the heads of doors and windows, and sometimes the sills and subdivisions of windows as well, into an overall pattern. Similarly, vertical divisions such as door frames may be extended across the ceiling and duplicated in the opposite wall. The definition of the room is intensified by a cage of lines. Mostly, these lines are straight, but in the Art Nouveau period they were allowed to wander in curving naturalistic patterns. If the spacing of the lines is considered so that the areas that they define are controlled by some proportional system, the surfaces will be unified by the law of similarity as well (see 4.2.8).

Intensifying dynamics

In centralised rooms, floor and ceiling patterns are also often strongly centralised. In a room that is rectangular, multiplying and emphasising the horizontal divisions will tend to strengthen the main axis. Frank Lloyd Wright habitually used horizontal wall divisions both to link
spaces and to emphasise their dynamics. His use of subdivision in ceilings is worth studying from the same point of view.

**Subdivision and complexity**

Increasing the number of subdivisions tends to increase the visual complexity of a room. However, the increase in complexity obtainable in this way is subject to Miller’s limit (see 4.2.32). Large numbers of regular subdivisions will be perceived as an overall pattern, as *part* of the surface, not a *division* of it.

In eighteenth-century European interiors, hierarchy and tripartition were often used to overcome this. Walls were divided vertically and often also horizontally into three major zones, one larger and dominant and two smaller and secondary. In rectangular rooms, the long walls were often divided so as to form a square at the centre, with narrower, vertically proportioned areas on either side. Then the central section housed the fireplace and the side divisions, the doors; in the opposite wall there was sometimes a similar dominant/secondary arrangement of windows. This trick creates an effect of centrality in a room that is not centralised, thus increasing the complexity of the space as well as the surfaces. Sometimes this effect was pursued still further by making the main vertical wall divisions substantial projections, emphasising them with free-standing columns and so on.

**Furniture in self-contained rooms**

Only a few examples of the ways in which the dynamics of rooms and the placing of furniture interact symbolically can be given here. Consider a square dining room with a round central table; dining in such a room would be at once formal and egalitarian. On the other hand, a long dining room with a rectangular table running in the direction of the main axis might seem a less formal arrangement but gives dominance to the people seated at the ends. Again, a square bed placed in the centre of a square room might suggest a setting for erotic ritual rather than comfortable relaxation. In general, furniture placing that reinforces the major spatial dynamics of the room will contribute to formality of behaviour and hierarchy of relationships.
Normally, the corners of rooms attract minor pieces of furniture. However, in square rooms particularly it is possible to emphasise the diagonal, rather than the major axes, by placing important pieces of furniture or fittings in the corner. The resulting tension between the simplest organisation and the actual organisation will tend to make such an arrangement more interesting or even dramatic, particularly if it is reinforced by the subdivision of the surfaces.

Finally, if furniture is placed for convenience, in a coordinated form of order (4.2.46), this will promote an atmosphere of simplicity and informality. In each case, the effect can be further reinforced or realised by the character of the furniture itself. This illustrates the principle of definition (see 4.2.44).

Scale and interiors

This discussion of self-contained rooms has so far been largely directed to medium-sized rooms, of the kind likely to be encountered in beginning design problems. Very large spaces and grand spaces present some additional problems which are worth mentioning briefly.

A large space and a grand space are not the same thing. For a space to appear grand, we have to be able to see how large it is. Grandeur is often emphasised by strong hierarchical order and by the use of materials, but these are secondary considerations. The technical term for this issue of perceived relative size in architecture is scale.

Psychological studies have shown that people use a variety of cues to estimate the size and distance of objects. Among the most important cues for interiors are gradients of pattern or texture, perspective, movement parallax or the apparent movement of close objects in relation to distant ones, which occurs as we move our eyes, and influences from the apparent size of distant objects such as doors and people (Prak 1977).

Buildings in the classical tradition were liberally provided with all these sorts of cues. Floors were subdivided and patterned in ways that produced clear texture gradients and emphasised the perspective of the
space; there were often colonnades and arcades, which are excellent sources of movement parallax, and a wide variety of repeating building elements that could be used to infer scale. Under these conditions, the apparent grandeur of buildings was proportionate to their size. There were exceptions. False perspective and painted extensions were sometimes used to make buildings appear larger. In the interior of St Peter’s, Rome, the eye is misled because the sizes of all the elements have been increased according to strict proportional rules, so that elements which one expects to be small, such as skirtings, are as high as a tall man; the resulting false scale has been much criticised.

Today, it is quite common for even vaster spaces, such as trade centres and transport terminals, to provide few if any cues to scale. Such spaces are not grand but simply large and confusing.

**Atriums**

Atriums are often found in modern hotels and in other building types such as shopping centres and office buildings. Unlike the space in the ancient Roman house from which the word is taken, they are very large multi-storey internal spaces. In hotels and other public buildings, they serve the practical purpose of visual orientation; people can tell where they are in the building by looking out into the atrium. However, their expressive purpose is probably their main reason for existence. This is to make the arriving guest feel important as an occupant and a temporary possessor of such a grand space. The dynamics of these spaces are interesting and instructive.

The strong horizontal patterning of the sides of the typical atrium by access galleries serving the upper floors contradicts the intended vertical thrust of the space and weakens or destroys its centrality. The scale is not in question: the galleries provide excellent cues. However, the dynamics are wrong. A common solution is to draw attention back to the centre by introducing some large vertical feature, often suspended and usually a work of art of some kind. While this works fairly well, it is worth comparing such interiors with one of the earliest twentieth-century examples, Frank Lloyd Wright’s Larkin Administration Building.
There, vertical piers extended from the bottom to the top and projected strongly from the faces of the galleries, so that the horizontal dynamics were weakened and the vertical dynamics emphasised.

**Long corridors**

Long straight corridors present other problems of scale and dynamics. The cues to distance provided by perspective alone start to break down at distances of about 30 m (100 ft). In modern buildings there are often few other cues; texture gradients, for example, are minimal. At the same time, the strong directional dynamic produced by the ‘good continuation’ of the walls, floor and ceiling create an uncomfortable sensation of being hurried or sucked towards an infinitely distant goal.

This unfortunate effect can be weakened by providing better cues to scale. For example, a larger scale floor pattern gives a better texture gradient. Highly visible regular subdivisions, such as projections of the walls and ceiling, will at once weaken the continuation of the surfaces and help people to infer distances. The floor patterns can be given related divisions. Such devices give a more accurate sense of scale and also change the nature of the implicit movement from a headlong rush to a rhythmical progression. Of course, the best solution is to plan so as to avoid long straight corridors, but this is not always possible.

**Curved spaces**

Another obvious limitation of this discussion of self-contained rooms is that it has been confined almost entirely to rectangular spaces. Many of the richest and most beautiful interiors depend for their effect on the use of curved surfaces. However, achieving such effects requires a very high level of skill. Earlier it was pointed out that curved forms present practical difficulties in planning and construction. They are also much more difficult to imagine and to represent.

This does not mean that you should not study the use of curved forms. For a classification of the spatial arrangements used in the European tradition, reference should be made to Frankl (1914, 1968). Ching (1979) gives a useful introduction. Arnheim (1977) provides examples
of dynamic analysis. However, it is probably wiser to get a good grasp of the spatial possibilities of rectangular shapes first. After that, you can experiment with simple curved elements derived from the circle. Compound curves, such as those found in many Baroque interiors, are more difficult still.

Linked spaces

In the linked-space conception, two or more rooms are interconnected visually. This is not just a matter of having doors between them. The openings are large and permanent, and the views from one room to the next are an essential part of the aesthetic conception. However, the individual rooms remain clearly defined and may be of different shapes and sizes and have different decorative treatments; their floor and ceiling levels may also vary.
This conception is well suited to buildings in which exploration or voluntary movement between different kinds of entertainment or instruction are major activities. The Small Baths of Hadrian’s Villa are an early example (MacDonald and Pinto 1995). Sir John Soane’s house in London (Fig. 4.43), which was designed to display both his collections and his architectural skill, is another well-known example (Stroud 1984). Some modern art galleries and the ‘boutique’ sections of some major department stores, such as Bergdorf & Goodman in New York, are also conceived as linked spaces.

**Nested spaces**

The placing of one space inside another, but open to it, is a variant of the linked-space conception. Such an arrangement defines the inner space as privileged or special in a more emphatic way than full enclosure. In its simplest form, the definition of the inner space may consist only of four corner columns and a canopy. Bernini’s Baldachino in St Peter’s, Rome, is a good example, and the so-called *aediculae* (‘little buildings’) in Charles Moore’s own house at Orinda, California (Fig. 4.44), are modern, playful, miniature ones. The more enclosed the inner space, the harder it is to perceive the relationship of contained to container.

**The open plan**

It is generally agreed that the open plan was invented by Frank Lloyd Wright in the early years of the twentieth century, although, as with all inventions, there were precedents (Hitchcock 1958; Hidebrand 1991). As a space conception, the open plan lies between the subdivision of rooms discussed in 4.5.22 and that of linked spaces. The open-plan conception is often combined with the elementarist conception, but there are important distinctions between the two.

The open plan originated in domestic architecture. It is still mainly used for houses, though it is also applied to other building types, such as hotels and apartments, for similar reasons. The principle is simple. Two or more of the main rooms are opened up to each other to such an extent that they almost but not quite lose their individual identity. The result is that the apparent size of the space is increased.
Minimal versions of the open plan

The condition that the different forms should retain their individual identity was not always observed even by Wright. In some of his later houses, the living room and dining room are simply thrown into one, with minimal definition of areas for activities. The kitchen is also often treated as an adjunct space. It was in this minimal form that the open plan became popular around the world.

However, the open plan is not just a way of getting one decent-size room in a house by giving up some privacy. It is a way of generating a much richer and more complex space, a space that provides enclosure and refuge along with an invitation to explore.

Room definition in the open plan

Aesthetically, as has been suggested, it is essential to the open-plan conception that the definition of the different rooms be retained. In those examples in which he exploited the possibilities of this conception to the full, Frank Lloyd Wright used many different devices to achieve this. Separately or in combination he used changes of ceiling level, changes of floor level, changes of lighting, free-standing piers or screens and built-in furniture to mark the boundary between one space and another while leaving access free. The subdivision of walls and ceilings, on the other hand, is very often used to emphasise the continuity between spaces.

The handling of the transitions between spaces is critical. Where, as often happens in Wright’s work, the rooms are connected at the corners rather than the sides, he intensifies the visual interest of the remaining sections of the wall to compensate. Often such openings are on either side of a fireplace, under a lower section of the ceiling. The fireplace itself is grand, more or less elaborately treated, and often framed by built-in furniture. Thus the tendency for the room to dissolve into the adjoining spaces is more than compensated. On the other hand, in the vulgarised versions produced by speculative builders, it often happens that all definition of the individual rooms is lost, and the resulting space is no more than a formless volume.
Order in the open plan

Because the open plan provides a more complex visual environment than the self-contained room, additional attention must be paid to its visual order. As discussed in 4.2, a basis of perceptible order is essential if complexity is to be stimulating and enjoyable and not merely confusing. In the work of the master architects of the first half of the twentieth century, three main devices are used to tie the elements of the open plan into a unified whole. These are axes, grids, and what may be called strong enclosure.

Frank Lloyd Wright’s houses often have a very strong axial organisation about a centre point. These axes are not, as in nineteenth-century Beaux-Arts plans, occupied by corridors (see also 4.5.49). Instead they are the principal axes of the rooms that are combined in the open plan. The central focus is usually marked by the main fireplace and chimney and, as previously noted, this is also very often the point of transition between the different spaces. The organising power of axes depends on the law of good continuation (see 4.2.6) and also, where the axis is emphasised by linear decoration, on the rule of connectedness (see 4.2.10).

In his later ‘Usonian’ houses, Wright also often used a planning grid, to which all the elements of the design were related. Mies van der Rohe also made consistent use of planning grids (see also 4.4.25). The effectiveness of planning grids in visual coordination, like that of proportional systems, depends on the law of similarity (see 4.2.8).

Strong enclosure

Strong enclosure relies on the mental tendency to complete incomplete figures in accordance with the Law of Pragnanz (see 4.1.16). The linked spaces are designed so that the viewer will believe that they are all part of one larger, rectangular space that provides the organising frame of reference. This is achieved by emphasising the diagonal. The entrance is placed at an inner corner, so that the viewer’s attention is directed to the opposite, outer corner. The wall, ceiling and floor planes that meet at this other corner can be seen to continue to the right and left of the viewer into areas that are concealed by walls or screens. On the basis of
these cues, the viewer spontaneously constructs a mental image of an enclosing rectangular space.

The device of strong enclosure seems to have been invented by the Europeans. It is the arrangement used in Le Corbusier’s Villa ‘Les Terrasses’ and in Mies van der Rohe’s Tugendhat House (Fig. 4.45). In Le Corbusier’s Villa Savoye (Fig. 4.46), the living room and dining room are simply thrown together in a single large rectangular space; however, if the terrace outside the living room is included, as it must be since it is visible through the glass wall, this group of spaces also has this diagonal form of organisation. Although in this case he was not the originator, Wright was quick to demonstrate that anything the Europeans could do he could do better; he used this plan form in his most famous house, ‘Falling Water’ (Fig. 4.47).

**Wall subdivision in the open plan**

Frank Lloyd Wright often used horizontal wall subdivisions, or materials such as brick or field stone in which the joints give a horizontal emphasis to strengthen the sense of enclosure and connectedness, in
his interiors. He also used ceiling patterns for the same purpose. In other cases, as explained in 4.5.32, he used subdivisions of walls not to create continuity between spaces but to sharpen their individual identities. By contrast, European architects who made use of the free plan tended to avoid wall subdivisions, probably under the influence of elementarism (see 4.5.38).

**Furniture in the open plan**

In the open-plan conception, furniture plays a role in the definition of the individual spaces. Often it is built-in, as an architectural element. Even where that is not the case, in the classic examples the selection and placing of the furniture are designed to reinforce the overall order and the definition of the various parts. Wright designed the furniture for his houses, and the furniture for Le Corbusier’s and Mies’ buildings of the 1920s and 1930s was designed in conjunction with their collaborators, Charlotte Perriand and Lilly Reich.
The open plan and the section

So far, only horizontal relationships between spaces have been considered. However, it is also possible to open rooms into each other using the third dimension. Le Corbusier was particularly fond of this device. In many of his designs, one main space, usually a hall or a living room, is extended vertically and others on upper floors open onto it. Two examples among many are the library of the Maison la Roche, Paris (now the Fondation le Corbusier), which opens onto the upper part of the entrance hall, and the main bedrooms of the maisonettes in the Unité d’Habitation, Marseilles, which open onto the upper part of the living room.

The elementarist conception

The term ‘elementarist’ seems to have been conceived by the Russian artist Kasimir Malevich in about 1915 (Banham 1960). The influence of Russian art spread throughout Europe in the 1920s, and the elementarist space conception spread with it. While some of the artists involved, particularly El Lissitzky and Moholy-Nagy, clearly thought of their work as related to architecture, the elementarist conception has its roots in painting and sculpture, not building, and this creates certain difficulties.

The elementarist conception, as its name implies, involves thinking of architecture as an arrangement of elements in space. These elements are not rooms. They are horizontal and vertical planes and lines, with perhaps a few geometric solids. The role of these elements as roofs, ceilings, walls, floors, supports and so on is quite secondary; their primary purpose is to ‘modulate space’ aesthetically. The space in which they are arranged is thought of as continuous, but filled with an invisible three-dimensional rectangular grid. The elements are located in relation to the lines and nodes of this grid. The arrangement of the elements defines subspaces, once again on the basis of the Law of Pragnanz, but these subspaces remain part of and subordinate to the larger, all-encompassing space. Whereas in the open-plan space conception the identity of the individual rooms should not be lost, in the elementarist conception it is the continuity of this imaginary space
that must be preserved; there is no ‘inside’ or ‘outside’. The form of order involved is a kind of rational coordination.

**Elementarism in practice**

It is obviously difficult to realise this conception in a usable building. Buildings are mostly intended to enclose space, not to allow it to flow uninterrupted. Its most perfect realisations are, in fact, large sculptures, like Kiesler’s *Cité dans l’Espace*, which was shown at the 1925 Paris exhibition of decorative arts; it is an intricate array of suspended elements which inspired innumerable later display stands. The early architectural examples cheat in one way or another in order to achieve the desired effect. The earliest, the Rietveld/Schröder house in Utrecht (Fig. 4.48), also dates from 1925; only the upper floor is designed according to elementarist ideas; the ground floor is quite conventional. The Barcelona Pavilion by Mies van der Rohe (Fig. 4.49) was an exhibition building from which even the normal function of display was eliminated at the architect’s suggestion. Wright’s ‘Falling Water’ looks elementarist from the outside, but the effect is achieved by the use of extensive terraces and overhangs; the house proper is far more enclosed than it appears in the famous view across Bear Run.
Nevertheless, the elementalist conception was successfully adapted to building by such leading second-generation Modern Movement architects as Marcel Breuer and Richard Neutra, and has continued to be influential. The adaptations focused on connecting inside with outside, and elementarising the open plan. Walls, floors and roofs are made to project from the building into the surrounding space, which at once emphasises their character as planes and the continuity of inside and outside. The external walls are, so far as possible, made of glass so that spatial continuity is not interrupted. Where, for practical reasons, one solid element must be connected to another, either vertically or horizontally, narrow strips of glass, or even mirror, were inserted at the junction to preserve the visual separation of planes and the continuity of space. Some of these devices have become part of the general aesthetic tool-kit, and are used even where the dominant conception is not an elementarist one (Fig. 4.50).

### Wall treatment in the elementarist plan

Since walls, floors and ceilings in the elementarist conception are treated as independent planes, subdivision is avoided or kept as neutral as possible. Where subdivision is essential, a square grid is preferred. However, the tendency is to sharpen the individuality and separateness of elements by making them different in material, colour, tone, texture and so on.
Furniture in the elementarist plan

What has been said about furniture in the open-plan conception applies even more strongly to the elementarist conception. The furniture is simply another element in the overall order, and both its planning and its design must reinforce that order. Irrational placement within a rationally coordinated order creates strong interest, which will mostly be inappropriate for furniture.

So far as the design of furniture is concerned, it is much easier to realise the principles of elementarism in furniture than in buildings. Banham (1960) comments that Rietveld’s armchair (Fig. 4.51), designed in about 1917, is the most striking example of an elementarist structure. It is also extraordinarily uncomfortable: it is a piece of sculpture, not a chair.
The elementarist revival

In the last decades of the twentieth century, there was a revival of elementarism. Originally, as previously explained, elementarist architects aimed at a highly rational form of coordination. In its revived form, however, it was transformed by an obsession with complexity, which originated in a reaction against the Modern Movement and was given form and direction by the writings of Robert Venturi (1966).

The new elementarism, in contrast to the old, aims at a high level of irrational coordination, or what Arnheim calls ‘accident’ (see 4.2.50). The elements are not placed in relation to an imaginary grid, but freely, in an arrangement governed only by their mutual dynamics. The elements themselves are often curved or irregular. Oblique planning is preferred; even the horizontal and the vertical are avoided. The widest possible range of colours and textures is used. All of these are devices for increasing complexity and interest, by avoiding similarities.

Dangers of the new elementarism

Accident is a difficult form of order. It requires for success a very well-developed visual imagination, excellent skills in representation and/or access to a powerful computer graphics system, and a good deal of trial and error. Even in the carefully composed photographs in journals, some built examples are confusing and disturbing to the point of ugliness. There are also, of course, examples that are successful in their own terms. We would, however, question whether in many of these latter examples such a high level of interest is appropriate; it can be argued that it exceeds people’s normal tolerance for environmental complexity (see 4.1.21) and serves no symbolic purpose.

Against this, some theorists have argued that, because the early twenty-first century is a period of confused and conflicting values, visual confusion in architecture is symbolically appropriate. It is suggested here that, even if conflict is more evident than cooperation, it is not the task of architects to aggravate this condition or to add to the emotional distress that confusion and ugliness cause to people. This is an issue that might be debated in the studio.
A note on ‘serviced space’

Any of the foregoing space conceptions can be applied inside a volume of serviced space, such as an exhibition centre or a floor of an office building. All too often, however, the layout and furnishing of volumes of serviced space are not governed by any spatial conception at all, but only by a very low level of rational or irrational coordination. So-called ‘open plan’ offices, which are not open plan at all in the sense we have been discussing but simply undefined volumes, provide many examples.

Choosing a space conception

Different space conceptions have different practical and symbolic characteristics. In choosing a space conception, you should therefore give thought to matching these characteristics to the constraints. The ‘self-contained room’ conception is superior to the other three in providing privacy, security and noise control. Symbolically, the more enclosed and defined a space, the greater is its independence; independence is appropriate to spaces of either very high or very low status: the managing director’s office or the cleaner’s closet. The more open the space conception, the more equal the status of the spaces and the greater the encouragement to explore.

The open plan and the elementarist space conceptions originated in buildings of domestic scale and are generally unsuited to large, complex buildings. However, it is possible to combine different space conceptions in one building. In a complex plan, different ‘clusters’ (see 2.5.14) may be designed using different space conceptions, provided that they can all be fitted within some overall order. For example, the maisonettes in Le Corbusier’s Unité d’Habitation have individually an open plan, but in relation to the whole building each maisonette is conceived as a self-contained ‘room’. Again, the public spaces of a large building complex may have an open plan or an elementarist conception while the bulk of the building is conceived in terms of self-contained rooms.

Patterns of value

In the process of selecting a space conception for your building, you
will have begun to think about the relative symbolic importance of the various rooms or clusters. It is possible that they are all of more or less equal importance, like the individual rooms in a wing of an hotel. However, even in such a democratic grouping there are likely to be some spaces that are less important, such as cleaners’ closets, and some that are more important, such as the lobby at the entrance to the wing. More often, some rooms or clusters of rooms will be obviously more important than others. In either case, these relationships, of hierarchy or equality, provide the primary content or theme that the form of the building must express. The next step in the development of this theme will usually be to consider the arrangement of the rooms or clusters in relation to the main pattern of circulation.

**Circulation**

In the earlier discussion of trial layouts (2.5.16–17), the pattern of circulation was treated simply as a guideline or a pattern of guidelines. It was no more than a diagrammatic way of representing the constraints. We now have to consider how such abstract diagrams can be transformed into organising devices that control a sequence of architectural experiences, and also become architectural elements in their own right. In Chapter 2, we moved from considering constraints on individual rooms to constraints on arrangement. Now we are moving from considering the aesthetic qualities of individual spaces and groups of spaces to the aesthetic qualities of sequences of spaces.

**Experiencing buildings**

It is possible to treat a building as a static object of aesthetic contemplation. One can sit or stand and stare at it from some selected viewpoint, often, in the case of classic works, a viewpoint predefined by generations of photographs. More often, a building is experienced by walking or driving towards, around or through it. To use a musical analogy, the path along which the approach to, and progress through, the building takes place provides the melodic sequence linking the composition into a whole.

Such a sequence may have any one of many different expressive
characters. It may take the form of a crescendo, building up from smaller, simpler spaces to larger, more complex and more ornate ones. This is commonly the relation between the porch or narthex of a church and the nave, or between the foyer of a theatre and the auditorium. Again, the sequence may be a diminuendo, moving from a grand and elaborate entry to smaller and more intimate spaces, as with the progression from the lobby of a hotel or office building to the individual rooms or offices. These are hierarchical relationships. In a more democratic grouping, the sequence will be more rhythmic and repetitive. Whatever the value of the sequence, it may be elaborated by rests, variations and incidents to reduce monotony.

The *marche*

The Beaux Arts system of education had a technical term for the kind of sequence we have been discussing. It was called the *marche*, or walk. This term will be adopted here. The *marche* in Beaux Arts theory was the preferred path along which the visitor approached, entered and passed through the building. It disclosed the form of the building and connected the individual spaces of which it was composed, or, more exactly, the symbolically important ones. This is a way of thinking about the aesthetic effect of buildings that is still very useful.

However, the original Beaux Arts idea of the *marche* was somewhat restrictive. It was expected to be straight, and to be aligned with the main axis of an axial layout. Secondary communication spaces led off from it symmetrically at points that were well marked spatially and decoratively. The main entrance was emphasised both externally and internally. Van Zanten (1977) quotes Gromort, a Beaux Arts teacher, as remarking that ‘one enters a truly beautiful building from only one direction, and in this direction, the entrance is never too generous’.

Such an organisation suits a strongly hierarchical, very formal public building. This was, indeed, the kind of building which the Ecole des Beaux-Arts trained its students to design. It is not, however, the only possible organisation, even for such buildings. Almost all the Beaux Arts assumptions about the *marche* have been successfully challenged by architects.
4.5.50

**The marche in the houses of Frank Lloyd Wright**

As Hildebrand’s detailed analyses reveal, Wright often turned Beaux Arts principles upside down (Hildebrand 1991). Entrances are often understated and placed at right angles to the main approach. Inside, the *marche* may turn again at right angles or even reverse completely. It seldom follows the main axes. Particularly in the early houses, the *marche* ends at the fireplace core, the cave, around which the spaces of the open plan are distributed and from which, looking out through these spaces, various prospects are revealed.

Hildebrand suggests that Wright treated the house in this way because he conceived of it as a refuge. Access, therefore, should not be too quick or easy, nor should the plan be too intelligible. Despite this, Wright manages the *marche* so cleverly that it would be difficult to feel lost or bored while moving along these complex paths. Each change of direction is marked by a clearly identified space. A straight section of the path often ends at an outlook or view, so that the space which marks the change of direction acts as a viewing platform. The new direction is either the only option or strongly emphasised. This kind of *marche*, in which the progression is broken and varied by a series of aesthetically significant incidents, may be called *anecdotal*.

4.5.51

**The Barcelona Pavilion**

Such complications were not confined to the work of Wright. The *marche* of Mies van der Rohe’s Barcelona Pavilion (Fig. 4.49) approaches the building parallel with the main façade, reverses completely, and then takes three right-angle turns to reach the exit (Schulze 1985). The Pavilion was a public building, part of an international exhibition, and was visited by many thousands of people. Its complicated *marche* was successful for two reasons: first, the building was quite small, so that it was impossible to get lost; and, second, as part of an exhibition it was intended for divergent exploration.

4.5.52

**Other variations in the marche**

From these examples, it is clear that the *marche* need not be straight; it can bend to and fro. It can also be curved. In connecting a group of
buildings or pavilions on a hilly site, for example, a curving spinal corridor may be the easiest form to adopt. A curving corridor is more interesting; the curve cuts off the more distant internal views and adds ‘mystery’ (see 4.2.51). If one side is glazed, it also gives views outside in the direction of motion.

The *marche* need not take the physical form of a corridor. It may consist of a series of linked halls or courtyards. In an open or an elementarist plan, it may pass through spaces allocated to some specific activity. In such cases, care has to be taken to make sure that the two kinds of activity do not conflict, by, for example, keeping the line of the *marche* to one side of the space.

**Choosing an approach**

From the examples given, it should also be clear that the approach taken to the *marche* should be chosen mainly on the basis of the relative importance of intelligibility in the particular case. If people feel or actually become lost, they will not appreciate the aesthetic quality of the setting. In large, complex public buildings that people visit on business or to obtain services, the *marche* should be as simple as possible and the circulation system as a whole will be most easily grasped if it is symmetrical. In smaller and more private buildings, or in buildings for diverersive exploration, the *marche* can be more complicated, provided that the principles set out in 2.4.25 are observed, so that visitors will not feel lost.

**The *marche* in the third dimension**

The *marche* can be continued into the third dimension by stairs, ramps or escalators (see also 2.2.26–32; 3.4.24). Lifts create a spatial discontinuity: the *marche* ceases at one lift lobby and recommences at another. An historical review of the aesthetics of staircases is beyond the scope of this book. Reference should be made to Pevsner (1941, 1960) and Templer (1992a). Stairs and ramps, because of their sloping lines, have an inherent visual interest and there is a recurrent tendency to treat them sculpturally. Fine examples, among many, are Michelangelo’s stairs to the Bibliotheca Laurenziana in Florence, the main staircase in Aalto’s Villa Mairea in
Finland, and the escape stair of Le Corbusier’s Unité d’Habitation, Marseilles. This sculptural aspect of stairs will not be pursued further here. Rather, their spatial dynamics as part of the *marche* will be considered.

![Figure 4.52](image)

**Figure 4.52**
Ramps, Villa Savoye, Poissy (1928–29)
Le Corbusier

### 4.5.55

**Changing viewpoints**

Stairs, ramps and escalators provide changing viewpoints from which the spatial organisation of the building can be appreciated. The ramp in Le Corbusier’s Villa Savoye (Figs 4.46 and 4.52) is perhaps the most famous example. In most buildings, stairs or ramps form part of the *marche*; in the Villa Savoye the ramp is the *marche*. It rises from the ground-level lobby to the roof terrace, and provides views of all the symbolically important spaces of the building. Le Corbusier also made dramatic use of ramps in public buildings, for example in the High Court in Chandigarh (Fig. 4.53). More recent examples of this kind of use of ramps in public buildings are to be found in the work of Richard Meier, such as the Barcelona Museum of Contemporary Art.

### 4.5.56

**Dramatic transitions**

The impact of a symbolically important space can be heightened by contrast if it is entered from a space of a different character. Staircases, ramps and escalators provide opportunities for such dramatic transitions. Frank Lloyd Wright and Le Corbusier often took advantage of this in their house designs. The main spaces are placed on the upper floor and the *marche* leads from a relatively low, dark and enclosed entrance up a stair or ramp to a relatively high, light and open space.
The staircase as spectacle

Finally, in the case of stairs and perhaps ramps, the movement of people can provide a spectacle in itself, and a curved or helicoidal stair increases this visual interest (Figs 4.54 and 4.55). Escalators are weakened aesthetically in this respect by their very advantages; on an escalator people stand still and move rapidly. Charles Garnier, architect of the Paris Opera, described the dramatic possibilities of stairs in such a setting: 'There will be profit and advantage for everyone, if the big central stairway is a place of luxury and movement. The sparkling light ... the animated and smiling faces there ... the greetings exchanged, will all
have an air of festivity and pleasure’ (Van Zanten 1977, pp. 268–72). Garnier also emphasises the advantages, from this point of view, of having galleries arranged to overlook the stairs.

**Representing the **marche**

As with interior spaces generally, the best way of representing the *marche* is a plan and section (see 4.5.3). However, because of the linear nature of the *marche*, small, rough, one-point perspectives may also be useful. Make quick sketches to explore the possibilities for developing a satisfactory *marche* in the various trial layouts developed earlier.

**Choosing a layout**

At this point, it should be possible to select one of the trial layouts for development. This requires judgements about the relative suitability of the layouts to the chosen space conception, and the relative strength of the *marche* in each case. Such judgements may have to be still further revised as the exterior of the building is considered. In the Beaux Arts tradition, this chosen layout, still subject to refinement and adjustment, was called the *parti*, from the French phrase *prendre parti*, to take a stand or make a choice (Van Zanten 1977). This term acknowledges that there

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**Figure 4.55**

Helicoidal stair, Perret’s studio, Paris
(1929–32)
Auguste Perret
will always be other options that have not been developed and that, as argued in the previous section, form is not determined by the constraints.

**Summary**

This section has discussed some ways of looking at buildings as arrangements of interior spaces. Four types of spatial conception were discussed: assemblies of rooms, linked rooms, the open plan, and the elementarist conception. The importance of circulation in organising people’s experience of buildings was stressed. The idea of the *marche* as a way of understanding circulation was introduced. The next section turns to the aesthetic interaction between spatial organisation and external appearance – that is, the issues of mass and surface.

**Mass and surface**

**Introduction**

This section is about the external aesthetics of buildings. Putting it after the section on spatial organisation implies a value judgement. Buildings should, we believe, be conceived from the inside out. This judgement is not universally shared. In the nineteenth century and again at the end of the twentieth century many architects saw their task as being primarily one of exterior decoration, or at best the conception of buildings from the outside in. Like the rejection of technological constraints, this seems to have been part of a retreat from a difficult reality into a world of fantasy. It is true that in some serviced space buildings the constraints placed on the exterior by the demands on the interior are relatively weak, but they are never non-existent.

In almost all cases, designing from the inside out respects the hierarchy of constraints. Of course, the decision to respect the hierarchy of constraints is itself a value judgement, though one that we take to be demanded of any responsible architect.

The section begins by considering the extension of the *marche* into the outdoors. This is followed by discussions of the three main aspects of
external appearance, massing, façade articulation and fenestration, and
ornament and decoration. The possibilities of adjusting the apparent
relations of inside and outside, and the relation of building to context,
are considered in connection with each of these three aspects.

4.6.2

The *marche* and the exterior

Although the interior part of the *marche* has been discussed first, the
*marche* does not begin with the entrance door. The *marche* begins when
the building first comes into sight from the preferred direction of
approach. In a heavily built-up area, the direction of approach may be
fixed by the street pattern. When a building is to stand free, the architect
can, to some extent, control the exterior *marche* by landscaping. The
*marche* may pass through the building and out into a garden, in which
case the garden front becomes a secondary approach.

4.6.3

Multiple views

Ideally, perhaps every view of a building should be aesthetically equal.
However, it should be borne in mind that the sculptors of the
Renaissance and the Baroque, who gave great attention to multiple views
in theory and practice, usually contented themselves with only one main
viewing direction. Even strongly three-dimensional architectural
masterpieces such as Aalto’s Villa Mairea or Le Corbusier’s chapel at
Ronchamp have viewing directions which, while considered and
consistent, are obviously not intended to be primary (the north-east
and the north façades respectively). This is in part a matter of
architectural propriety: some parts of the building are less important
and therefore less emphasised visually.

4.6.4

Angles of approach

Where the direction of the exterior *marche* can be controlled, there is a
choice between an axial and an oblique approach. The axial *marche* is
the most formal, and tends to emphasise the entrance façade. An
oblique approach, particularly if it involves changes of direction,
emphasises the three-dimensional form of the building. It also allows
the modelling of the exterior to be revealed gradually from changing
viewpoints. The possibilities of the oblique approach can be enhanced if landscaping is used to frame successive views, as in some Japanese landscape gardens.

**Viewing distances**

In considering the exterior of a building, it is useful to take account of three main viewing distances. In the *distant view*, the whole building is seen as an element in a larger setting. In the *middle view*, the whole building is visible but the surroundings are seen only peripherally. In the close view, the building fills the visual field completely.

In the distant view, massing and shade and shadow effects on the façades are visually the most important aspects of the design. In the middle view, the importance of the massing is reduced and the subdivision of the façade in terms of shade, shadow, colour, texture and tone is dominant. In the close view, it is the colour and texture of materials and the ornament that attract attention.

**Massing**

Massing is a technical term of the appearance of a building considered as an isolated three-dimensional object. The effect of the massing depends on the proportions of the whole building and its parts, the dynamics resulting from those proportions, the connections between the parts and the hierarchical relations between parts. An important aspect of massing is the silhouette.

Massing bears a strong relationship to the plan. However, this relation is not necessarily direct. The visible mass must contain the elements of the plan horizontally and also their vertical extension, but, as at the Sydney Opera House, may not match them exactly. There is an issue of propriety and symbolism here. Arnheim, for example, has criticised the Sydney Opera House just because the inside and the outside do not match and the outside is to that extent misleading (Arnheim 1977). This is an issue that might be discussed in the studio.

Just as there are different space conceptions, there are different kinds of massing. Roughly, the building may be treated as a simple solid, or as a
group of solids connected in various ways, or as a segment of elementarist space (see 4.5.38).

4.6.7

The simple solid

Simple solids can for architectural purposes be divided into parallelepipeds and the rest. ‘Parallelepiped’ is the rather awkward technical term for a rectangular block. We begin by considering just two varieties of ‘the rest’, an old form, the pyramid, and a modern one, the shallow concrete dome. These will serve to illustrate the strengths and weaknesses of such forms (see also 4.4.24–26). It should be noted that what is being talked about here is not domes or pyramids as crowning elements of buildings but as forms resting directly on the ground.

4.6.8

Pyramids

One of the most powerful of architectural images is that of the pyramids of Egypt (Fig. 4.56). The sloping sides catch the eye. The dynamics of the pyramidal shape symbolise both stability and protection, aptly enough for tombs intended to be eternal. Their strong Gestalt, or visual unity, is also appropriate to a monument to an absolute priest-king. However, the pyramidal shape is not a convenient or symbolically attractive one for occupancy by living human beings. People, it was pointed out earlier, need a certain minimum of height if they are to move about freely. The sloping walls of a pyramid, if it were to be used to enclose a habitable space, would make large areas around the periphery unusable. From the outside, too, a pyramid symbolically resists entrance. The walls draw back from the approaching visitor. Porches look either tacked on or gouged out. Again, this is appropriate to a tomb but not to a habitable building. Nevertheless, pyramid-shaped buildings have been proposed and constructed in recent years (Fig. 4.57).

4.6.9

Domes

The dome, with its emphasis on centrality and containment, is symbolically appropriate to buildings for spectacle or communication, such as sports arenas and auditoria. However, domes, and particularly modern reinforced-concrete shell domes, which are kept shallow to
avoid tensile stress, suffer from the same disadvantages as pyramids, disadvantages that are all the more acute if they are to be entered and used by large numbers of people. Ingenious solutions to these difficulties have been devised. One example is Saarinen’s Kresge Auditorium at the Massachusetts Institute of Technology (Figs 4.58 and 4.59). There, large portions of the dome have been cut away, creating vertical sides. Another example is the small sports palace in Rome, by Vitelozzi and Nervi (Fig. 4.60), where the outer part of the dome is reduced to a structural skeleton, allowing entrance and eliminating the useless enclosed space.

**Projecting the plan**

These examples illustrate why it is that the three-dimensional form of buildings is so often a projection of the plan, and why it is usually best, particularly in the case of buildings that are not single-cell, to start the
investigation of massing in this way. However, it is possible to have a building shape that has vertical walls but is not a parallelepiped. Just one example will be discussed, the cylinder.

**Cylinders**

Cylindrical buildings are quite common, even apart from defensive and industrial construction. Because of its centrality, the cylinder is well suited to buildings that have one main dominating space. If the cylinder is of large diameter, joining porches or ancillary spaces onto the outside wall does not look too awkward. The cylinder is also the natural form to support a dome. All these features are illustrated by the Pantheon, Rome (Figs 4.61 and 4.62). Its symbolism, as a temple equally dedicated to the worship of all the ancient Roman gods, is particularly appropriate. These advantages of the cylinder are found also in the ellipse and in more complex compound curves, as many European Baroque churches show.

It is also possible to plan more complex buildings within the cylindrical form. The difficulties of having curving walls have been briefly mentioned earlier, but in the case of a cylindrical building the curvature of the outer wall will usually be slight, and radial partitions at least can be straight. An amusing eighteenth-century example is the main house of the Désert de Retz near Paris (Figs 4.63 and 4.64), which takes the
form of a shattered column; the symbolism is part of an elaborate literary fantasy developed in a number of buildings throughout the site. In recent years, Mario Botta has demonstrated that cylinders (Figs 4.65 and 4.66) can be used in very much the same way as parallelepipeds.
The paralleliped

In choosing a simple parallelipedal mass, the architect rejects many of the possibilities of expression through massing. What remains is proportion. Rational proportions, based on whole-number ratios, suggest order, harmony and formality. More important perhaps is the issue of figure quality or containment versus directionality. The more nearly it approaches a cube, the more enclosed and self-contained the building will appear. In his designs for villas, Le Corbusier was concerned to express first of all retreat, and secondly civilisation against nature, through the contrast of geometrical form and rural setting. The Villa at Garches, where the main façade has a proportion of about 1:1.5, emphasises enclosure and retreat. The Villa Savoye, named Les Heures Claires, has a more relaxed proportion of 1:4.

Of course, there are many famous single-storey parallelipedal buildings with still more horizontal proportions. Mies van der Rohe’s Farnsworth house (Fig. 4.67) has a horizontal proportion of almost 7:1. In that case, the architect, while retaining the contrast between geometry and nature, has used proportions that harmonise with the general horizontality of the setting. The articulation of the façade is used to restrain the horizontal thrust: it is both central and rational.

By contrast, the strongly vertical or horizontal parallelipedal forms of many serviced space buildings very effectively symbolise their character as a box of neutral space to be subdivided, with the added implication of dominance, in the case of a vertical building, or universal territorial ambition in the case of a horizontal one.

Whatever its proportions, the choice of a parallelipedal mass is a decision to emphasise the visual isolation and object-quality of the
building in relation to its surroundings. This kind of isolationism is a much-criticised feature of many Modern Movement buildings.

**Planning and the parallelepiped**

A parallelepipedal mass imposes some severe constraints on planning. It matches quite well with most serviced space buildings, with very simple plans such as that of the Farnsworth house, and with linear plans often used by Glen Murcutt (Fig. 4.68). Plans with a variety of different-sized and different-shaped rooms, strongly interconnected, tend to generate more complex three-dimensional forms. Such plans may be able to be fitted into a parallelepiped only by force. However, the classical simplicity of the parallelepiped continues to exercise a strong attraction for architects. As a result, compromises have been worked out that allow a complex plan to appear as a simple form. Two main compromises have evolved. The first compromise is to add precision to a dominant mass, to accommodate secondary spaces that tend to complicate the plan. This approach is exemplified by many of the houses designed by Charles Moore and his partners in the California Bay area during the 1960s. These houses have one grand two-storey space which contains the living room and sometimes also the master bedroom on a partial upper level. The main space is expressed externally as the dominant mass. Secondary spaces, small in relation to the dominant mass, are added like ‘saddle bags’, to adopt Moore’s own metaphor. Internally such ‘saddle bags’ may read as adjunct spaces (4.5.8).
The second compromise is to simplify the massing of a complex plan form by adding partly enclosed transitional or indoor/outdoor spaces, such as terraces, so as to give the appearance of a single, rectangular volume. This is the solution adopted by Le Corbusier in the villa at Garches, known appropriately as ‘Les Terasses’, and in the Villa Savoye. This solution, by comparison with the ‘add on’ solution, presents problems of expression (4.3.5) which are worth pursuing.

**Expression and the parallelepiped**

Palladio’s Villa Rotonda (Figs 4.69 and 4.70) provides a classic example of an appropriate expressive relationship between inside and outside. Palladio was able to achieve this in part because there is little differentiation of the internal spaces. The centralised symmetry of the plan is perfectly reflected on the outside. Hierarchy is expressed in the different heights of the floors, but on each level the rooms are symbolically equal.

By comparison, as previously noted, modern buildings often contain a much larger range of rooms of differing size and importance. To relate such a complex interior successfully to a simple exterior is a challenging task. Partly it is a task of façade articulation and fenestration. For the present, however, the concern is only with massing.

Towards the end of the first volume of Le Corbusier’s *Complete Works* (1937, 1946, p. 189) there is a famous group of sketches in which Le Corbusier reflects on this problem (Fig. 4.71). The sketches show, in
abstracted form, the La Roche/Jeanneret house in Paris, the villa at Garches, an unexecuted villa at Carthage (carelessly captioned as a house in Stuttgart) and the Villa Savoye. Each represents a different approach to the task of expression.

**The La Roche/Jeanneret house**

This house has a plan of the characteristic type that results from taking internal constraints, including, of course, the spatial conception, seriously. It has recesses, projections and changes of direction. Le Corbusier describes it as an easy kind of thing to do, picturesque and expressive. It can, he says, always be disciplined by distinguishing the parts clearly and establishing a hierarchy, issues that will be discussed shortly. Le Corbusier distinguishes it from the other three as being
‘programmable’, that is, arising directly from the plan as the generator. The other three forms he describes as cubic compositions, pure prisms, that is, parallelepipeds, and he clearly prefers them to the first.

**The villa at Garches**

Le Corbusier represents the villa at Garches, somewhat misleadingly, as an absolutely pure prism. It certainly appears so from the front, but at the back it can be seen that the plan is in fact L-shaped. The prismatic shape is achieved by the addition of a large, partially enclosed terrace in the angle of the L (Fig. 4.72).

Le Corbusier comments that this form was very difficult to achieve, but satisfying to the spirit. It was spiritually satisfying to him because it was a pure Phileban solid (4.4.24). It is also clear from the sequence of sketch plans that have survived (Benton 1987) that Le Corbusier struggled very hard to achieve this outcome. In the final solution, the enclosed terrace is given the status of an external room, two storeys high and of a clearly defined, cubical shape. This clear definition of the terrace spaces is abandoned in his last two examples. Presumably, therefore, it was one of the things that Le Corbusier found difficult to achieve in this design.
The design for Carthage

In this design, a reinforced-concrete frame supports a series of tray-like floors, one above the other, whose sides define the parallelepiped. The walls of the habitable areas are, however, set back from the surfaces of this parallelepiped and can follow the interior demands of layout and space conception. Le Corbusier describes this arrangement as easy and practical. It is well suited to repetitive plan buildings such as apartment buildings in climates where open terraces are useful.

The Villa Savoye

Le Corbusier (1937, 1946) describes the massing of the Villa Savoye as a generous compromise between the external statement of architectural organisation, the ‘pure prism’, and the various internal constraints. The basic definition of the volume is provided by the walls of the upper floor or piano nobile: four almost identical façades each with its continuous horizontal slit window. On the ground floor the habitable area is recessed and the surface of the enclosing prism is reduced to a few slender columns. A third level is suggested by the curving walls of a rooftop solarium. Thus far, we have the pure prism.

However, the usable area of the first floor is much smaller than the enclosure. More than one-third of the area is occupied by a large living terrace and a smaller one off the kitchen. More than a quarter of the window slit area is, in fact, unglazed openings framing the view from these terraces. The exterior is symmetrical, and the entrance and the ramp, which form the marche, are symmetrically placed in relation to it; the plan is quite asymmetrical. The inner asymmetry is clearly visible from the outside through the slits that open onto the terraces. Thus the viewer is made simultaneously aware of the complexity of function and the simplicity of the containing form: complexity within order. What has been sacrificed in order to achieve this is simplicity of form in the main first-floor terrace.

Adjusting the proportions

Since proportion is central to the aesthetics of parallelepipedal buildings, it must be carefully studied in relation to both the internal constraints
of plan and section and such external constraints on site conditions and building regulations, which may limit either horizontal or vertical dimensions, or both. If the proportions resulting from your first massing sketches are not satisfactory, it may still be possible to correct them by making small adjustments to plan or section. It may, for example, be possible to increase one plan dimension and reduce the other, retaining the overall area, or to select a variant layout of different horizontal dimensions. Similarly, it may be acceptable to increase or reduce the heights of some floors, or to add a plinth at the bottom or a parapet or pergola at the top, thus adjusting the apparent height. Façade articulation can also be used to adjust apparent proportions (4.6.70).

**Composition**

The term *composition* will be used for massing that involves the grouping of solids. Where the trial layouts show that the building divides naturally into a number of elements or clusters (see 2.5.14), and the site constraints are weak or insignificant (see 2.3.34), the composition of elements each of which retains some identity of its own can be a good approach. Here we have to consider the relationships of the parts to each other and to the whole, the proportions of the individual elements, and the definition of the junctions between elements.

**Composition and expression**

In 2.5.15 it was suggested that a useful approach to making a plan intelligible is to strengthen its inherent form of organisation. To be understood, however, the organisation must be made visible. A compositional approach to massing lends itself to expression, or making organisation visible, because each element can be given its appropriate weight and character. This contrasts with the expressive difficulties of the simple parallelepipedal form. A good composition will enable the overall organisation and the relative importance of the parts to be inferred from the visible form. Expressive massing is not a substitute for a good *marche*, but it can complement it.
Radial or linear

Also in 2.5.15 it was argued that there are two fundamental types of organisation, radial and linear. Bear in mind that the type of organisation is something you have to discover in the process of developing final layouts. There is no large element of choice, as in selecting a space conception or a *marche*. Each kind of organisation has its own expressive possibilities. Each can be either rational or irrational (see 4.2.43).

In a radial plan, the centre is the dominant position. The central element of a radial plan will be either the most important space or group of spaces, or the main circulation space. Conversely, any plan in which there is a dominant element to which all the other elements are attached is a radial plan. There can be just one radius, or two, as in the symmetrical ‘Palladian’ English country house (Fig. 4.73), or three or

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Figure 4.73
Palladian English country house,
Chiswick Villa (begun c. 1725)
Lord Burlington
four. With more than four radii the plan starts to lose intelligibility. The radii can be short or long, straight or curved, meeting precisely in the centre or arranged in a pinwheel. In a radial plan, the entrance will be either directly to the central element or from the end of one of the radii.

In a linear plan, the ‘line’ is that of the *marche*. A linear plan is entered at one end. The entrance is often the most important part of such a plan, from the expressive point of view. In such cases, it is appropriate to give the entrance visual dominance through massing. The rest of the *marche* is then diminuendo, leading to more private and/or less symbolically important parts of the building.

In ancient Indian and Islamic architecture, the opposite arrangement can be found. The symbolically most important element is at the far end of the *marche*, remote from the entrance. The length of the approach emphasises the importance of the goal. Examples are the Sokullu Mehmed Pasha mosque in Istanbul (Figs 4.74 and 4.75) and the temple of Surya at Konarak, India (Fig. 4.76). In these buildings the entrance is made dominant in relation to the outer enclosure, but the sacred space is far larger and taller, expressing its dominance through massing.
**The strength of connection**

The connections between elements can be strong or weak. If they are strong, the plan and the massing will be correspondingly compact, as in Wright’s Robie house (Fig. 4.77). If they are weak, the plan and the massing can be more open, as in the Dessau Bauhaus buildings by Walter Gropius.
Gropius (Fig. 4.78). These are both radial plans, but the principle applies equally to linear plans. The more open the massing, the easier it is to give individual expression to the elements, but the harder it is to give overall unity.

**Hierarchy in massing**

The elements at the top of the value hierarchy will necessarily occupy the privileged position in the plan (see 1.28, 4.2.49, 4.3.6). If the overall organisation is to be made visible, the visual importance of these primary elements must match their position. Similarly, in order to achieve clear expression, the visual importance of the secondary elements must be matched to their status in the hierarchy of values. Such distinctions cannot, however, be very precise; in fact the rule of tripartition (see 4.2.32) can usefully be applied here: don’t try to distinguish more than three grades of importance. However, it is still necessary to know what visible characteristics make for visual importance.

**Visual importance**

So far as massing is concerned, features that make for visual importance are good Gestalt, verticality of proportion, relative size, and relative height. Façade articulation and silhouette, which also contribute to visual importance, will be discussed later.

The associated issues of planning and proportion are also similar. However, adjustments to the proportions may be even more necessary, since the sizes and shapes of elements will be additionally constrained by the requirements of joining them.

**Making adjustments**

The process of making adjustments to obtain a satisfactory massing can be illustrated by a comparison of two houses by Frank Lloyd Wright, the Johnson house at Wind Point (Fig. 4.79) and the Robie house in Chicago. Each has a radial plan. In each one, Wright had to overcome the same basic difficulty: marking the centre of a composition of sprawling horizontal elements.
In the Johnson house, Wright adopted a traditional solution. The central cluster of great hall, dining room, music room and library centre, as usual in Wright’s houses, on a group of fireplaces. This whole area is covered by a single huge vault, carried high above the roofs of the radial wings and stepped. The centre of the vault is further marked by the chimney and a lookout. This is a twentieth-century version of the dome on a drum.

The massing of the Robie house is more ingenious. The restricted suburban site forced Wright to arrange the main spaces in a straight line, and, as at Wind Point, the chimney, massive as it is, would not have been sufficient to mark the centre. Wright has solved this problem by running the bedroom floor, not in the same direction as the main floor, which would have been the obvious solution, but crosswise. This floor presents its short end to the street and adjoins the chimney, reinforcing it visually rather than enveloping it. This had the potential to create a further difficulty: the bedrooms, which are symbolically secondary, are given a dominant position because they are high up and central. Wright resolves this in turn by enclosing the bedroom level in the deep roof of the main floor, and reinforcing the horizontal continuity and unit of this primary mass with sweeping bands of windows and brickwork. The main floor is thus visually far larger than the bedroom floor and is seen to contain and dominate it.
Small but important

A particularly difficult problem arises when the most important element is quite small in relation to the total composition. Two examples from the work of Alvar Aalto, one simple and traditional, the other much more daring and complex, will serve to illustrate this point.

Aalto regarded dining as an activity of high symbolic importance (Herdeg 1983). In his design for the Pedagogical University of Jyvaskyla, Finland (Fig. 4.80), he therefore sought to give visual emphasis to the student dining room, a small element in the total complex, and the staff dining room, which is relatively tiny. He did this by raising them both on a massive brick base or podium, which contains service spaces. The student and staff dining halls are linked, but the staff dining room is set back, and the link is set back still further and its treatment is bland. The façade of the student dining hall is of glass and timber, horizontal in proportion and with minimum modelling; the glass reflects the dark pines that surround the site. The staff dining room, by contrast, has a colonnade of white marble and its glass walls are strongly recessed. Façade articulation and materials are thus combined with basic massing to make the staff dining room read as a pendant jewel in relation to the larger element.

A similar problem arises in the design of a modern town hall. Symbolically, the town hall itself, in which the councillors meet in public, is the most important element. Yet in most places the administrative and service functions have enormously outgrown the ‘town meeting’ function. In the civic centre that he designed for
Saynatsalo (Fig. 4.82), Aalto addressed this problem. The whole group is built like a castle around an artificial mound. Most of the civic spaces, which include a library and offices, are on the level of the top of the mound, which is one storey above the characteristically flat terrain. The town hall occupies one corner of the complex; it is a storey higher again and the room itself is as high as it is wide, so that the hall dominates the little group like the keep of a castle. Finally, while the roofs of the other elements are almost flat, that of the town hall takes an aggressive V-shape (Fig. 4.81). Thus, what is most important is made most visible.

**Junctions between elements**

Composition requires that the elements composed retain their visual identity. It is quite different from modelling (see 4.4.34). Ideally, therefore, the elements will be strong and the connections weak, as at the Dessau Bauhaus. However, for practical reasons it is often necessary that elements should abut one another. The shaping of such junctions is critical to the success or failure of the composition.

There are four ways in which such junctions can be formed. The two surfaces can meet in the same plane. The junction can be marked by a projecting element. The elements can be offset, more or less. Finally, a recess can be formed between the two. These options will be discussed in relation to walls. Similar principles apply to junctions between pitched roofs.
In the same plane

It will be obvious that if two walls of the same height meet in the same plane, there is no distinction of two elements. Separateness must be defined by some kind of contour in accordance with the law of closure (see 4.2.5). A first step towards separation is made if one element is higher than the other. Providing this difference in height is of the order of at least 20% and preferably 40%, a virtual line will be created dividing the surface into two elements in accordance with the Law of Pragnanz (see 4.1.16). This is a weak form of separation. It can be strengthened by the articulation of the façade, as discussed later, but it will always remain ambiguous and indecisive.

Projections

In the classical tradition, attached columns or pilasters were used in conjunction with pediments to define elements within a continuous expanse of wall. Robert Adam, the eighteenth-century Scottish architect, was fond of this device and used it, for example, in the large London development known as the Adelphi.

In the work of picturesque architects such as Voysey and Lutyens, projections such as bay windows, staircases, chimneys and even downpipes (Fig. 4.83) are often used to create visual separation between elements whose walls are in fact in the same plane. These vertical separations are often reinforced by vigorous modelling of the silhouette.

The use of projections to define elements in this way overlaps with their use as part of a system of façade articulation.

Offsets

The commonest method of handling junctions between elements is by the use of an offset. The wall plane of the less important element is set back from the wall plane of the dominant element. More rarely, it is brought forward; this is symbolically weak in that it advances the less important over the more important. The effect is strengthened if there is also an offset in height. Quite a small offset, say 300 mm (1 ft), will serve the purpose, though apparent separation increases with the size of the set-back.
The works of Palladio and his English followers provide innumerable examples of the sophisticated use of this technique. In this classical tradition, the buildings are of course symmetrical and the elements at the end are often projected both forwards and vertically to increase the closure and centrality of the whole. Holkham Hall by William Kent (Figs 4.84 and 4.85) is an example in which the traditional use of offsetting in composition is pushed to its limits.

Recesses

A recess may be little more than a groove formed in the wall, or it may be a room-sized gap. As with offsets, the wider and deeper the recess, the stronger the visual separation of the elements. Narrow, deep recesses create dramatic shadows but they are difficult to maintain; they easily become rubbish receptacles. For this reason, it is wise, if you are using a recess to define elements, either to keep it quite small, say around 300 mm × 300 mm (1 ft × 1 ft) or even less, or to make it large enough to be landscaped and maintained.
The recess was much favoured as a way of defining elements by architects of the later part of the Modern Movement. A striking example is the Casa Girasole in Rome, by Luigi Moretti (Fig. 4.86). There the façade is divided into two distinct elements, each a stack of apartments, by a narrow slit, which does not extend to the ground but widens to form an entrance court.

**Elementarist massing**

What has already been said about the elementarist conception of space (4.5.38–40, 4.5.42–43) applies equally to massing; the two cannot in fact be distinguished. Elementarism treats architecture as an arrangement of elements in space; the size of the elements is irrelevant. Some large building complexes of the late twentieth century, in which whole groups of buildings are related to each other and connected by glazed streets and atriums, can be regarded as elementarist designs on a very grand scale.

**Pitched roofs**

So far, this discussion of massing has made only the briefest mention of roofs. As long as one prefers to think of buildings as Phileban solids or groups of Phileban solids, a pitched roof is a visually unacceptable intrusion. For this reason, Italian architects of the Renaissance and Baroque generally preferred the shallowest possible roof pitch and often concealed the roof behind a parapet, an unhappy device that creates a sort of peripheral box gutter (see 3.5.87). The universal admiration in which Italian architecture was held ensured that these solutions were widely adopted elsewhere. The Modern Movement, as previously noted, favoured flat roofs. The technical difficulty and expense of making a reliable flat roof (see 3.5.75–77) has, however, led to a widespread revival of enthusiasm for pitched roofs. On the whole, this is a good thing. Nevertheless, pitched roofs present aesthetic problems that flat roofs avoid. One kind of problem arises in joining roof to wall.

**Roof to wall**

The roof cannot simply meet the wall in a line. Technically this would be unacceptable, because there is a change of material and because of
the problems of water runoff (discussed in Chapter 3). However, even if, by the use of a perfect material, such a junction could be made, it would be *visually* weak and ambiguous. It would not be clear whether the junction line ‘belonged’ to the top of the wall or the bottom of the roof. Historically, we find two basic solutions to this visual problem: either the wall is allowed to master the roof, or the roof masters the wall.

**Wall over roof**

In the European tradition, far the most popular solution to the edges of the pitched roof, at least until the twentieth century, was to elaborate the top of the wall with a projecting cornice which at once supported or contained the gutter and made it visually part of the wall.

Recessing the roof is a characteristically French solution. In France, the medieval tradition of steeply pitched elaborate roofs continued into the Renaissance and Baroque periods. The roofs read as separate objects placed on top of the masses defined by the walls. Their great height adds dominance to the significant elements. Le Vau’s design for the chateau of Vaux-Le-Vicomte (1657–61) illustrates this approach. The revival of this style in the nineteenth century was transmitted world-wide thanks to the educational influence of the Ecole des Beaux-Arts and the American preoccupation with French culture. The approach has the same technical disadvantages as the use of parapets.

**Roof over wall**

The use of deeply overhanging eaves and gables is a latecomer to ‘high’ architecture in the European tradition. Two sources can easily be identified. One is the vernacular tradition of the alpine chalet, which seems to be the source for Bernard Maybeck’s Californian designs (Fig. 4.87 and 4.88). The other is the architecture of Japan, which is the source usually suggested for the roof treatment of Frank Lloyd Wright’s prairie houses and for the work of Greene and Greene in California (Fig. 4.89). The difficulties of the visually dominant roof have already been discussed. Architects working in the style which here has been called ‘elementarist revival’ have favoured low mono-pitch or arc-shaped roofs (see 3.5.84) because such forms can easily be treated as sloping
‘elements’ in their own right. The treatment of a building as a group of related but separate elements also allows the use of such roof forms without any great problems in resolving the junctions between them. However, it should be noted that architects working in this style sometimes appear quite indifferent to the resolution of junctions between elements where they occur; this is in accordance with their belief in maximising interest and tension, and raises the same general doubts (4.5.43).

Expression and the roof

As previously noted, a visually dominant roof emphasises protection and enclosure rather than internal differentiation. However, it is
possible to use variation in roof height to express the significance of spaces that are not otherwise visible from the outside.

An example is the huge ‘cooling tower’ that marks the assembly chamber in Le Corbusier’s design for the Palace of Assembly in Chandigarh (Fig. 4.90); a secondary, pyramidal element similarly marks the council chamber. The further such raised roof elements are from the outer wall, the higher they must be if they are to be visible from the middle view, and not just the distant view. This effect of perspective was well understood by the architects of the Renaissance and Baroque periods, who overcame it by, for example, raising central domes on drums and elongating the dome itself.

**Representing massing**

A preliminary idea of massing can be got from small-scale elevations. However, massing is essentially three-dimensional, and there is no real substitute for small, two-point perspectives for exploring massing (Fig. 4.91). The details of surfaces can and should be omitted, in order to concentrate on the main issues of proportion, junctions between elements, and expression. Sketches from at least two different viewpoints will be needed if you are to get a real grasp of the massing possibilities of a given layout. If the massing looks wrong, adjust it in perspective, using overlays, and then consider the implications for planning. Several repetitions may be needed to get a satisfactory balance.
Façade articulation

Façade articulation consists of the patterns created on the building surfaces by visible structure, by fenestration or the arrangement of windows, by the jointing of materials, and by decoration. There is an overlap between massing and façade articulation. Projections and recesses may be introduced into a façade either to express the importance of interior spaces or for purely decorative reasons. However, there is no point in doing much work on façade articulation until the massing is more or less settled, since changing the proportions of the masses will change the proportions of the façades.

Massing resembles sculpture in the round; façade articulation is more like relief sculpture. It is the pattern of light and shade produced by projections and recesses which is most important in giving the façade its organisation and interest (Fig. 4.92). This is because the contrast between sunlight and shadow is several orders of magnitude greater than the contrast that can be obtained by the most extreme variations of colour or tone of material. Mere colour variations may not be visible at all in the distant view, owing to aerial perspective or the softening of colours by distance; this effect is distinct from the tendency of coloured materials, and particularly strong or high chroma colours, to fade over time. Colour may be used decoratively for the near view, but in preliminary design the most attention should be given to patterns of light and shade.

Figure 4.92
Museum of Contemporary Art, Barcelona, part elevation (1987–95)
Richard Meier
Representing the façade

It follows from what has just been said that façades can be represented adequately in elevation. However, you need to know what shades and shadows a given façade geometry will produce. Many architecture schools no longer teach sciagraphy, or the geometrical rules for constructing correct shades and shadows on an elevation. If you have not learned sciagraphy, you should try to find a computer program that embodies these rules; a computer program has the advantage that it will generate shade and shadow patterns at different times of the day and year. As a last resort, build rough models and test them in a heliodon or outside in the sunshine. The basic principle is that the width of the shadow cast by a projection on a surface is proportional to the size of the projection.

Constraints on fenestration

Constraints on fenestration have already been discussed at some length (see 3.3.25–26, 3.3.31–38, 4.5.9–13). A good way to start the development of your façades is to draw the outline elevation and indicate the approximate positions, shapes and sizes of windows permitted by the known constraints. On an overlay, also show the columns and beams of the structure, if it is a framed building, and the positions of any internal partitions.

The reason for marking internal columns and partitions carefully is that they cannot be satisfactorily joined to a sheet of glass. This should be obvious, but it is often overlooked by students and even sometimes by practitioners. Apart from the difficulty of cleaning and the danger that the glass will be cracked by overheating, the column or partition is perfectly visible through the glass. Setting the column or partition back a little from the glass does nothing to conceal it and also creates problems of acoustic privacy. The problem can usually be overcome by adjusting the plan or the position of the window where the external wall is mainly solid. However, it is more difficult where the external wall is a glass curtain or where there are continuous horizontal strip windows. In these cases, an opaque or preferably a solid element must be introduced in the glazing to mask the junction. In serviced space
buildings, the window mullions are usually coordinated with the modular grid that controls the placing of partitions. Alvar Aalto disliked modules; in the Ministry of Pensions, Helsinki (Fig. 4.93), which has horizontal strip windows, he designed solid panels that could be fitted into the window frames whenever a partition was wanted.

Wall and frame

Façades can be divided into those in which the wall is dominant and those in which a visible structural frame is dominant. It does not follow that because the wall is visually dominant it must also be load-bearing. A frame structure can be concealed within a wall. Each type of façade has several variants.

The façade as wall

Arnheim (1954, 1974) discusses the possible relationships between window and wall where the wall is the dominant façade element. First, the window may be a hole punched in a solid surface; in this case the window is figure, the wall ground. Second, solids and openings may alternate so that the figure–ground distinction is blurred. Third, there is the glass curtain wall in which the glass of the ‘window’ becomes the ground.
Of these three possible arrangements, the most traditional (that is, the window as simple void) is aesthetically the most complex. Aspects that must be considered are the relationship between the individual window and the wall surface, proportions, the placing and grouping of windows, and the subdivision of windows.

**Window and surround**

Arnheim (1954, 1974) has pointed out a potential ambiguity in the relationship between window and wall surface. The window in this case is the figure and the wall is the ground. The contour surrounding the window therefore belongs to the window, not the wall, and there is a tendency for the wall to be perceived as *continuing behind* the window. Since the window is in fact a hole in the wall, this is perceptually ambiguous. The effect is responsible for the flimsy ‘cardboardy’ appearance of many buildings of the Modern Movement and later periods. Traditionally, windows were surrounded by mouldings that projected from the wall surface and at which the ‘ground’ of the wall could end, which was perceptually much stronger.

**Proportions of individual windows**

The general rules given in 4.2.28 apply. See also the earlier discussion of proportions in relation to the interior. Additional factors that have to be considered in designing façades are the relationship of the proportions of the individual openings to those of the façade as a whole, and to each other. Bear in mind that the more these relationships are governed by some proportional system, or self-similarity (4.2.29), the more unified and harmonious the effect. Conversely, the more varied the shapes of which the façade is composed, the more interesting the façade will be, and the greater the risk of producing an effect that is merely confused.

**Placing and grouping of windows**

Visually the simplest and most orderly grouping of windows is a symmetrical arrangement of windows of similar shape and size, symmetrically placed in the wall (refer to the discussion of symmetry in 4.2.11–15). The Law of Pragnanz ensures that *minor* departures from
such regular arrangements, such as occur by accident in many classical and Renaissance buildings, will be overlooked. Departures that fall just short of being obvious, on the other hand, create perceptual tensions. This fact was exploited by Asplund in the well-known garden façade of the villa Snellman (Fig. 4.94), where small variations in window shape, alignment and spacing are used to add interest to what would otherwise be a somewhat bland design. In general, the difficulty of using such traditional, orderly arrangements of windows today arises from the internal variety of buildings and the demand for windows adapted to the specific activities of individual rooms.

At the other extreme from such orderly and symmetrical arrangements is the situation in which windows of different shapes and sizes are arranged asymmetrically, organised by proximity, balance and common region, often with some help from connection (4.2.9–10). This is the kind of organisation that one finds in the work of Art Nouveau and Secession architects such as Horta, Guimard and Olbrich (Fig. 4.95). Practically such arrangements are sensible but aesthetically they are quite difficult.

An intermediate solution is that of the main façade of the villa at Garches by Le Corbusier (Figs 4.96 and 4.97). Here, as his famous diagram of the *tracés régulateurs*, or regulating lines, shows, a mixing of symmetry and asymmetry, and of similar and dissimilar elements, is harmonised by the use of alignment (the law of good continuation, 4.2.6) and by repetitions at all scales of the overall proportions of the façade.
**Subdivision of windows**

Windows are subdivided in order to provide for opening sections (2.2.7), to keep glass sizes within reasonable limits (3.5.46) and for purely ornamental reasons. The sizing of frames was discussed in 3.5.52–53. In subdividing windows, care should be taken to avoid horizontal divisions at or near eye level, since they will obstruct the outlook. The proportions of the parts and their relation to the whole should be considered in the same way as the proportions of the whole window and its relations to other windows and the wall (4.6.47).

The simplest subdivision is a repetition of equal divisions, and the simplest version of this is division into two equal parts. Such a subdivision suits either sliding or hinged (casement) openings. One of the two parts can be fixed or both can move.

However, division into two identical parts is almost always visually weak and ambiguous. You may prefer to divide the window into more parts, or to make the parts unequal, or both. Fixed and opening parts may alternate, as in the ‘Chicago window’, which had a fixed centre pane and an opening section on each side, a convenient arrangement for cleaning from the inside provided that the width of the fixed section is not more than about 1500 mm (5 ft). Solid panels, fixed or opening, may be introduced provided they do not reduce the glass area too much. In the case of windows that extend to the floor, it is wise to provide a horizontal division, or transom, between 600 mm (2 ft) and 900 mm (3 ft) from the floor to reduce the risk of breakage by kicking, cleaning and so on.

**Blurring the boundaries**

Another possible relationship between solid and void is produced by increasing the area of the windows so that the wall is reduced to strips or bands between equal or greater areas of window. This, as Arnheim (1954, 1974) points out, is characteristic of Gothic church architecture; the solids and void alternate, but neither is clearly figure or ground.

The Gothic balance between solid and void can also be seen in English
manor houses of the Elizabethan period, which were imitated in this respect by country houses of Arts and Crafts architects such as Voysey and Lutyens and the American Stick and Shingle styles, and also by the architects of the Art Nouveau and Frank Lloyd Wright (Hitchcock 1958; Scully 1955, 1971). In these houses, large areas of plain wall, or areas in which solid is plainly dominant, alternate with large areas of window.

The examples given so far are successful because the solid void pattern is either an overall texture, as in Gothic tracery, or an alternation of strongly defined and often unequal elements, as in the nineteenth- and twentieth-century houses. Mechanical alternation of equal or almost equal elements, on the other hand, is likely to be cold and dull. There are many twentieth-century examples of multi-storey buildings whose façades are made up of approximately equal strips of solid and void, arranged either horizontally or vertically. Even Eero Saarinen, who used this kind of articulation in his design for the CBS building in New York, was not able to make much of it. In this context, it should be noted that in the villa at Garches, where stripes of solid and void are given equality of treatment in the façade pattern, Le Corbusier nevertheless made sure that the area of one was clearly larger than the other: on the entrance front, solids occupy the larger area; on the garden front, glass.

**The glass curtain**

Finally, there is the glass curtain wall. Here the void or glazed area becomes the ground and the slender web of the glazing bars is the figure. A very early and influential example is Unilever House, New York, by Skidmore, Owings and Merrill.

In such façades the rhythm of the vertical glazing bars is usually constrained by the need for internal partitioning (4.6.42). The distance between column centres is divided into a number of equal parts, to give a module which for reasons of buildability is usually somewhere between 900 mm (3 ft) and 1500 mm (5 ft). In multi-storey buildings there is often a solid upstand at the edge of each floor level of about 750 mm (2 ft 6 in) to 900 mm (3 ft) in height. This may be required by regulations governing fire protection or thermal performance. Alternatively, such upstands may be there merely to relieve the anxiety
of people who suffer from a fear of heights, or to protect the glass from furniture being pushed against it or the activities of cleaners. There is also often a solid *downturn* which acts as a beam and also closes the edge of the false ceiling space. The area of a glass curtain wall outside an upturn or downturn is usually composed of opaque material, and this gives a horizontal subdivision, though it is weak because it depends on colour not shadow.

Similarly, where columns are placed immediately inside the curtain wall, there will usually be a vertical strip of opaque material in the wall itself. This gives a secondary vertical rhythm and generates glazing panels of unequal area, which adds some complexity to the façade.

In designing a glass curtain wall, it is useful to set out all these constraints first, and then consider and adjust the proportions of the subdivisions both in themselves and in relation to each other and the façade as a whole.

**The dullness of glass curtains**

Glass curtain walls have an inherent tendency to dullness. The number of repetitions of similar elements usually greatly exceeds Miller’s limit, and, as a result, the perceived visual complexity is proportional to the number of different-shaped divisions, not the total number of divisions (Heath, Smith and Lim 2000). Designing a glass curtain wall becomes a struggle between the constraints imposed by the building module and by economy of production, on the one hand, and by the correct perception that some kind of elaboration is needed, on the other hand. Unfortunately, the solution adopted has often been to introduce colour variation, which, for reasons already discussed, is of limited use. This problem will be looked at further in discussing ornament (4.6.55–77).

**The frame rules, ok?**

Where a structural frame is exposed, and not concealed behind a masonry or glass curtain wall, many different relationships between beam, column and infill or wall surface are possible. A few of the common ones will be mentioned: it is a good exercise to work out as many as you can.
First, consider the cases in which the outer faces of the beams and columns are in the same plane, or flush (Fig. 4.98, top). This relationship tends to emphasise the grid-like character of the frame. In such cases, the infill is usually either flush with the surface or recessed from it. The more the infill is recessed, the deeper the shade or shadow and the more the frame is emphasised. It is possible for the infill to be set back well behind the columns, to form sunshades, cleaning access, balconies and so on.

Second, there are the cases in which the beam, or more often a cantilevered slab, projects beyond the column (Fig. 4.98, middle). This tends to give a horizontal emphasis, which is most suitable where the proportions of the building as a whole are horizontal. The infill may be flush with the outer edge of the cantilever, in which case the columns should be set far enough back to allow easy cleaning between column and wall: at least 900 mm (3 ft) from the outer edge. Alternatively, the infill may be in the plane of the columns, in which case once again the external cantilever may be made large enough for various practical purposes; the restriction on cantilevers previously suggested (3.2.38) should be noted here.

Third, there are the cases in which the columns project beyond the beams (Fig. 4.98, bottom). This tends to give a vertical emphasis, suited to vertically proportioned buildings. Projecting columns can also be used to reduce the horizontal thrust of one- or two-storey façades by playing the rhythm of the bays against the direction of the whole. The infill in such cases is usually set flush with the beams, though, as in the previous cases, it is possible to set it further back.

**Infill**

Frames can be infilled with glass or with masonry, or with a mixture of the two, or with various kinds of lightweight or panel construction. Here, only glass and masonry will be considered. Glass infilling is subject to the same constraints as a glass curtain wall, though if the infilling is recessed to give a horizontal projection of 900 mm (3 ft) or more, the projection can take the place of a vertical fire barrier. In such
cases, the placing of furniture still has to be considered. There is a tendency to favour glass or lightweight materials in frames for large and particularly for tall buildings, for reasons of speed and ease of erection.

Masonry infilling is commonly used where a building is built on a site boundary or where there is some particularly aggressive environmental nuisance to be excluded. Masonry infilling is usually located more or less flush with the frame, or at least the beams, since there is little or no practical advantage in setting it back. Many combinations of glass and masonry are also possible, though it should be noted that placing masonry above glass within a frame creates unnecessary problems of support.

Aesthetically speaking, the issues of proportion of the individual parts and of relating the parts of the infill to each other and to the bays of the frame are the same as those discussed earlier.

**Mixed effects**

There is no overriding technical or practical reason why a façade should not consist of a combination of two or more of the treatments discussed in this section. Architects who have reacted against the austerity of the Modern Movement have not hesitated to ‘mix and match’ their façades. In a complex building, this may have considerable advantages from the point of view of expression; different parts can be distinguished by differences of façade character. The usual cautions apply: variety is only expressive within a framework of order.

In the case of serviced space buildings, the issue is more complex. Introducing a medley of different façade treatments in such buildings is not expressive. It denies the reality of the homogeneous, characterless space that the façades enclose. The question is, does such deception matter? This is an issue for debate in the studio. It also serves to introduce the question of ornament in general.

**Ornament**

Ornament is here defined as any addition made to a façade for the purpose of making it more expressive. This definition looks back to a
traditional sense of ornament as adornment or improvement, or making special (4.1.14), as opposed to the more recent view of it as superfluous and even atavistic, a view that is often traced to the writings of Adolf Loos at the beginning of the twentieth century (Banham 1978). This section is also concerned with decoration, defined as the introduction of visual interest for its own sake.

The discussion of ornament and decoration that follows is necessarily limited. A systematic theoretical treatment is to be found in Gombrich (1979). The best book on ornament in the sense of decoration is still Jones (1856, 1982); Stevens (1980) is also very useful.

Ornament in context

Ornament in this broad sense cannot be considered in isolation. It is part of a process of adjustment and refinement which will almost always include both levelling and sharpening, simplification and ornament (4.1.14–17). This last part of this chapter therefore calls on you first to review what you have done so far, in order to assess the need for ornament, and then gives an overview of possible adjustments, of both kinds. This is essentially a review of 4.2 in this specific context.

The need for ornament

The need for ornament is a matter of judgement. You have drawn up your façade design, and what you have does not look right, either in relation to its context or in itself, or both. Of course, if it does look right, you should leave it alone, at least until you have the comments of your teachers. However, if it really does not look right, the first thing to decide is what is causing the wrongness.

The most likely cause of visual wrongness is lack of clarity in figure–ground relationships. This easily arises if you get too involved in the details and fail to shift your viewpoint and consider the hierarchy of values, that is, the relative importance of the building in its setting and of the parts in relation to the whole. From the point of view of expression, it is this hierarchy of values that has to be translated into a visual hierarchy. What you have may be too busy and fussy. Everything
is shouting for attention, there is no apparent order and the message is lost. Again, the design may be too bland: it is neat and tidy but there is no visual distinction of the more important and the less important. More subtly, visual attention may be directed, but in ways that do not make sense. The visually outstanding elements may be practically or in terms of values insignificant.

**The need for decoration**

Failures of expression are the most common cause of aesthetic wrongness, but cases in which a design can be improved by purely decorative additions are also common. There are two main situations in which decoration may be needed. First, the distant and middle views of serviced space buildings may be unacceptably bland. Second, in buildings of all kinds it may happen that the façade articulation is too sparse or too large in scale to provide any visual focus for the close view. In considering the use of decoration to overcome such failings, bear in mind that misapplication of decoration is a very common cause of failures of expression.

**Back to the tool box**

Having decided that adjustments to your design are needed, you then need to decide what particular devices, or combinations of devices, you are going to use to achieve this. At this point it may be helpful to re-read 4.2.3–10, 4.2.31–36 and 4.2.49. Note that the Gestalt laws and rules are reversible. If, for example, increasing similarity or connectedness in a given case increases figure and ground contrast, then reducing them will reduce figure and ground contrast.

It is important to bear in mind that levelling and sharpening take place in relation to the ground. The ground itself may be visually simple or visually complex. Before attempting to level or sharpen anything, therefore, it is essential to understand the character of the ground.

**Adjustments of the distant view: general principles**

In the distant view, the primary decision is whether the building should harmonise or contrast with its setting. The main issues, as pointed out
earlier, are silhouette, tonal contrast, and large-scale patterns of light and shade on the façade.

**Skyline and silhouette**

A building will always stand out if it breaks the skyline, whether it is an office tower rising above a modern city or a French chateau rising above the woods of the surrounding park. The more complex the silhouette, the more attention the building is likely to attract. Complexity can be added to the silhouette by increasing the number of changes of direction in the contour, by the use of curved or sloping elements, and by adding decorative projections, such as gargoyles, turrets, lanterns, chimneys and so on. Miller’s limit applies, though in the case of designs with bilateral symmetry the calculation should be based on half the silhouette only. Examples of considered elaboration of the silhouette can be found in American skyscrapers of the period between the First World War and the Second World War, and in many palaces, chateaux and grand houses, such as the Chateau de Chambord.

**Tone**

It is easy enough to see how close or far apart in tone a building and its background are. Adjusting the tone is usually a matter of selection of materials.

**Light and shade**

The large-scale pattern of light and shade, which reads as texture, is more difficult both to visualise and to control. Consider, however, a building set against a background of trees. If the trees are of similar species, the size of the masses of foliage and the size and shape of the shadows they cast on each other will have a general similarity and this similarity will be strengthened in perception in accordance with the Law of Pragnanz. If the structure, fenestration, screening and so on of the building create masses of light and shade of similar scale, the building will stand out less. Conversely, if the scale of the light and shade pattern on the building is much larger than that of the background, it will stand out more.
Adjustments of the middle view

The middle view is the one on which student projects are most often judged. It is also the most complex. Here, we consider adjustments that may be made to a design to vary its relationship to its immediate setting, to adjust the apparent proportions, and to improve the expression of internal differentiation.

At the margin

Sharpening the surround contours of a façade will strengthen its figure-quality (4.2.5). The most important contour is the top; the classical cornice served to strengthen the top contour, and some modern equivalents (Fig. 4.99) were mentioned earlier (4.2.38). Statuary was sometimes added above the cornice or parapet for the same reason. Similarly, in the classical tradition such devices as paired pilasters and rustication were often used to strengthen the vertical contours. (Rustication consists of the use of relatively large, strongly textured stone blocks set into a smooth or lightly textured façade; it should not be too difficult to invent modern equivalents.) Because the return of the cornice at the corner creates such a strong visual effect, it was rarely necessary to ornament the corners of buildings in the classical tradition. However, it is notable that in Gothic buildings, where the cornice is absent, corners are often ornamented with turrets or similar features; the Doge’s Palace in Venice is an example.
Harmony with nature

Where a building is seen against a natural background, broken contours made up of small-scale elements are likely to reduce contrast; this is the opposite of the situation in which the building is seen against the sky (4.6.61). Where a building is entirely surrounded by trees, deep roof overhangs will shade the walls and help to merge them with the shade of the trees. Using local materials in their natural state, and colours derived from local soils, rocks and vegetation, will also reduce figure-ground contrast.

Contextualism in the city

Inserting a new façade into an existing continuous street front poses special problems. In the case of historic row houses, such as those of London, Amsterdam, Boston and Sydney, the simplest and often the best solution is to reproduce the surrounding façades. This will, indeed, often be required by regulation. Where, however, the buildings are merely of roughly similar size and character, or where there is a great range of scale and style, the task is more difficult. All too often the response is to try to make the new façade stand out from its surroundings. The consequences are to be seen in many downtown areas: all the buildings are shouting and all are lost in the general cacophony.

The urban environment

Downtown settings are inherently high in information content. Anecdotally at least, it appears that for many people they offer too much stimulation (4.1.19). There is evidence that reducing the amount of information in such settings can be more successful both environmentally and commercially (Nasar 1988b).

Much of the stimulation of such settings, however, comes from what Rapoport (1982) calls the semi-fixed and unfixed elements: signs, street furniture, window displays and, above all, people. Buildings cannot compete with all this and for the reasons given above it is doubtful whether they should attempt to. Rather, in such settings the buildings
should provide the neutral ground against which the urban drama can unfold.

**Harmony in the city**

If the argument of 4.6.67 is accepted as being at least sometimes true, then in such cases the downtown street façade should aim at conserving whatever order is present. Proportions, materials and small-scale details have a significant influence on the overall coherence of groups of buildings (Groat 1988). In addition, maintaining or emphasising any rhythms that may be present, such as width of street frontages or spacing of windows, and carrying through lines such as those of cornices, mouldings, and window heads and sills are effective ordering devices. If order in the street has already vanished, then bear in mind that visual figure is created by contrast: a restrained façade is likely to stand out more in such circumstances than yet another attempt at being interesting; at the same time it reduces the information overload.

**Apparent proportions**

In urban settings, regulations governing height and site coverage may force your design into an awkward overall proportion. It is in many cases possible to correct this by suitable articulation of the façade.

If the façade is just larger than square in the horizontal direction, it is often possible to give it an apparent horizontal proportion by treating the ground floor, or the bottom two or three floors, in a different way from the upper part, for example by using different materials or more decoration. This is particularly appropriate where, as often happens, the lower floors have a different function to the upper. Horizontality can be further emphasised by using band windows, introducing string courses, and using materials such as brick which have a strongly horizontal pattern.

Façades with width-to-height ratios of between 1:1.5 and 1:2.5 have a weak tendency to verticality which may need to be strengthened. This can be done by introducing major or minor vertical subdivisions. Major subdivisions are best formed by projecting or recessing part of the
façade. The use of minor subdivisions is well illustrated by Louis Sullivan’s Guaranty Building in Buffalo. There the weight of solid and void is almost equal, forming a texture, but the whole is given verticality by the vigorously projecting masonry piers.

**Adjustments of expression**

The middle view gives the greatest opportunities for the expression of internal differentiation. Important spaces can be identified visually by projections, by enlarging their windows or giving them different shapes from other windows, and by elaborating window surrounds or subdivisions. Similarly, major entrances may be marked by elaboration.

When a façade has an inherently complex pattern of fenestration – that is, where the interior organisation calls for many windows and perhaps windows of different sizes and shapes – levelling may be needed as much as sharpening, if the significant elements are to stand out. One way to achieve this is to group the less important windows as far as possible, thus creating a hierarchy of organisation (4.2.48). Windows can be grouped by increasing their alignment, or their proximity, or their similarity, or by enclosing them in a frame or a field of a different colour or texture from the rest of the wall, or by linking them with mouldings (4.2.6–10).

**Serviced space**

As observed earlier, the façades of office buildings and other kinds of serviced space often seem to cry out for decoration. The puzzle is to achieve a successful effect without implying an internal differentiation that does not in fact exist. A solution is sometimes possible in terms of hierarchical subdivision (4.2.49). Thus, the overall façade can be divided vertically by projecting or recessing the side bays, and horizontally into base, shaft and plant room, and in the case of tall buildings also by the introduction of intermediate plant rooms. This much can be done even with a glass curtain wall. A further level of subdivision can be introduced if, as in the Lake Shore Drive Apartments and the Seagram Building by Mies van der Rohe, some of the dividing elements are made bigger than they need to be and used to define
another level of subdivision. If the frame is expressed, a further level of subdivision is possible. Bear in mind that Miller’s limit applies to each level of subdivision.

**Works of art**

‘Decorative art’ was strongly rejected by the Modern Movement. Confusingly, the use of works of art for decorative purposes was accepted and in fact encouraged. The somewhat convoluted distinctions involved have now largely been forgotten, and architects are once again making use of the assistance of painters, sculptors and craft workers in ways ranging from the purely decorative to the expressive. The main problem, as with the employment of any highly skilled workers, is cost. The potential uses range from figurative work at the scale of doorknockers, and assistance in the design of ornamental patterns, through to sculpture to mark entrances (Fig. 4.100), and large-scale murals to mitigate the effects of blank walls, such as the murals that surround the library of the University of Mexico City, by O’Gorman, or the cross-sectional mural by Haas which decorates the west façade of the Boston Architectural Centre (Haas 1981).
The close view: decoration

The reasons for providing decorative treatment of surfaces that are viewed from a short distance were given previously. There are many different possible decorative treatments. Among the commonest are: using a material that is inherently decorative, sharpening the surfaces of elements to decorative effect (Fig. 4.101) and applying coloured patterns of one sort or another. The last two may be combined. Note that not all external surfaces are in fact seen close-to. The most significant areas from this point of view are those around entrances (Fig. 4.102).

Decorative materials

Decorative materials suitable for use outdoors include the hard decorative stones, such as granite, and materials whose jointing naturally forms small-scale patterns, such as brickwork and some kinds of stonework. Brickwork in particular lends itself to decorative elaboration, through the use of different-coloured bricks to make patterns and also by projecting courses or individual bricks to create textures (Fig. 4.103) or large-scale symmetrical patterns.
**Shaped surfaces**

Books on traditional masonry, which was built using large blocks of stone, show many examples of decorative treatments that were formed by cutting or carving the stone. One of them, rustication, has been mentioned previously. The availability of computer-controlled lasers has made some of these forms of cut decoration economically feasible again. Casting can also be used to form decoration (3.5.27). Concrete blocks are often cast with decorative patterns, as in the famous ‘textile’ blocks designed by Frank Lloyd Wright. Metals can also be cast, stamped or pressed into decorative patterns. The material that best lends itself to decorative elaboration, however, is architectural terracotta, which can be extruded or moulded to give very fine detail and can also be glazed with brilliant, durable colours.

**Coloured patterns**

Besides architectural terracotta, other forms of tiling and also painting and coloured plasterwork can be used to produce colourful decorative patterns. Used in limited areas and close to the ground, where they can be easily maintained, these forms of decoration are often successful, though they are still subject to the technical problems described in Chapter 3.
REFERENCES


REFERENCES


Geertz, C. (1973), The Interpretation of Cultures, Basic Books (no place of publication).


McDowell, Andrea (1996), 'Daily life in Ancient Egypt', *Scientific American*, vol. 275, no. 6, pp. 68–73.


Miller, G. (1956), 'The magical number seven plus or minus two: Some limits on our capacity for processing information', *Psychological Review*, vol. 63, no. 2, pp 81–96.


Rapoport, A. (1984), ‘Architectural education: ’There is an urgent need to reduce or eliminate the dominance of the studio’, *Architectural Record*, October, pp. 100–5.


Sime J.D. (1985), Movement toward the familiar: Person and place affiliation in a fire entrapment setting’, *Environment and Behaviour*, vol. 17, no. 6, pp. 697–724.


REFERENCES


Thorne, R. & T. Purcell (1994), ‘Can a mode of practice in the design professions be transferred to universities to become a teaching method? The case of the consultant model in teaching’, paper presented at the annual meeting of the Higher Education Research and Development Society of Australasia, Australian Natural University, Canberra.


Williams, R. (1976), Keywords: A Vocabulary of Culture and Society, Fontana, Glasgow.


Wotton, Sir Henry (1686), The Ground Rules of Architecture Collected from the Best Authors and Examples, London.


## EXPANDED CONTENTS

### 1  INTRODUCTION

1.1 What this book is not 3
1.2 What this book is 3
1.3 Difficulties 4
1.4 Modern architectural education 4
1.5 Problems of coordination 5
1.6 The studio situation 5
1.7 Knowledge and design 6
1.8 An example of interaction 6
1.9 Designing as exploration 7
1.10 Maps and searches 7
1.11 A popular view of designing 8
1.12 Limits on the imagination 9
1.13 Escaping our limitations 9
1.14 Representation 10
1.15 Shifting viewpoints 11
1.16 Lines of attack 11
1.17 Kinds of constraint 11
1.18 Part and whole 12
1.19 Backtracking 13
1.20 Emotional difficulties of backtracking 13
1.21 Be prepared 13
1.22 Stopping 14
1.23 Where do constraints come from? 14
1.24 Constraints and authority 14
1.25 Constraints as needs 15
1.26 Constraints as facts 15
1.27 Constraints as values 16
1.28 Hierarchies of values 17
1.29 Ill-defined goals 17
1.30 A definition of designing 18
1.31 Satisficing 18
1.32 Stopping 19
1.33 Knowing how 19
1.34 The constraint model of designing 20
1.35 Heuristics and their limitations 20
1.36 Search plans 21
1.37 State of the art review 21
1.38 Analysing examples 22
1.39 Solving the parts 22
1.40 Recognition 22
1.41 Generate-and-test 23
1.42 Buy it or break it 23
1.43 Building up 24
1.44 Picking the winners 24
1.45 The pervasiveness rule 24
1.46 The salience rule 25
1.47 The Gordian knot rule 25
1.48 The rigidity rule 25
1.49 Interactions 25
1.50 About computers 26
1.51 The structure of this book 26
1.52 Chapter content 26
1.53 The order of the chapters 27
1.54 Cross-references 27
1.55 Disclosures of interest 28
1.56 A functionalist tract? 28
1.57 Professionals and laypeople 28
1.58 Architecture in the social setting 29
1.59 Teachers and learners 29
1.60 Warning 29

### 2  THE PLAN IS THE GENERATOR

2.1 Introduction 33
2.1.1 The importance of plans 33
2.1.2 The domain of action 33
2.1.3 Activities and values 34
2.1.4 Categorising values 34
2.1.5 Values and reasons 35
2.1.6 Discovering values 35
2.1.7 State of the art review 35
2.1.8 The architectural literature: books 36
2.1.9 The architectural literature: monographs 36
2.1.10 The architectural literature: journals 36
2.1.11 Interpreting architectural literature 37
2.1.12 The environment–behaviour literature 37
2.1.13 Studying examples 38
2.1.14 Briefs and programs 39
2.1.15 Asking and listening 39
2.1.16 The client in the studio 40
2.1.17 From top to bottom 40
2.2 Rooms and how to design them 41
2.2.1 Rooms and plans 41
2.2.2 Some exceptions 42
2.2.3 Rooms and activities 43
2.2.4 Props 43
2.2.5 Fixed props 44
2.2.6 Non-fixed props 44
2.2.7 Openings 44
2.2.8 Relationships between props 45
2.2.9 Sequences 45
2.2.10 Groupings 46
2.2.11 Sizes of groupings 46
2.2.12 Taking a stand 47
2.2.13 Meaning and scale 48
2.2.14 Dynamics 48
2.2.15 Guidelines and conventions 49
2.2.16 Room heights 49
2.2.17 Using guidelines critically 50
2.2.18 Communication spaces 50
2.2.19 Halls and lobbies 51
2.2.20 Coat hooks and cloakrooms 51
2.2.21 Orientation 51
2.2.22 Waiting 51
2.2.23 Transit 52
2.2.24 Support services 52
2.2.25 Corridors and passages 52
2.2.26 Stairs 52
2.2.27 Stair width 53
2.2.28 Treads and risers 53
2.2.29 Landings 54
2.2.30 Stair configurations 54
2.2.31 Ramps 55
2.2.32 Lifts and escalators 55
2.2.33 Working methodically 56
2.2.34 Preliminary design 57
2.2.35 Time savers 57
2.2.36 Using standards sensibly 57
2.2.37 The next stage 58
2.3 Marvels and mysteries of the site 58
2.3.1 What is a site? 58
2.3.2 The site and the studio 59
2.3.3 Aspects of the site 59
2.3.4 The site as environment 60
2.3.5 Location 60
2.3.6 Access 60
2.3.7 Services 60
2.3.8 Climate 61
2.3.9 Microclimate 61
2.3.10 Orientation and aspect 62
2.3.11 Prospect 62
2.3.12 Character 62
2.3.13 The site as property 63
2.3.14 Boundaries 63
2.3.15 Building lines and floor space ratios 64
2.3.16 Easements and rights of way 65
2.3.17 The site as surface 65
2.3.18 Contours and landform 65
2.3.19 Soil and surface water 66
2.3.20 Existing structures 67
2.3.21 Vegetation 67
2.3.22 Animals 67
2.3.23 Subsoil: geology 68
2.3.24 Subsoil: underground structures 69
2.3.25 Getting to know the site 69
2.3.26 Exploring systematically 69
2.3.27 The uses of site information 70
2.3.28 Recording the visit 70
2.3.29 Modelling dynamic features 70
2.3.30 Site analysis 71
2.3.31 Overlay mapping 71
2.3.32 Deciding on siting 71
2.3.33 The minimum number of storeys 72
3 THE MATERIALS OF CONSTRUCTION

3.1 The idea of technology 113
3.1.1 Technology in the architecture school 113
3.1.2 What is technology? 113
3.1.3 Capital, labour and materials 113
3.1.4 Machinery 114
3.1.5 Substitution 114
3.1.6 The bonds of poverty 114
3.1.7 Embarrassment of riches 115
3.1.8 Architects’ values 115
3.1.9 Technical innovation and rationalism 116
3.1.10 Technological progress 116
3.1.11 Criticisms of technological rationalism and progressivism 117
3.1.12 Architects and the industrialisation of building 117
3.1.13 Why the ideal failed 118
3.1.14 Industrialisation of buildings: the reality 119
3.1.15 Looking backwards 120
3.1.16 Giving up the struggle 121
3.1.17 Some criticisms of technological nihilism 121
3.1.18 Popular values and building performance 122
3.1.19 The hierarchy of technical values 122
3.1.20 Stability and safety 122
3.1.21 Weatherproofness 123
3.1.22 Health 123
3.1.23 Comfort 123
3.1.24 Durability 124
3.1.25 Sustainability 124
3.1.26 Complexities and contradictions of sustainability 125
3.1.27 The politics of sustainability 125
3.1.28 Economy 126
3.1.29 Lifetime performance 126
3.1.30 Popular demand and the market 127
3.1.31 Building regulations 128
3.1.32 Technological values in normal architectural practice 128
3.1.33 Technological values in the studio 129
3.1.34 Rules of thumb 129
3.1.35 Summary 130
3.1.36 The plan of this chapter 131

3.2 Load and support 131
3.2.1 Structural theory and the design studio 131
3.2.2 What do we need to know about structure? 132
3.2.3 Loads 132
3.2.4 Differential compression of foundation 132
3.2.5 Moisture movement of foundations 133
3.2.6 Design and equivalent loads from foundations 133
3.2.7 Wind loads 133
3.2.8 Modelling wind behaviour 134
3.2.9 High- and low-pressure zones 134
3.2.10 Eddy currents and vortices 135
3.2.11 Support vertical loads 136
3.2.12 Supporting roofs 136
3.2.13 The roof and the building 136
3.2.14 Supporting the lowest floor 137
3.2.15 Supporting upper floors 138
3.2.16 Walls as supports 138
3.2.17 Multi-storey repetitive plan structures 138
3.2.18 Service core structures 139
3.2.19 Timber-framed buildings 139
3.2.20 Openings in walls 139
3.2.21 Columns as supports 140
3.2.22 Columns or walls? 141
3.2.23 Regular or irregular grids? 141
3.2.24 What sized grid? 142
3.2.25 Site considerations 142
3.2.26 Planning considerations 142
3.2.27 Economy 142
3.2.28 Aesthetics 143
3.2.29 Deciding on grids in the studio 143
3.2.30 Developing a structural system: the vertical loads 143
3.2.31 Lattices 144
3.2.32 Slabs 144
3.2.33 Checking vertical continuity 144
3.2.34 Structural anomalies 144
3.2.35 Overhanging upper floors 145
3.2.36 Transfer beams 145
3.2.37 Accommodating transfer beams 146
3.2.38 Resisting lateral loads 147
3.2.39 Overturning 147
3.2.40 Distortion 148
3.2.41 Resisting distortion: rigid frames 148
3.2.42 Resisting distortion: shear walls 149
3.2.43 Placing shear walls 149
3.2.44 Shear walls in framed buildings 150
3.2.45 Failure of elements under wind load 150
3.2.46 The size of the forces 150
3.2.47 The direction of the forces 151
3.2.48 Design 151
3.2.49 When to worry about wind loads 152
3.2.50 The size of the members 152
3.2.51 Using structures courses to advantage 152
3.2.52 The thickness of floors 153
3.2.53 The dimensions of columns 154
3.2.54 The thickness of walls 155
3.2.55 Movement 155
3.2.56 Why movement is important 155
3.2.57 Kinds of movement 155
3.2.58 Movement of the whole building 156
3.2.59 Movements of elements 157
3.2.60 Elastic deflections 157
3.2.61 Creep deflection 157
3.2.62 Advanced structures 158
3.3 Energy and building 159
3.3.1 Introduction 159
3.3.2 Regulation 159
3.3.3 Constraints on building form 159
3.3.4 Passive and active control 160
3.3.5 The human factor 160
3.3.6 Scope and limits of this section 160
3.3.7 In praise of mass 160
3.3.8 Mass and heat 161
3.3.9 Mass and fire 161
3.3.10 Passive fire protection in multi-storey buildings 162
3.3.11 Mass and acoustics 162
3.3.12 A note on theatres and concert halls 163
3.3.13 The informed use of mass 163
3.3.14 Filters 164
3.3.15 Insulation 164
3.3.16 Conductive insulation 165
3.3.17 Insulation and wall thickness 165
3.3.18 Sound insulation 166
3.3.19 Doors, windows, verandahs and awnings 166
3.3.20 The heat of the sun 167
3.3.21 Radiation and the exterior 167
3.3.22 Shading the whole building 168
3.3.23 Shading the roof 168
3.3.24 Shading the walls 168
3.3.25 Windows 170
3.3.26 Glass and heat transmission 170
3.3.27 Glass and the transmission of radiation 170
3.3.28 Absorbent glasses 171
3.3.29 Reflective glass 171
3.3.30 External sunshades 172
3.3.31 Fixed sunshades 172
3.3.32 Adjustable sunshades 173
3.3.33 Daylighting 174
3.3.34 The eye and daylighting 175
3.3.35 Discomfort glare and daylighting 175
3.3.36 Light distribution in interiors 176
3.3.37 Roof lights and skylights 176
3.3.38 Side windows 177
3.3.39 Daylighting in modern office buildings 178
3.3.40 Natural ventilation 178
3.3.41 Changing the air 179
3.3.42 Natural ventilation and cooling 179
3.3.43 Wind 180
3.3.44 Wind speed 180
3.3.45 Natural ventilation: windows 181
3.3.46 Convection in buildings 181
3.3.47 Advanced convective systems 182
3.3.48 Some problems of advanced convective systems 184
3.3.49 Internal convection: fireplaces 185
3.3.50 Fire 185
3.3.51 Evaporative cooling 186
3.3.52 Condensation 186
3.3.53 Summary 187

3.4 Services 188
3.4.1 Introduction 188
3.4.2 Central Heating 188
3.4.3 Space requirements for central heating 188
3.4.4 Mechanical ventilation 189
3.4.5 Air-conditioning 189
3.4.6 Temperature variation 190
3.4.7 Variation in external conditions 191
3.4.8 Variation in internal conditions 191
3.4.9 Wilful abuse 192
3.4.10 Air quality and infection 192
3.4.11 Pollutant gasses 192
3.4.12 Coping with variability 192
3.4.13 Zoning systems 193
3.4.14 Dual duct and reheating systems 193
3.4.15 Fan-coil systems 193
3.4.16 Mechanical principles of air-conditioning 194
3.4.17 Elements and arrangements of a system 194
3.4.18 Size of air-conditioning plant 195
3.4.19 Horizontal ducts 195
3.4.20 Vertical ducts in multi-storey buildings 195
3.4.21 Artificial lighting 196
3.4.22 Transport services 196
3.4.23 Moving walkways 196
3.4.24 Escalators 196
3.4.25 Supply services 197
3.4.26 Cold-water supply 197
3.4.27 Fire control 198
3.4.28 Hot-water supply 199
3.4.29 Gas for heating and cooking 200
3.4.30 Electricity 200
3.4.31 Information services 200
3.4.32 Distribution 201
3.4.33 Aerials and antennae 201
3.4.34 Displays 201
3.4.35 Waste services 202
3.4.36 Solid-waste disposal 202
3.4.37 Liquid waste 203
3.4.38 Plumbing and drainage in single-storey buildings 203
3.4.39 Plumbing and sewerage in multi-storey buildings 204
3.4.40 Toilets in public buildings 204
3.4.41 Dimensions and numbers 204
3.4.42 Handbasins in toilets 205
3.5.60 Control joints 236
3.5.61 Spacing of joints 236
3.5.62 Size of control joints 237
3.5.63 Visual effect of control joints 237
3.5.64 Differential movements generally 238
3.5.65 Weatherproofing 239
3.5.66 How water enters buildings 239
3.5.67 Capillary action 239
3.5.68 Pressure differentials 239
3.5.69 Resisting water penetration 240
3.5.70 Absorption 240
3.5.71 Cavity walls 240
3.5.72 Wide joints 241
3.5.73 Sealants: wall surfaces 241
3.5.74 Sealants: joints 241
3.5.75 Sealing roofs: the ‘flat’ roof 242
3.5.76 Why use flat roofs? 243
3.5.77 The form of flat roofs 243
3.5.78 Gravity and water penetration: weatherboardings 244
3.5.79 Roofs 244
3.5.80 Thatch, slates and shingles 244
3.5.81 Tiles 245
3.5.82 Sarking 245
3.5.83 Corrugated and rib metal sheet roofing 245
3.5.84 Roof forms 246
3.5.85 The appearance of pitched roofs 246
3.5.86 Mansard roofs 247
3.5.87 Box gutters 248
3.5.88 Eaves 249
3.5.89 Eaves gutters 250
3.5.90 Problems with snow 250
3.5.91 Downpipes 251
3.5.92 Weatherproofing by the use of pressure gradients 252
3.5.93 Maintenance 253
3.5.94 Accessibility 253

4 MASTERY, CORRECT AND MAGNIFICENT
4.1 Introduction 257
4.1.1 Aesthetics 257
4.1.2 Talking about aesthetics 257
4.1.3 The philosophical tradition 257
4.1.4 Recent developments in aesthetics 258
4.1.5 The aim of this chapter 258
4.1.6 Objections to aesthetics 259
4.1.7 Is it all a matter of taste? 259
4.1.8 Conditioning 259
4.1.9 Persuasion 260
4.1.10 Imitation 260
4.1.11 Cultural learning 260
4.1.12 Facts and values 261
4.1.13 Aesthetic behaviour 261
4.1.14 Making special 261
4.1.15 The roots of aesthetic behaviour 262
4.1.16 The Law of Pragnanz 262
4.1.17 Misunderstanding of the Gestalt laws 263
4.1.18 Eye movements 263
4.1.19 Arousal theory 264
4.1.20 Misunderstandings of arousal theory 264
4.1.21 Arousal and preference 265
4.1.22 Individual differences 266
4.1.23 Previous experience 266
4.1.24 Current goals 266
4.1.25 Stimulus seeking 266
4.1.26 Choice 267
4.1.27 Criticisms of arousal theory 267
4.1.28 Familiarity 267
4.1.29 Popular preferences 268
4.1.30 Architects’ preferences 269
4.1.31 The ‘high’ culture 269
4.1.32 Good taste 270
4.1.33 The dictatorship of taste 270
4.1.34 The culture of architecture 271
4.1.35 An ethical problem 271
4.1.36 The aesthetic tradition of architecture 272
4.1.37 Summary 272
4.2 Order and complexity 273
4.2.1 The perceptual basis of aesthetics 273
4.2.2 Understanding through examples 273
4.2.3 Unity 274
4.2.4 The other Gestalt laws 274
4.2.5 The law of closure 274
4.2.6 The law of good continuation 275
4.2.7 The law of proximity 276
4.2.8 The law of similarity 276
4.2.9 The rule of common region 277
4.2.10 The rule of connectedness 277
4.2.11 Symmetry 277
4.2.12 Translation 279
4.2.13 Rotation 279
4.2.14 Reflection 280
4.2.15 Glide reflection 280
4.2.16 Symmetry in plans 280
4.2.17 Proportion 281
4.2.18 Setting out the work 282
4.2.19 Technical proportion 282
4.2.20 Proportion and structure 283
4.2.21 Proportion and appearance 283
4.2.22 Mysticism and proportion 283
4.2.23 Modern mysticism 284
4.2.24 What is the golden section? 284
4.2.25 The Fibonacci series 284
4.2.26 The golden section in nature 285
4.2.27 The golden section in history 286
4.2.28 The golden section and psychology 286
4.2.29 Proportion and self-symmetry 287
4.2.30 Visual complexity and buildings 287
4.2.31 Number of elements 288
4.2.32 Miller's limit 289
4.2.33 Variety of elements 289
4.2.34 Asymmetrical elements 289
4.2.35 Asymmetry of arrangement 290
4.2.36 Perceptual dynamics 290
4.2.37 Directions 291
4.2.38 Controlling directional dynamics 291
4.2.39 Balance 293
4.2.40 Vertical balance 293
4.2.41 Centres 294
4.2.42 Forms of order 294
4.2.43 Rational and irrational order 294
4.2.44 Definition 295
4.2.45 Homogeneity 295
4.2.46 Coordination 295
4.2.47 Coping with complexity 296
4.2.48 Hierarchy 297
4.2.49 Hierarchy and complexity 298
4.2.50 Accident 299
4.2.51 Exploration 300
4.2.52 Environmental preference 300
4.2.53 Time and space 301
4.2.54 Disorder and ugliness 301
4.2.55 Form and content 302
4.3 Symbolism, expression and style 303
4.3.1 Content and values 303
4.3.2 Symbolism 303
4.3.3 Signs 303
4.3.4 Failures of symbolism 304
4.3.5 Expression 304
4.3.6 Expression and content 305
4.3.7 Kinds of content 305
4.3.8 Content: propriety 305
4.3.9 Content: function 305
4.3.10 Content: behavioural cues 306
4.3.11 Content: status 306
4.3.12 Technology as content 306
4.3.13 Expression and style 307
4.3.14 Style and identity 307
4.3.15 Style defined 307
4.3.16 Common features 308
4.3.17 Computers and style 308
4.3.18 Unselfconscious and conscious style 309
4.3.19 Style and self-assertion 309
4.3.20 Individual style 310
4.3.21 Is individual style necessary? 310
4.3.22 Regional styles 311
4.3.23 Schools and movements 312
4.3.24 Institutional styles 312
4.3.25 Religion and style 313
4.3.26 National style 314
4.3.27 Historic styles 315
4.3.28 Architectural history 315
4.3.29 The battle of the styles 315
4.3.30 Mere building 316
4.3.31 The style for the age 317
4.3.32 How styles change 317
4.3.33 Variation 318
4.3.34 Extrapolation 318
4.3.35 Martindale cycles 318
4.3.36 Novelty and style 319
4.3.37 Cultural borrowing 320
4.3.38 Invention 320
4.3.39 Architectural invention 321
4.3.40 Transitions 321
4.3.41 Demand for change 321
4.3.42 The rate of change 322
4.3.43 Pluralism 322
4.3.44 The decline of style 323
4.3.45 Fashion 323
4.3.46 Fashion in architecture 324
4.3.47 In defence of fashion 324
4.3.48 Planned style 325
4.3.49 Expression without style 325

4.4 Sources of form 326
4.4.1 Form and function 326
4.4.2 Function as a relation 326
4.4.3 Other ways of looking at function 326
4.4.4 Does form follow function? 327
4.4.5 Forms and relations 327
4.4.6 Form constraints 328
4.4.7 Relational constraints 328
4.4.8 Levels and kinds 328
4.4.9 The designer's share 329
4.4.10 Top-down and bottom-up 329

4.4.11 Top-down: the bed of Procrustes 330
4.4.12 Top-down: the fruits of experience 330
4.4.13 Bottom-up: the wood and the trees 331
4.4.14 The sources of form 331
4.4.15 Buildings as sources 331
4.4.16 Imitation 332
4.4.17 Analogical design 332
4.4.18 Analysis and abstraction 333
4.4.19 Transformation 333
4.4.20 Extending the range 334
4.4.21 Relevance or classicism? 334
4.4.22 Revivalism and eclecticism 335
4.4.23 Originality and invention 335
4.4.24 Cubes, cones and spheres 336
4.4.25 Advantages of geometry as a source 337
4.4.26 Disadvantages of geometry as a source 337
4.4.27 Technology as a source of form 337
4.4.28 Nature as source of form 338
4.4.29 Graphic play 339
4.4.30 Shapes in the clouds 339
4.4.31 Architectural examples 340
4.4.32 The attraction of graphic play 340
4.4.33 Limitations of graphic play 341
4.4.34 Modelling 342

4.5 Space and time 342
4.5.1 Introduction 342
4.5.2 Conceptions of internal space 343
4.5.3 Representing interior spaces 343
4.5.4 Self-contained rooms 344
4.5.5 Dynamics of rectangular rooms 344
4.5.6 The third dimension 345
4.5.7 Exploiting the third dimension 346
4.5.8 Adjunct spaces 347
4.5.9 Openings 347
4.5.10 Placing openings 348
4.5.11 Lighting and prospect 348
4.5.12 Scale and proportion: doors 349
4.5.13 Scale and proportion: windows 350
4.5.14 Surface subdivision 351
4.5.15 Joints 351
4.5.16 Wear and tear 352
4.5.17 Subdivision and unity 352
4.5.18 The solidity of surfaces 353
4.5.19 Defining corners 353
4.5.20 Webs of lines 353
4.5.21 Intensifying dynamics 353
4.5.22 Subdivision and complexity 354
4.5.23 Furniture in self-contained rooms 354
4.5.24 Scale and interiors 355
4.5.25 Atriums 356
4.5.26 Long corridors 357
4.5.27 Curved spaces 357
4.5.28 Linked spaces 358
4.5.29 Nested spaces 359
4.5.30 The open plan 359
4.5.31 Minimal versions of the open plan 360
4.5.32 Room definition in the open plan 360
4.5.33 Order in the open plan 361
4.5.34 Strong enclosure 361
4.5.35 Wall subdivision in the open plan 362
4.5.36 Furniture in the open plan 363
4.5.37 The open plan and the section 364
4.5.38 The elementalist conception 364
4.5.39 Elementarism in practice 365
4.5.40 Wall treatment in the elementalist plan 366
4.5.41 Furniture in the elementalist plan 367
4.5.42 The elementalist revival 368
4.5.43 Dangers of the new elementarism 368
4.5.44 A note on ‘serviced space’ 369
4.5.45 Choosing a space conception 369
4.5.46 Patterns of value 369
4.5.47 Circulation 370
4.5.48 Experiencing buildings 370
4.5.49 The marche 371
4.5.50 The marche in the houses of Frank Lloyd Wright 372
4.5.51 The Barcelona Pavilion 372
4.5.52 Other variations in the marche 372
4.5.53 Choosing an approach 373
4.5.54 The marche in the third dimension 373
4.5.55 Changing viewpoints 374
4.5.56 Dramatic transitions 374
4.5.57 The staircase as spectacle 375
4.5.58 Representing the marche 376
4.5.59 Choosing a layout 376
4.5.60 Summary 377

4.6 Mass and surface 377
4.6.1 Introduction 377
4.6.2 The marche and the exterior 378
4.6.3 Multiple views 378
4.6.4 Angles of approach 378
4.6.5 Viewing distances 379
4.6.6 Massing 379
4.6.7 The simple solid 380
4.6.8 Pyramids 380
4.6.9 Domes 380
4.6.10 Projecting the plan 381
4.6.11 Cylinders 382
4.6.12 The parallelepiped 384
4.6.13 Planning and the parallelepiped 385
4.6.14 Expression and the parallelepiped 386
4.6.15 The La Roche/Jeanneret house 387
4.6.16 The villa at Garches 388
4.6.17 The design for Carthage 389
4.6.18 The Villa Savoye 389
4.6.19 Adjusting the proportions 389
4.6.20 Composition 390
4.6.21 Composition and expression 390
4.6.22 Radial or linear 391
4.6.23 The strength of connection 393
4.6.24 Hierarchy in massing 394
4.6.25 Visual importance 394
4.6.26 Making adjustments 394
4.6.27 Small but important 396
4.6.28 Junctions between elements 397
4.6.29 In the same plane 398
4.6.30 Projections 398
4.6.31 Offsets 398
4.6.32 Recesses 399
4.6.33 Elementarist massing 400
4.6.34 Pitched roofs 400
4.6.35 Roof to wall 400
4.6.36 Wall over roof 401
4.6.37 Roof over wall 401
4.6.38 Expression and the roof 402
4.6.39 Representing massing 403
4.6.40 Façade articulation 404
4.6.41 Representing the façade 405
4.6.42 Constraints on fenestration 405
4.6.43 Wall and frame 406
4.6.44 The façade as wall 406
4.6.45 Window and surround 407
4.6.46 Proportions of individual windows 407
4.6.47 Placing and grouping of windows 407
4.6.48 Subdivision of windows 409
4.6.49 Blurring the boundaries 409
4.6.50 The glass curtain 410
4.6.51 The dullness of glass curtains 411
4.6.52 The frame rules, ok? 411
4.6.53 Infill 412
4.6.54 Mixed effects 413
4.6.55 Ornament 413
4.6.56 Ornament in context 414
4.6.57 The need for ornament 414
4.6.58 The need for decoration 415
4.6.59 Back to the tool box 415
4.6.60 Adjustments of the distant view: general principles 415
4.6.61 Skyline and silhouette 416
4.6.62 Tone 416
4.6.63 Light and shade 416
4.6.64 Adjustments of the middle view 417
4.6.65 At the margin 417
4.6.66 Harmony with nature 418
4.6.67 Contextualism in the city 418
4.6.68 The urban environment 418
4.6.69 Harmony in the city 419
4.6.70 Apparent proportions 419
4.6.71 Adjustments of expression 420
4.6.72 Serviced space 420
4.6.73 Works of art 421
4.6.74 The close view: decoration 422
4.6.75 Decorative materials 422
4.6.76 Shaped surfaces 423
4.6.77 Coloured patterns 423
5 TEACHING ARCHITECTURE
5.1 The ideology of architectural education 427
5.1.1 Introduction 427
5.1.2 Conventional wisdom 427
5.1.3 Arguments in favour of inexpressibility 428
5.1.4 The limits of inexpressibility 429
5.1.5 Inexpressibility as a given 430
5.1.6 Inexpressibility as ideology 430
5.1.7 Art and artists before the nineteenth century 431
5.1.8 Unity and diversity 431
5.1.9 Social status of ‘the Artist’ before the Renaissance 432
5.1.10 The Renaissance and the status of the artist 432
5.1.11 New threats 432
5.1.12 Poetry and science 433
5.1.13 The threat from science 433
5.1.14 Poetry and the market 434
5.1.15 The threat from the market 435
5.1.16 The invention of the artist 435
5.1.17 Romanticism and education 436
5.1.18 Architecture and knowledge before the eighteenth century 437
5.1.19 The decline of architectural knowledge 437
5.1.20 Architecture and the market 438
5.1.21 Romanticism and architectural education 439
5.3.48 An objection to the façade exercise 537
5.3.49 Further exercises in aesthetics 537
5.3.50 Planning exercises 537
5.3.51 Simple room-planning exercise:
   a bathroom 538
5.3.52 Characteristics of the bathroom
   exercise 538
5.3.53 Simple room-planning exercise:
   a bedroom suite 539
5.3.54 Extensions of the bedroom exercise 540
5.3.55 A bridging exercise 540
5.3.56 Further planning exercises 541
5.3.57 A first building exercise 541
5.3.58 The planning phase 542
5.3.59 Choosing a space conception 545
5.3.60 Massing studies 545
5.3.61 Elevations 545
5.3.62 Interiors 545
5.3.63 Exercises in imitation 545
5.3.64 Further exercises 547
5.3.65 Summary of design exercises 547
5.3.66 Assessment 548
5.3.67 Assessment methods compared 549
5.3.68 Conclusion 550