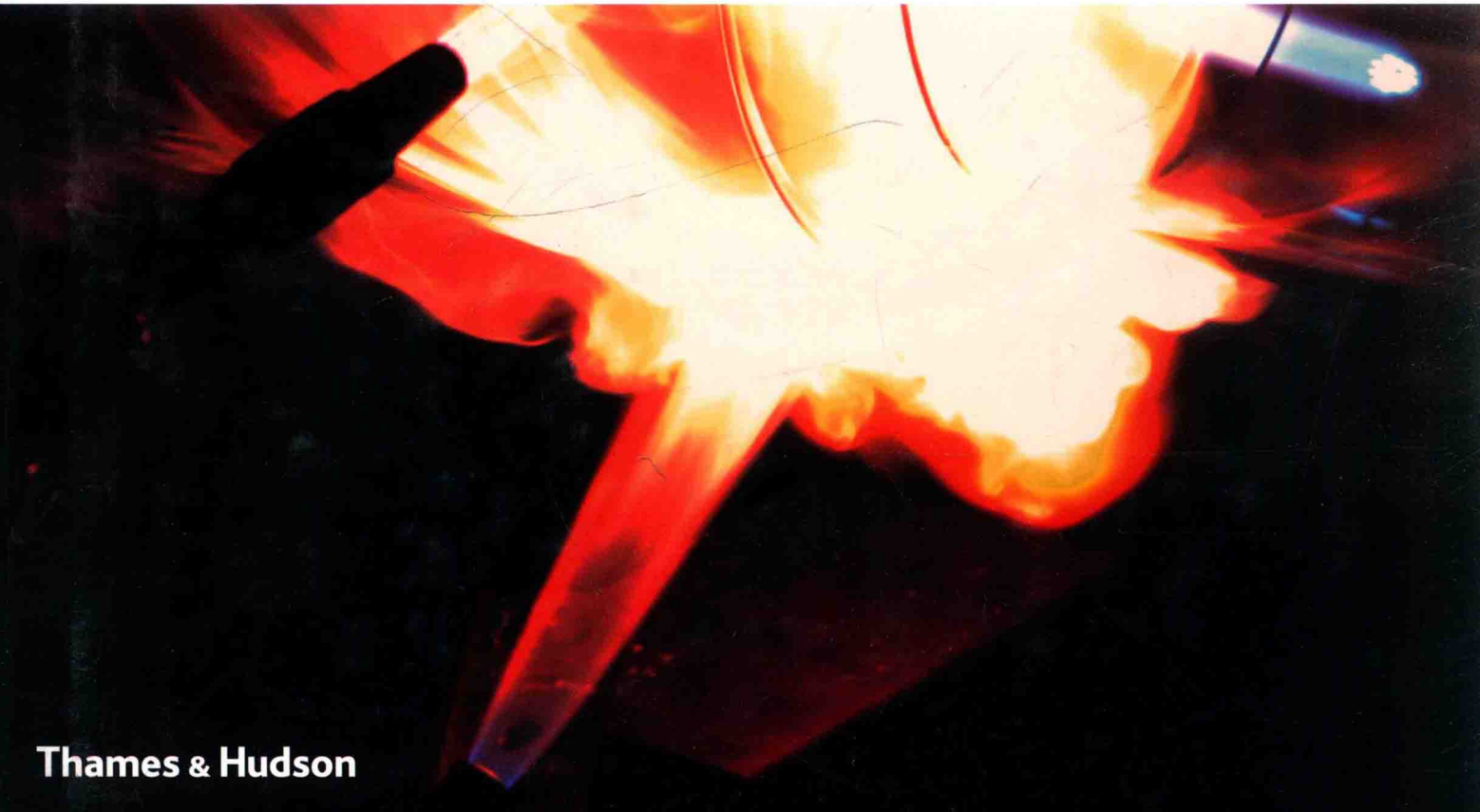
MANUFACTURING PROCESSES
FOR DESIGN PROFESSIONALS

ROB THOMPSON



Thames & Hudson

Rob Thompson

Manufacturing Processes for Design Professionals

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On the previous spread: The Eye chair, designed by Jackie Choi for Boss Design (see pages 342–343).

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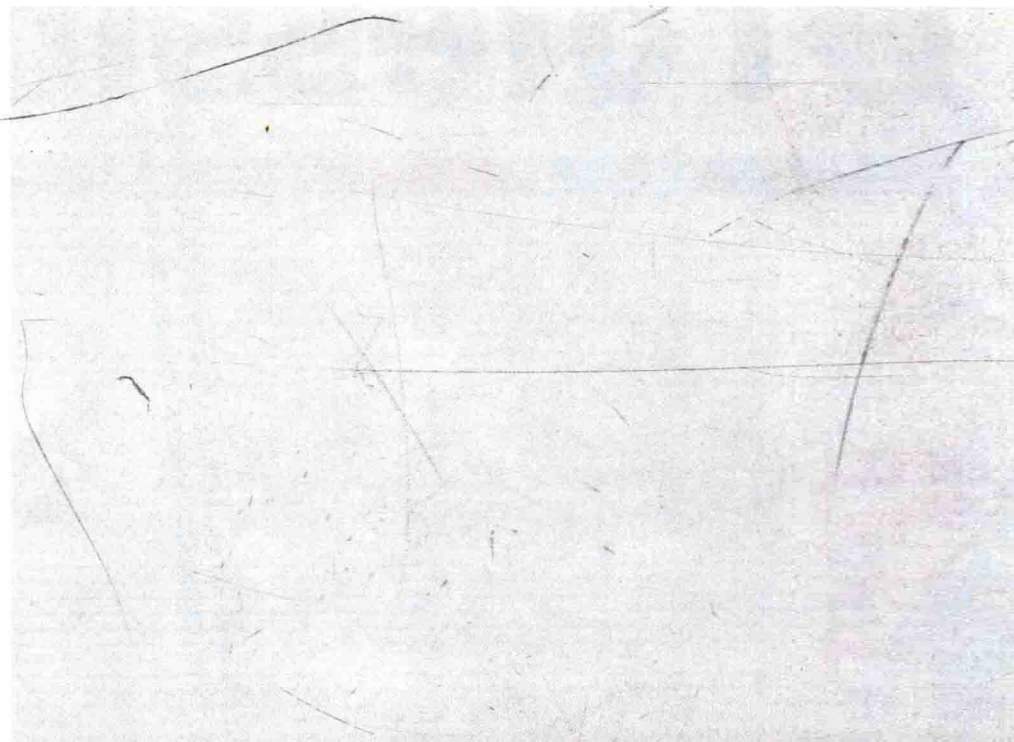

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How to use this book

***Manufacturing Processes for Design Professionals* explores established, emerging and cutting-edge production techniques that have, or will have, an important impact on the design industry. There is a danger today of designers becoming detached from manufacturing as a result of CAD, globalization and design education. This book aims to restore the balance with a hands-on and inspiring approach to design and production. It is a comprehensive, accessible and practical resource that focuses on providing relevant information to aid fast and efficient decision-making in design projects.**

STRUCTURE

This book is organized into 2 main sections: Processes and Materials. These can be used separately or in combination. Each section contains design guidance supplied by manufacturers to ease the transition between design and production and provides information that will inspire decision-making, encourage experimentation and support design ideas.

HOW TO USE PROCESSES

The Processes section is organized into 4 parts, each focusing on a specific type of technology, and each process is explained with photographs, diagrams and analytical and descriptive text. The 4 parts (colour coded for ease of reference) are: Forming Technology (blue), Cutting Technology (red), Joining Technology (orange) and Finishing Technology (yellow). Each featured manufacturing process is fully illustrated and provides a comprehensive understanding of the process through 3 key elements. The text gives an analysis of the typical applications, competing or related processes, quality and cost, design opportunities and considerations, and environmental impacts of a process. There is also a full technical description of the process and how the machinery involved works, with diagrams, and a case study showing products or components being made by a leading manufacturer using the featured process.

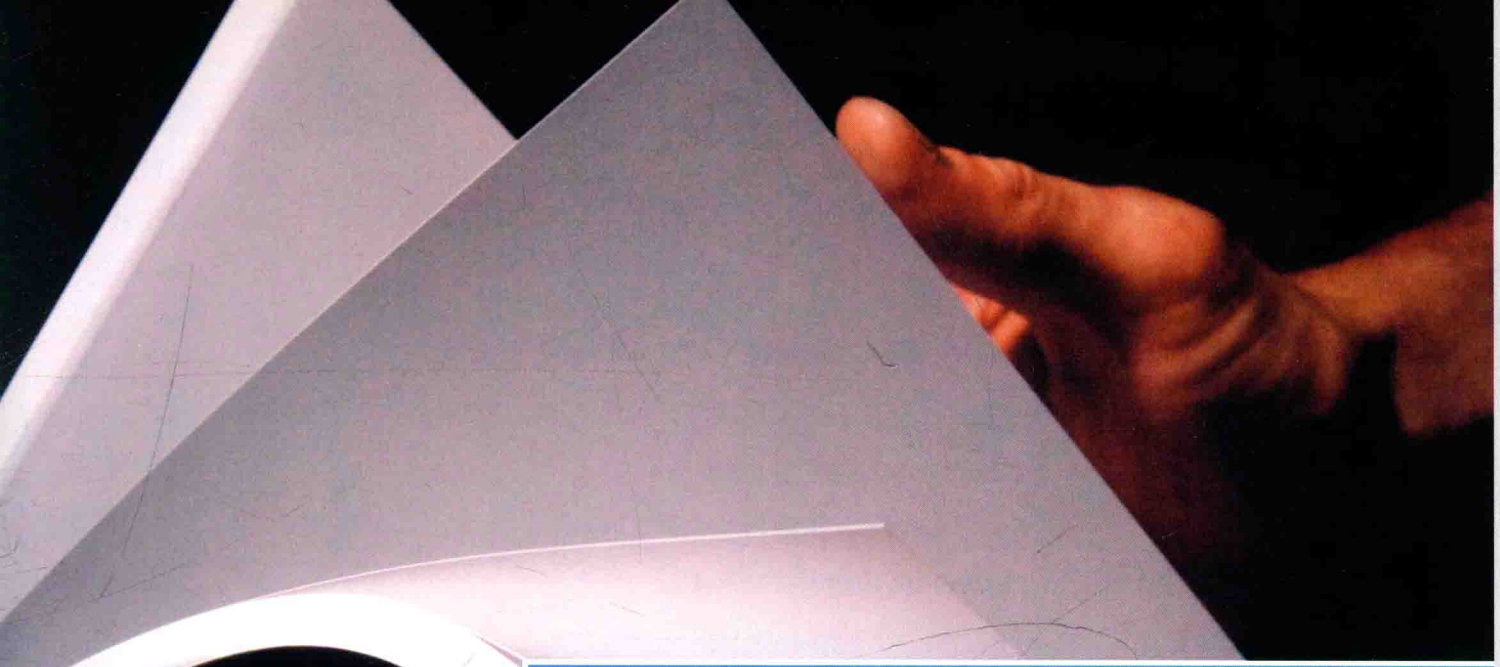
On the opening spread of each process you will find a data panel, which provides a bullet-pointed summary of factors such as the typical applications, quality and cost, as well as function diagrams (see opposite) which, when highlighted, indicate the particular functions and design outcomes of each process. These function diagrams quickly enable the reader to compare a wide range of similar processes to see which is the most effective in producing a given item or component.

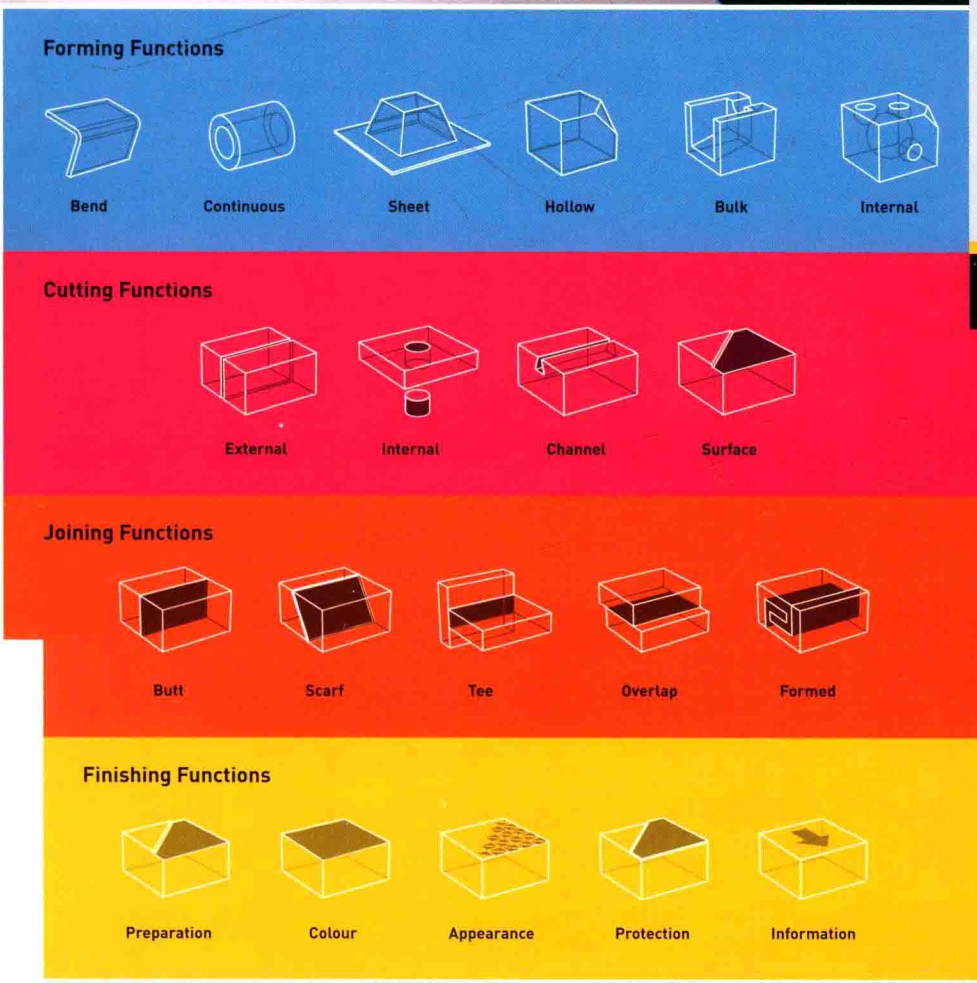
HOW TO USE THE CASE STUDIES

The Processes section features real-life case studies from factories around the world. The processes are explained with photographs and analytical and descriptive text. All types of production are included, from one-off to batch and mass. For cross-comparison the case studies can be set against each other on many levels, including functions, cost, typical applications, suitability, quality, competing processes and speed. This information is accessible, logical and at the forefront of each process.

HOW TO USE MATERIALS

Each manufacturing process can be used to shape, fabricate and finish a number of different materials. The main objective of the material profiles is to support the processes, expand opportunities for designers and provide relevant information for potential applications. The layout of the Processes and Materials sections is designed to encourage cross-



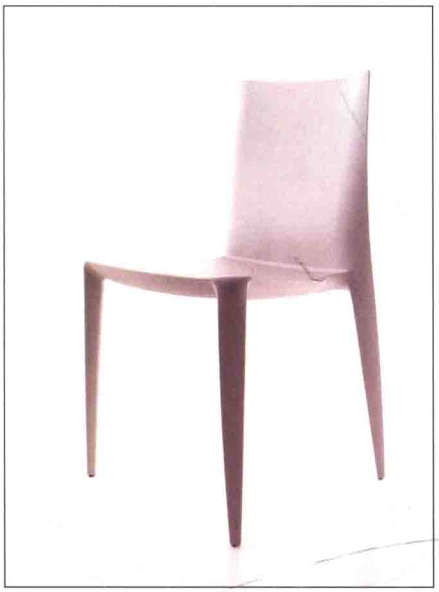


pollination of ideas between industry and design. This ensures that designers fully utilize the potential of their industrial toolbox to create forward-thinking and engaging products for the future.

HOW TO USE THE FUNCTION ICONS
These icons represent the function that each process performs. The functions are different for forming, cutting, joining and finishing processes. Likewise, different materials are more suitable for certain functions than others. These icons guide designers in the early stage of product development by highlighting the relevant processes and materials for their project.

Introduction

Manufacturing technology is both fascinating and inspiring. The products around us are the result of the delicate touch of craftsmen, highly mechanized production, or both. The Processes section gives first-hand insight into a range of manufacturing techniques including mass producing everyday products, batch producing furniture and prototyping with some of the most advanced technologies we have at our disposal. The visual case studies, combined with in-depth technical analysis, show what happens now and how designers and research institutes are continually pushing the boundaries of what will be possible in the future.



Bellini Chair

Designer/client:	Mario Bellini/Heller Inc.
Date:	1998
Material:	Polypropylene and glass fibre
Manufacture:	Injection molded

Panasonic P901iS smartphone

Designer:	Panasonic, Japan
Date:	2005
Manufacture:	Injection molded plastic covers using Yoshida Technoworks in-mold decoration technology

Manufacturing is continually in a state of transition. The level of technology is different in various industries, so whilst some manufacturers are leading the way, such as in the production of carbon fibre composites (page 214) and rapid prototyped plastics and metals (page 232), others are maintaining highly skilled traditional crafts. The combination of craft and industrial techniques in processes such as panel beating metal (page 72), jiggering and jolleying ceramics (page 176) and steam bending wood (page 198) produces articles that unite the user and maker with a sense of pride and ownership.

The examples in this book demonstrate the inner workings of a large range of manufacturing processes. In some cases the tasks are carried out by hand to demonstrate the techniques more clearly. The continued importance of an operator is evident in many processes. Even mass-production techniques, such as die cutting and assembling packaging (page 266), rely on an operator to set up and fine tune the production line. But, where possible, manual labour is being replaced by computer-guided robotic systems. The aim is to reduce imperfections caused by human error and minimize labour costs. Even so, many metal, glass, wood and ceramic processes are based on manufacturing principles that have changed very little over the years.

DEVELOPMENTS IN FORMING

Plastic products have come a long way since they were first formed by compression molding (page 44) in the 1920s. Injection molding (page 50) is now one of the most important processes for designers, and probably the most widely used. It is utilized to shape thermoplastics and thermosetting plastics, waxes for investment casting (page 130) and even metals (page 136). It is continually developing and in recent years has been revolutionized by in-mold decoration (page 50) and gas assist technologies (page 50). In-mold decoration is the application of graphics during the molding process, eliminating finishing operations such as printing. With this technology it is possible to apply graphics on 1 side, both sides or onto multishot injection molded parts (page 50). It is also possible to integrate fabric, metal foils and leather (see image, above right) into plastic moldings. Gas assist injection molding produces hollow, rigid and lightweight plastic parts (see image, above left). The introduction of gas reduces material consumption and the amount of pressure required in the molding cycle. Surface finish is improved because the gas applies internal pressure while the mold is closed.

Another area of important progress within injection molding is multishot. This is the process of injecting more than 1 plastic into the same die cavity to produce parts made up of materials with