

Principles of Architectural Detailing

PRINCIPLES OF ARCHITECTURAL DETAILING

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Blackwell
Publishing

© 2004 by Blackwell Publishing Ltd

Editorial offices:

Blackwell Publishing Ltd, 9600 Garsington Road, Oxford OX4 2DQ, UK

Tel: +44 (0)1865 776868

Blackwell Publishing Inc., 350 Main Street, Malden, MA 02148-5020, USA

Tel: +1 781 388 8250

Blackwell Publishing Asia Pty Ltd, 550 Swanston Street, Carlton, Victoria 3053, Australia

Tel: +61 (0)3 8359 1011

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First published 2004 by Blackwell Publishing Ltd

Library of Congress Cataloging-in-Publication Data is available

ISBN 1-4051-0754-5

A catalogue record for this title is available from the British Library

Set in 10½/14 pt Palatino

by Sparks, Oxford – www.sparks.co.uk

Printed and bound in India

by Replika Press Pvt. Ltd, Kundli 131028

The publisher's policy is to use permanent paper from mills that operate a sustainable forestry policy, and which has been manufactured from pulp processed using acid-free and elementary chlorine-free practices. Furthermore, the publisher ensures that the text paper and cover board used have met acceptable environmental accreditation standards.

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PREFACE



This is a book about architectural detailing, from the level of the conceptual design through to the physical realisation of design intent during construction. It addresses the creative act of making buildings and introduces concepts and models that we can use to achieve and retain creativity in architecture. It is a product of our collective endeavours as architects and academics striving for a better response to the ecological challenges that we face. Our focus is on the detail – the joint solution – although we have also emphasised the importance of the detail within the overall building design. This is because the act of design is not sequential in the sense of making a conceptual design for the whole building, then the details, then the specification and finally its construction. It is an iterative process in which abstract concepts are developed, tested and redeveloped continually with the aim of producing a set of information from which the building can be constructed. On the one hand the choice of structural systems, services, materials and components is influenced by conceptual design decisions, while on the other hand the conceptual design will be influenced by the details and means of construction. So, when developing conceptual designs for the building we should also be working on conceptual designs for the details. We start with this observation because the conceptual thinking at the level of the detail is vital to the successful construction, maintenance and eventual disassembly of the building and should be included in the early design iterations. This is especially true when using a whole-life approach to our built environment.

There are, to the best of our knowledge, very few books that specifically address the detailing of buildings and the detail design process from first principles. Instead, construction technology books illustrate typical details, providing familiar solutions

to common problems, with little explanation as to why they are composed as they are and without much guidance as to the sequence of assembly. Likewise, literature on sustainability tends not to deal with construction details and it is also rather rare for architects to talk about their approach to the materialisation of their designs. As such there is little guidance available to the student of architectural design to help in the development of details from first principles. The result is that both students and practitioners tend to copy the familiar solutions offered in the books, journals and office master files with insufficient thought for the consequences of their actions.

With greater awareness of ecological matters and the environmental impact of buildings on both our health and our planet, we face a challenging future. We can only guess at future climate change and its effects, perceived or otherwise, on our approach to building design, construction, use and reuse. What we do know, however, is that tried and tested approaches to construction may well be inappropriate. It is with this in mind that we have written this book, a modest attempt at encouraging a more ecological approach to architectural detailing from first principles. Our goal was simple – to write a concise book that would help students and practitioners to understand the underlying factors and principles of architectural detailing and the research still required. The contents are deliberately generic so as to appeal to detailers wherever they happen to work, supported by practical examples, checklists and graphics. Likewise, the principles outlined and illustrated are designed to be of equal value to those working with new build, refurbishment and alteration works. Although our book is intended as an introduction to architectural detailing, we have assumed that readers already have a little knowledge of design and construction. To aid clarity we have kept references out of the text; instead we offer some recommended reading in the appendices.

We hope that the book will inform, stimulate, encourage and assist those charged with designing and detailing buildings, leading to an exciting and invigorating environment that respects our health and enriches our planet.

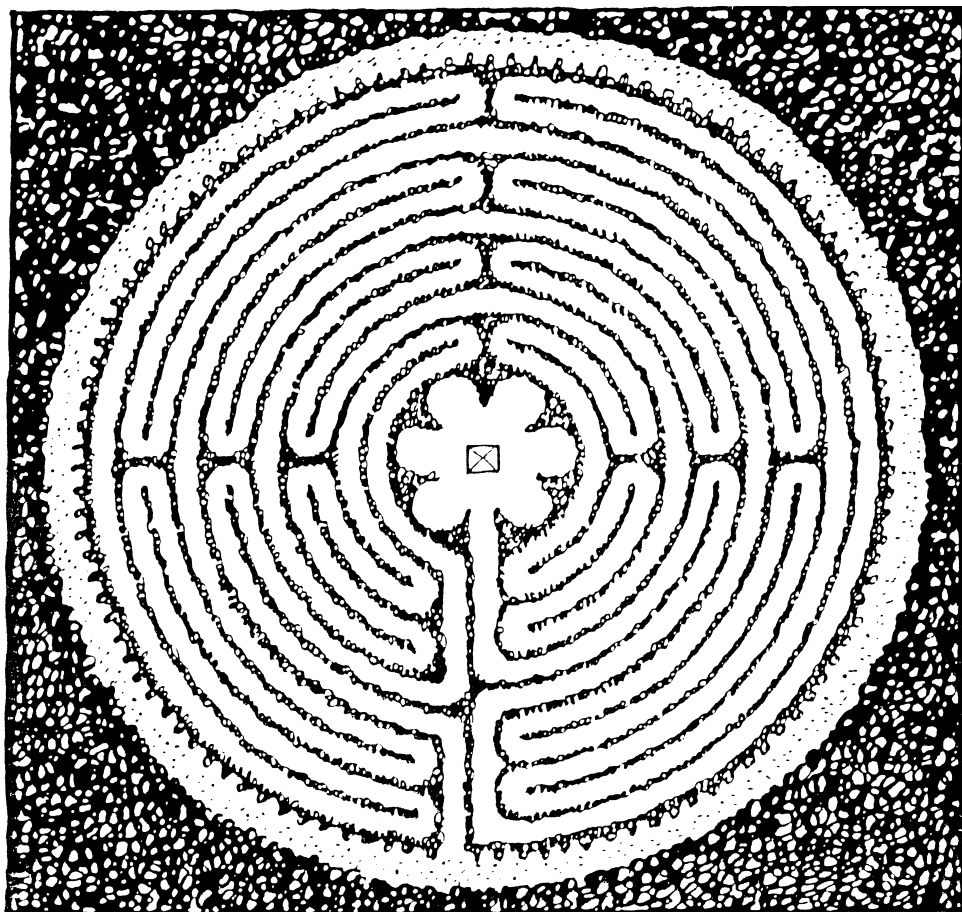
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Part A

FUNDAMENTAL ISSUES



A1 DETAILING – THE CREATIVE LINK

There is a well-known saying that ‘God is in the detail’. Some colleagues report that the famous architect Ludwig Mies van der Rohe first said that ‘Gott wohnt im Detail’, while others would argue that the quotation is as old as Methuselah. Whatever the truth behind this famous dictum, the point is that the detail is all-important in ensuring high-quality buildings. Indeed, common sense would seem to suggest that the place and meaning of architectural details is paramount, for without the details there would be no building. With increased awareness of environmental issues and the impact of construction activities on our host, the planet, we must consider a more environmentally conscious approach to building design, construction, use, reuse and disassembly. Such a whole-life approach requires a change in our way of thinking, an adjustment to our usual habits, and increased attention to the most challenging of areas – the coming together of materials and processes in a joint solution: the architectural detail. It is here that we face our biggest problems and of course our greatest opportunities for creative thinking and innovation. If we are to adopt a whole-life approach for our built environment, then dealing with joints is unavoidable. Indeed, in order to achieve a cultural architecture in the future it is essential that we deal fundamentally with architectural detail.

Unsettling matters

When designing buildings, architects and engineers tend to be very good at pushing the boundaries of creative endeavour in producing unique and stimulating designs. Styles in architecture and the design approach of architects are constant sources of debate and dialogue in the office and in the media – design

sells. Strangely, when it comes to the level of the detail that helps to refine the design concept, the same designers tend to talk differently, if at all, about the thinking behind the detailed design decisions. Perhaps it is just that it is easier to talk in the abstract and conceptual, more interesting to a wider audience than the mechanics of production and realisation. Whatever the reason behind this characteristic we should be concerned that details are not viewed in the same way as the conceptual design – details are undervalued – and this is an unsettling matter given their importance. Unsettling in so much as the time and thinking required to compose and then deliver good quality building is often lacking. It is in the detail, the resolution of joints, that the whole of society is reflected – the way in which we choose and produce building materials, the way we shape components, the way that we execute and assemble buildings, the manner in which we organise labour, the way that we deal with the project economy and the impact of our decisions on our ecology.

So when we start to ask questions such as Why are buildings detailed like they are? and Why do architects and engineers seem to come to the same kinds of solutions every time? it is not easy to find answers. Of course we also need to ask whether we are satisfied with the solutions that are built, and in an age of increased environmental awareness the answer to that last question has to be No. Collectively we need to encourage an innovative approach to detailed design thinking and decision-making, starting with education and taking the principles through into industry. All designers contributing to the built environment need to develop the ability to detail creatively and responsibly with spirit and resolve. For this we need a supportive culture and the time to realise our goals. Fundamentally, we need to loosen up our thinking.

A question of detail

Building design is concerned with solving problems that are specific to a particular client, to a particular site, at a given time. The nature of design is that these problems defy clear definition and therefore require a considerable amount of knowledge to be applied to their resolution. The origin of design problems (often referred to as ‘wicked problems’) tends to be unclear and the future is always open to question, the outcome of the design

process being the creation of a unique design solution, which is then transformed into an equally unique building. The approach taken by individual designers and/or design teams in attempting to resolve the problem before them – the knowledge that they apply – will have a direct influence on the design solution. It follows, therefore, that there is always more than one solution to a problem, regardless of its complexity or perceived familiarity. This is true of large designs and also the design of the component parts and specific joint solution(s).

The interrelationship between conceptual design and construction is paramount to creative detailing (see Fig. A1.1). Decisions made early in the briefing stage will colour and shape the conceptual design, which will influence the subsequent decisions made during the detail design phase. Constraints of production and existing (or available) technologies will also influence this decision-making process that we know as detailing, architectural engineering or materialisation. Limits and opportunities need to be recognised, understood and accommodated; time, finance and resources require careful consideration and evaluation. Furthermore, co-operation, collaboration and co-ordination are essential if design intent is to be realised and transferred effectively to the constructor.

It is very difficult, if not impossible, for one person to possess all of the necessary skills to design, detail and assemble a



Fig. A1.1 People need a more or less tailored built environment that responds to their natural territory and is in harmony with nature.

building. We rely on many individuals and organisations coming together to harness specialist skills and knowledge to the benefit of the project. It is the collective impact of our individual decisions and individual actions (or lack of them) that will impact on the completed artefact, the constructed work. The way that individuals come together and subsequently interact within the structure of the temporary project organisation, the procurement routes used, the time and finance available, and so on will all have an influence on the effectiveness of the detailing and hence affect the performance of the completed building. Since the building will continue in use long after project completion it is vital that the decisions we make are correct. This brings us to another rather fundamental question: Who is in charge of the details? Of all the people and organisations involved with the dynamic yet temporary building project and the building product over its lifetime, do we really know who is responsible for co-ordinating and integrating all of the technological, managerial and design knowledge concerned with the details? Are we really making progress in building and society?

In design offices there is a constant tension between creative design and the detailing phase (see Fig. A1.2). It is here that abstract ideas are converted into specific instructions – encoded in drawings, specifications and schedules – from which the contractor will construct the building. Empathy between conceptual designer and detailer is crucial in ensuring that design intent is adequately represented in the production drawings. This is why, in an ideal world, a conceptual designer should also make conceptual designs for the details, thus helping to ensure continuity between design and production. Failing this, the detailers should have a thorough appreciation and understanding of the conceptual design process, thus helping to maintain and enhance design intent as the design develops. Building design and detailing is not, however, confined to the offices of architects and engineers. Effective detailing requires collaboration with materials suppliers, product manufacturers and specialist trades-people, harnessing their collective knowledge to the benefit of the individual project. Fast-track construction demands effective co-ordination of engineering services, structure and fabric through dedicated information technology networks and effective interpersonal communication. Similarly, the application of lean design and lean construction techniques are



Fig. A1.2 Our built environment in its 'biodiversity' rests on its details.

equally dependent on competent people working in harmony towards a common goal. Design and construction knowledge is best integrated and harnessed through close working relationships, such as alliancing, partnering and the creation of technology clusters, with the ultimate aim of producing a high-quality building that exceeds the client's expectations. The whole should be more than the sum of the part (see Fig. A1.3).

With increased pressure to reduce the time taken to design and construct buildings, combined with associated downward pressure on initial cost and cost-in-use (by far the largest expense), we have seen a decrease in the time dedicated to the detailing process and in many cases a general decline in the quality of thought behind the information produced. With increased complexity of technologies, legislation, environmental concerns and the loss of craft-based knowledge there is a need for more and more information, which takes more time to produce, check and co-ordinate. Although this requirement

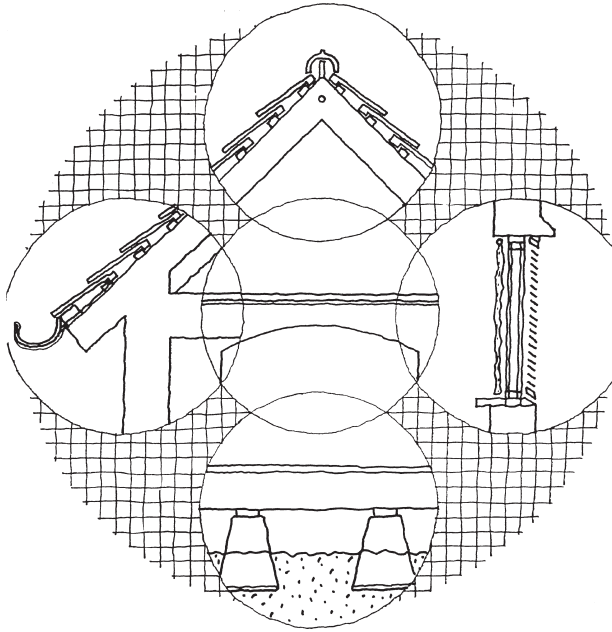


Fig. A1.3 The world of details condensed in a few characteristic ones.

is mitigated by the improvements in information technology, there is still a strong argument for increasing the amount of time dedicated to thinking and reflecting on our detailing and the associated production information. We need time to think about our individual and collective design decisions, adequate time for reflection (and discussion with others) before implementation; indeed, as we argue in this book, we need a suitable philosophical and practical framework in which to make informed decisions.

Creative solutions

If clothes are our second skins, then surely buildings are our third. We spend the majority of our time in and around buildings, be it at work, rest or play. Just as the wrong choice of clothes can make us uncomfortable, so too can the materials that we choose for our buildings and the way in which they are put together. Conversely, when we get the choice right we feel comfortable and confident and experience a sense of wellbeing. Conceptual and detail design decisions relating to material selection and their juxtaposition will affect the manner in which

we perceive and interact with our built environment and will directly influence our physical and mental health, hopefully in a positive manner.

In spite of our rather obvious observations about the fundamental importance of the architectural detail, we are repeatedly confronted with problems during the construction process and with the finished building, regardless of the type of procurement route adopted and the inherent level of complexity. Many of these problems are a direct consequence of careless or inappropriate detailing during the design phase or careless implementation during construction. Once spotted, these difficulties often seem insurmountable, thus leading some to claim, somewhat cynically, that it is 'the Devil who is in the detail'. With the benefit of hindsight we often find that it is the quality of thought behind the detail, both in design and execution, which is lacking. In essence these would appear to be problems brought about by a failure to apply our knowledge and skills in an appropriate way. In our search for creative solutions that work, we first need to give some thought to the underlying reasons behind the apparent lack of attention to detailing in practice. We need to look at the construction sector and to the education of design and construction professionals.

The construction sector

As construction technologies have evolved and buildings have become more complex in both design and assembly we have witnessed the development of specialists and the fragmentation of the building 'team'. Manufacturing, both on and off site, the increased importance of specialist suppliers and subcontractors, diversification of professionals, the tendency to out-source and sub-subcontract work, concerns over risk avoidance and confusion over responsibility for different elements of the work all contribute to an interesting and dynamic working environment; however, we are often left to ponder who is really in charge of design quality. When the outcome is good we all like to claim credit, but when there are problems it seems impossible to find anyone willing to own up to their responsibilities. The diverse and often competing organisations that contribute to the temporary construction project must interact, that is, they also must come together as a temporary joint solution, at

various stages through the life of a project. With increased diversification has come greater complexity of the organisational joints (if we may use such a term) and with it a more pressing need to really understand the interface between professionals, a concern that can sometimes overshadow the interrelationship of materials.

It is often difficult to find evidence of long-term thinking in the construction sector because of the focus on short-term project objectives. Attention tends to be on lower initial cost and ever-faster completion times, working with outdated economic models and project management tools that fail to adequately address quality and environmental concerns. Indeed, with some notable exceptions, we have yet to embrace a whole-life approach to the construction and use of buildings. Clients, their professional advisers and politicians all share a responsibility here; we could and should do more.

Built environment education programmes

Over the past 20 or so years there has been a gradual shift in the content of architectural programmes towards creativity at the expense of technology. Likewise, many of the construction-related courses have moved towards management skills at the expense of technology. Obviously, it is possible to put only so much content into a particular programme of study, but the result of this shift is that we have architects who are not adequately educated in the benefits of construction technology and managers who do not fully appreciate the technology and processes that they are charged with managing. We have also witnessed site operatives who, when faced with something slightly unfamiliar, are completely lost as to how to solve the problem, simply because they do not understand the underlying principles inherent in how buildings go together, reflecting a decline in skills training. This fundamental inability to teach some basic principles (and transferable skills) has resulted in us becoming over-reliant on copying and trusting the judgement of others; that is, we have lost the ability to question why things are how they are. In many cases the result is, at best, mediocre detailing; at worst there are difficulties with constructability, latent defects, ensuing maintenance problems and further down the line associated problems with disassembly, which

someone has to rectify and pay for. From our current perspective it appears that we have lost the art of creative detailing (see Fig. A1.4).

The current approach in architectural education is to emphasise the ‘great’ gesture and creative design proposals – architecture with a capital ‘A’. Such emphasis is often at the expense of the equally creative and vital issue of the technologies and the managerial skills required to first assemble the building and then to operate it. Small, apparently, is not beautiful. A useful comparison can be made with science. While nuclear physics became a key for a better understanding of matter as well as an

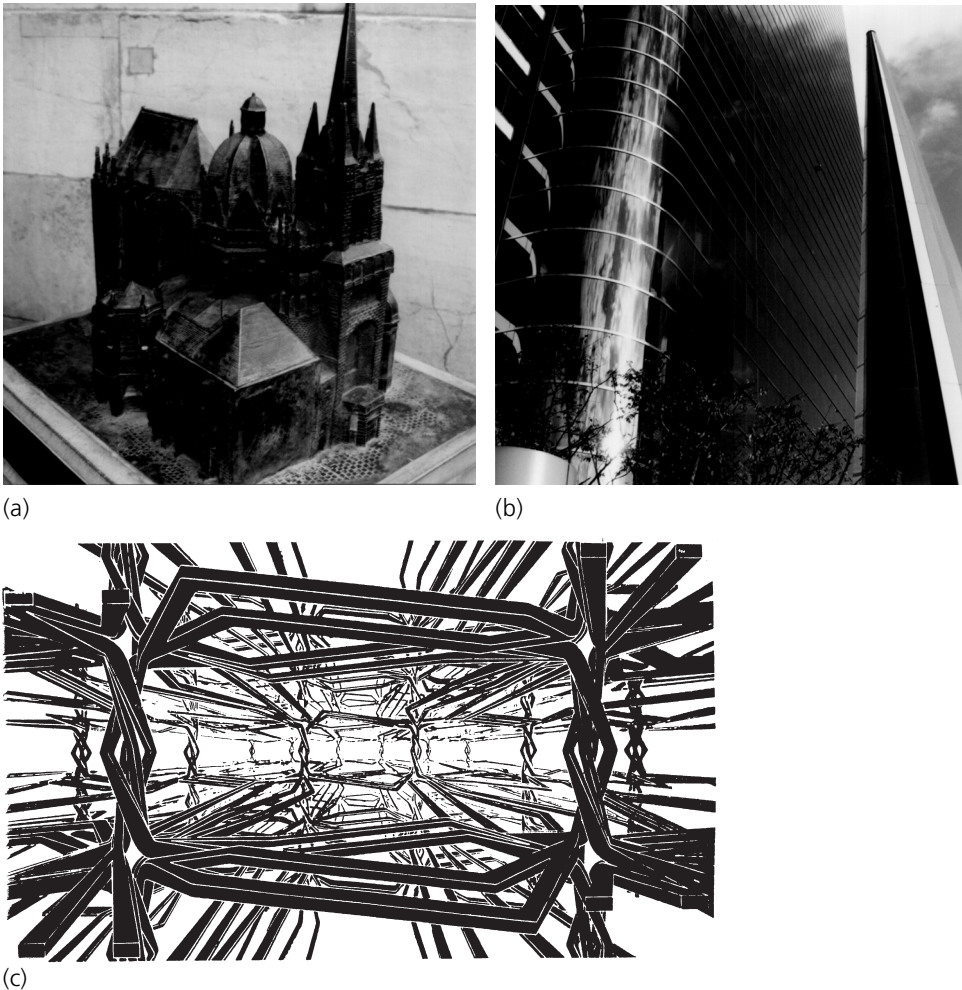


Fig. A1.4 (a–c) Detailing was, is and remains a precondition for each building in the past, in the present and in the future.

important knowledge base for numerous other disciplines, 'nuclear' architecture (if we may make this comparison) has yet to be discovered. Arguably, we remain overly concerned with the bigger picture and not with the pixels that compose it. Taking our cue from science, we argue that this missing link has urgently to be transformed into a creative link. Quality buildings demand quality thought, quality detailing and quality assembly. In some respects this missing link is starting to take shape in the form of the architectural engineering and architectural technology disciplines where the design of the details and the importance of engineering as a creative discipline are given far more prominence than is currently the case in architectural education. These new programmes are an interesting development that will, eventually, have a positive effect on the way in which we detail buildings. We do, however, still have a way to go.

Looking back at the recorded history of our built environment to the highlights of architecture and building technology, we can identify and recognise the knowledge and control exerted over the connection of materials, building parts, components and elements that made the masterpieces possible (see Fig. A1.5). Such buildings demonstrate a commitment to design vision, excellence in detailing and engineering solutions and of course great tenacity and determination to see the project through. Of course the less well-detailed and poorly crafted buildings were quick to collapse or to be replaced, thus even here our focus is directed to that which has been successful and which is deemed important by society. Drawing from the information embedded in the buildings around us we can see how our own ideas are confirmed. Details – connections, joints and knots – have an extraordinarily crucial place and meaning, both technologically and culturally. Nevertheless we often fail to provide the necessary attention to the details in our daily practice, distracted by other, seemingly more important issues.

This is a criticism that can also be aimed at education and research. Lack of a proper devotion to the details causes difficulties not only for designers and contractors (the experts) but also for the building users (the layperson) because it is the users who interact with the building on a daily basis over a period of many years. However, we must not be too negative. While bearing in mind that ineffective detailing is undesirable, in this book we want to emphasise the potential that effective detailing

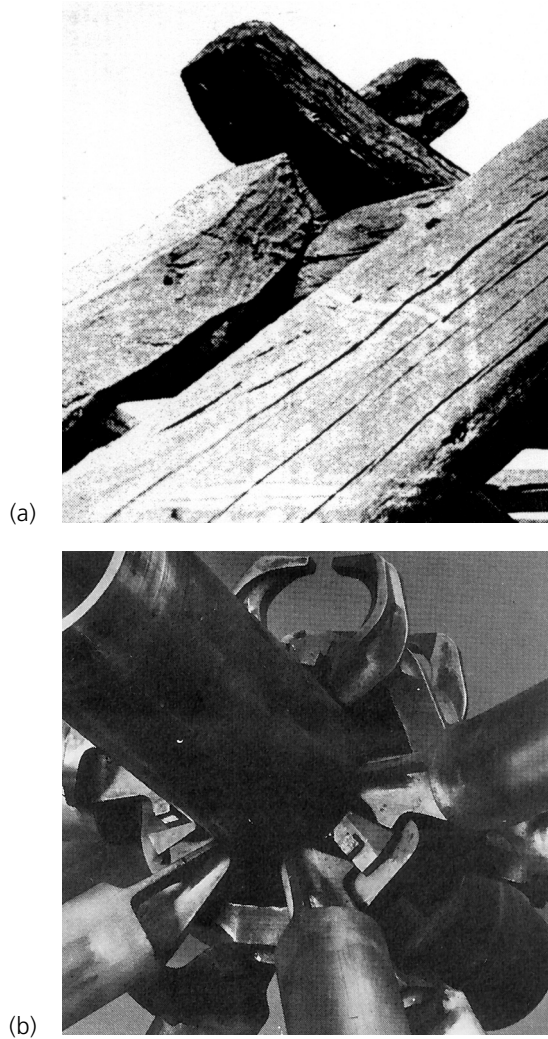


Fig. A1.5 (a,b) Different times, different materials, different approaches, clearly recognisable in the detail.

has to offer. In particular we would like to support the experts and students (the future experts) in the field of architectural design and assist in their commitment to creative detailing. Designers and engineers should have a greater say and hence more impact on the manner in which the conceptual design is realised. In the majority of cases it is not sufficient or acceptable to delegate this task to others who may not necessarily share the same values and goals. To do so requires a greater understanding of the subject.

The place and meaning of architectural details

Details are determined by their place of origin and their meaning. Science, art, technology and wisdom are the components that need to be brought together in the design and production of details. Design and technology can be dealt with through good education, comprehensive briefing and the professional management of design intent from inception to completion and beyond. Underlying this is a fundamental requirement for synthesis and integration towards an ecological approach.

Place

The place of architectural details can be 'located' on quite different levels. Some of the most significant of these, which are interconnected, are discussed briefly here.

- Architectural details have their place within each and every building structure. It is the sum of those details that collectively determines the structure and fabric of a building. They combine to form space and enclosure, and between them there are 'only' connecting lines or materials arranged according to the instructions given in the production information.
- Architectural details are the preconditions of any building structure. Their 'strategic' place collectively determines the main shape or form of a building structure. But at the same time – looking carefully – they also determine the *gestalt* of a building. Properly detailed means precisely designed, even in the smallest dimensions.
- Architectural details are parts of a phenomenon; their place can be found everywhere and in everything, in the sense that they are the connections, joints and knots which keep the whole of an object and building in its place.

Meaning

The meaning of architectural details can be found in a variety of guises, depending on our point of view.

- Architectural details express, mainly visually, a certain concept and design approach. As characteristic parts of a whole building they can carry a typical signature, a specific language, and communicate messages to users, society and of course architectural critics.
- Architectural details reflect the cultural background from which they come and in which they are 'born'. Often they breathe the atmosphere and show the 'colour' of their cultural context.
- Architectural details, according to their scale (and place), represent a kind of 'cosmos', which is one of the main determinants of each and every building, moving from the micro to the macro and vice versa.

The place and meaning of architectural details can be understood as a certain whole. On the one hand it can be seen that the detail is an extraordinarily important part, which exerts its entire impact on the whole. On the other hand there is the ancient concept of 'as in the large, in the small', in that the whole also exerts itself on the parts. It follows that we can imagine the whole (building) and its details as being the 'same'. Indeed, both are normally the result of the same manufacturing and design style.

Technique and technology both have their etymological roots in the old Greek term *techne*, which means the art to make an artefact (Fig. A1.6), to materialise, to build. From our

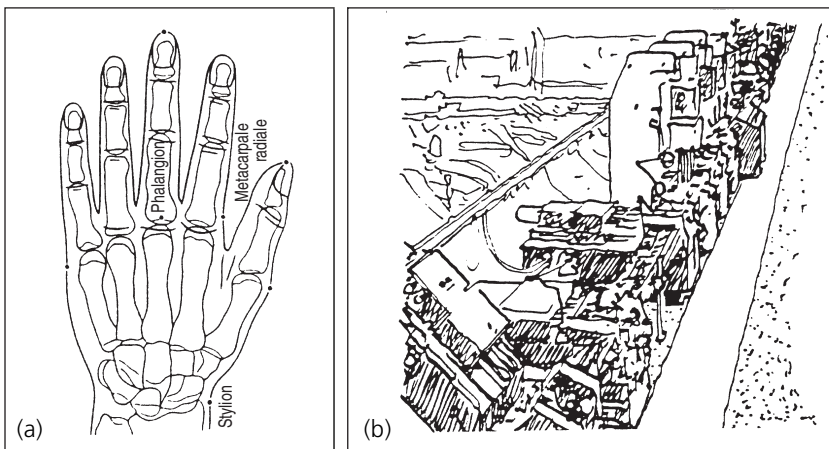


Fig. A1.6 (a,b) Two worlds of production, one with flowing transitions, one with sharp limits, and always with its own character.

current viewpoint we see two main approaches to the production of buildings and their details (although we should recognise that this is not possible everywhere in the world). These may be either, or a combination of, hand-made or machine-made.

Presently we are experiencing an enormous amount of technological development, a race towards complete automation (Fig. A1.7), supported by computer-aided design (CAD) and computer-aided manufacturing (CAM), and recently a strong tendency for virtual reality approaches and applications. Our attention to the machine-made is often at the expense of the hand-made which, of course, is still valid. Indeed, a huge part of the world population relies on hand-made approaches and human labour, a rather large proportion of which is in urgent need of a 'roof' and a supply of clean water. The hand-made procedures, therefore, are at least as important as the machine-made ones in our small world. We not only need virtual buildings but desperately seek the means to provide *real* buildings.



Fig. A1.7 Highly automated roof tile factory (Portugal). Quality control was undertaken best by experienced workers, following problems with mechanised systems.

Supporting an ecological approach

These observations bring us to the subject of ecological sustainability, which is strongly related to inequality in the world. This means that we have to save our resources, especially energy, and make a greater effort to use materials and space much better than we do at present. We have to avoid deterioration, exploitation and pollution as side effects of manufacturing, producing, using and recycling buildings. The argument for designing buildings that are environmentally friendly over their entire lifetime is well established, but the philosophy has been slow to find its way into normal practice. The concept of a building as a generator of waste, in its conception, during its long life and in its death (and possible rebirth), is an important one. Too often we are concerned only with the completion of a project, forgetting that it is during its use that a building, aided and abetted by its inhabitants, is particularly wasteful of energy and resources.

Decisions made early in the design process and the manner in which the structure, fabric and services are detailed and subsequently assembled will greatly influence the energy efficiency of the building. These detail decisions will also influence the ease with which the building can be adapted over its lifetime to accommodate changing user needs, and the ease, or otherwise, of disassembly and recycling or disposal of redundant materials. We must, therefore, focus on a harmonious and ecological approach to construction, use and reuse of our buildings and their constituent parts.

The dominating mechanical connections that tend to characterise architectural details are not necessarily the only ones available and applicable in building technology. Within this book we would also like to explore the possibilities of joining and connecting things, materials and components through familiar and rarely used techniques. First, and at the most fundamental level, we must recognise the force or power of attraction, which is the basis of adhesion, cohesion and gravitation. There are manifestations of this force on different scales and in