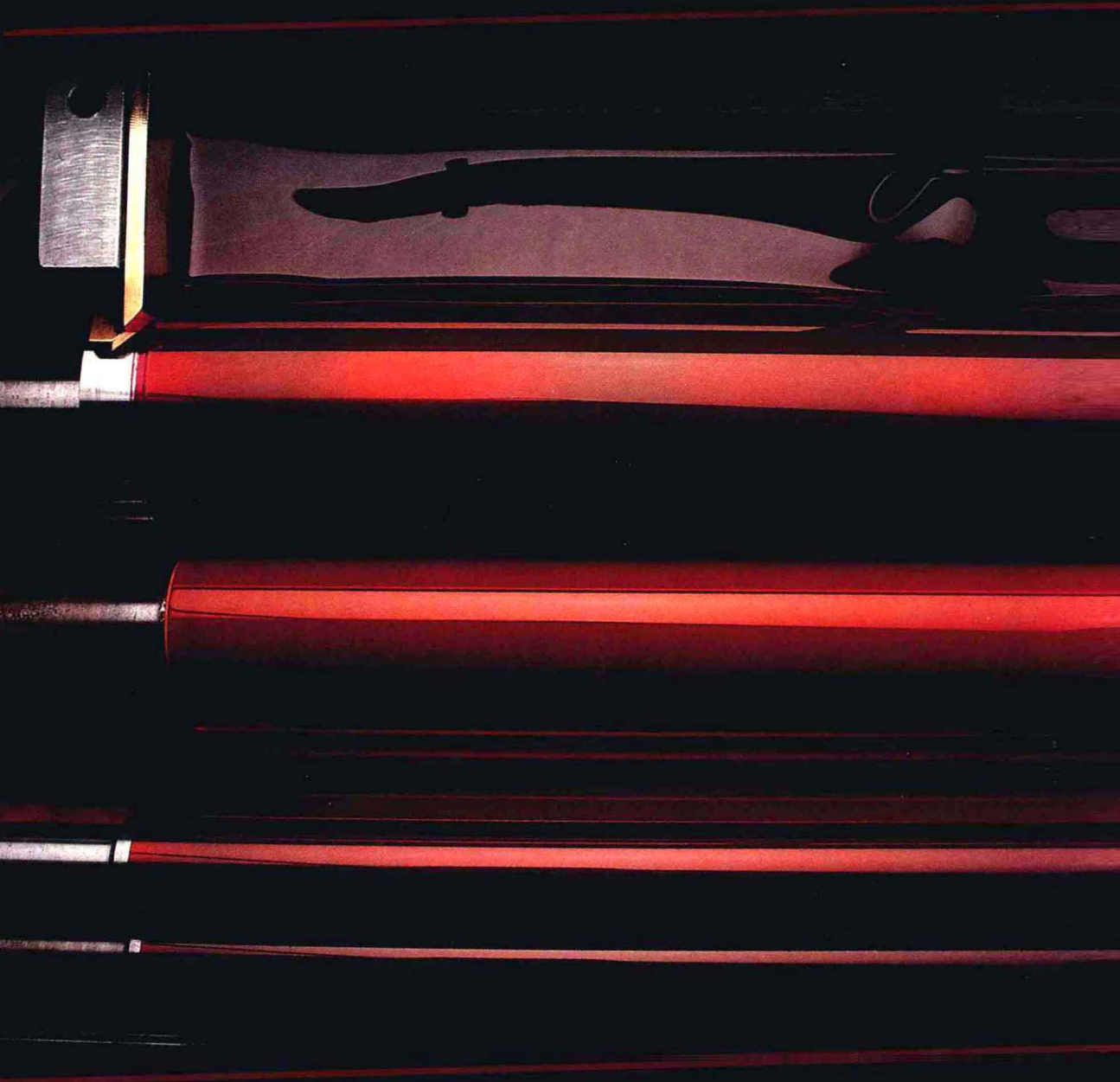


COMPREHENSIVE GRAPHIC ARTS

THIRD EDITION



ERVIN A. DENNIS

JOHN D. JENKINS

COMPREHENSIVE **Graphic Arts**

Third Edition

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PREFACE

This third edition of *Comprehensive Graphic Arts* has been extensively revised. The entire text of the second edition and all of its illustrations were reviewed in light of recent changes in graphic arts technology. Every effort has been made to produce a textbook that reflects the technologies currently used in the graphic arts industry. The popular short-unit format has been retained, for it provides an excellent organizational structure for the users of the text.

This new edition is divided into twenty-three sections. Each section contains four to sixteen units. Each unit explains in specific detail one aspect of the general area covered by the section. Within each section, the first unit provides a brief introduction to the section topic, and the final unit presents key terms, discussion topics, and meaningful activities. The units between discuss graphic arts technologies and procedures. This information will help the reader understand the major technological processes involved in the production of printed products.

Section 1 defines the graphic arts and surveys this increasingly important industry. Sections 2 and 3 show how to solve problems at the design and layout stage for efficient graphic reproduction. Sections 4, 5, and 6 explain and illustrate the techniques, including typesetting and imagesetting, used in copy preparation. Within these sections, important topic areas include proofing procedures and techniques for preparing camera-ready paste-ups. Photoconversion techniques are emphasized in Section 7. Here, process cameras and the use of high-contrast light-sensitive materials (including a discussion of photographic chemistry) are covered in detail.

Sections 8 through 15 describe the preparation of image carriers and the operation of the image transfer equipment used in the four major methods of printing: letterpress, lithography, gravure, and screen. Several units within these sections highlight safety practices and procedures concerning the proper handling of chemicals and operation of equip-

ment. Imaging methods and equipment are also discussed in Section 16, which covers continuous-tone photography, and in Section 17, which covers duplicating and special printing processes.

Section 18 covers finishing and binding. Here a full unit again accents safety. The major product-finishing methods, including paper cutting methods and the common soft- and hardcover binding methods, are presented in step-by-step detail. The two most important materials necessary for graphic arts printed products—paper and ink—are featured in Sections 19 and 20. A study of graphic arts technology would not be complete without a detailed look at these two critical components of visual communications.

Section 21 presents important material concerning legal, moral, and ethical considerations for the printer. Section 22—which is new—discusses a major content area, *desktop composition*. Desktop composition has become a standard procedure in the graphic arts industry. Thus it is appropriate that it be covered in a separate section, which contains four complete units of information and learning experiences. Section 23 details the career opportunities available in the vast graphic arts and graphic communications industries. Two new units have been added to this concluding section. One discusses how to be a successful employee. The other discusses the excitement of entrepreneurship in the graphic arts industry.

The book is heavily illustrated and contains a second-emphasis color throughout its entirety. Several pages of four-color process printing help communicate essential information about selected graphic arts topics. Detailed instructions should promote readers' successful learning of graphic arts procedures from prepress through postpress operations. Equipment manuals and company literature should always be used to supplement and to provide up-to-date technological information about the rapidly changing graphic arts field.

Graphic arts technology is an exciting and

expanding field of knowledge. It offers many opportunities for interesting and rewarding careers. As authors and educators with more than sixty years of combined experience in graphic arts educational technology, we hope the readers of this book will become as fasci-

nated and excited about making it a lifelong career as we continue to be.

Ervin A. Dennis
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About the Authors

Dr. Ervin A. Dennis is a professor in the Department of Industrial Technology, University of Northern Iowa, Cedar Falls, Iowa. He has had a long and varied career in education, including over thirty years of teaching at the high school, college, and university levels. Dennis has authored and contributed to several other textbooks and publications about communications, graphic arts, and photography. He is an active member of several education and industry organizations.

Dr. John D. Jenkins is professor and Coordinator of Industrial Technology Programs, Department of Industrial Education and Technology, Eastern Kentucky University, Richmond, Kentucky. He has had graphic arts teaching experience for over thirty years at the high school and university levels. In addition to his contributions to several publications, he has been active in several local and national technology education associations.

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A book of this size and complexity would not be possible without the direct and indirect assistance of many people, companies, corporations, and associations. The authors especially wish to express appreciation to their immediate family members who provided considerable moral support throughout the lengthy revision process. Their wives, Mrs. B. LaVada Dennis and Mrs. Jerry Ann Jenkins, deserve a significant word of thanks for their assistance in making this and the previous two editions possible. Without their direct aid and understanding, this third edition would never have been completed.

During the preparation of the first and second editions, several people gave considerable effort to assist the authors. Among them were Dr. Chris H. Groneman, Mrs. Virginia Groneman, Dr. Darrel L. Smith, Dr. Claude Rieth, and Ms. Jean Michaelsen. Graphic arts industry personnel extending their valuable assistance were Mr. Alan Haley, Mr. Donald Marsden, Mr. David J. Barton, and Mr. George Dalente. A number of university graphic arts students, colleagues, and friends assisted with selected photographs used throughout the book. Our thanks to all of them.

Because graphic arts technology is advancing so rapidly, several industry personnel were asked to review selected sections and units for this third edition, and to recommend content for them. Their input greatly assisted the authors and lends considerable credibility to the entire book. These people, their companies, and the content involved are listed for the benefit of the users of this book: Ms. Cynthia J. D. Hollandsworth, Typographic Advisor, and Mr. Glen Rippel, Software Section Manager, both of AGFA Compugraphic Division, and Mr. Curits E. Leszczynski, Governmental/Education Specialist, Linotype Company, all reviewed and suggested content for the several composition and typesetting units. Mr. William E. Seaman, Vice President, Cameron Press Division of Somerset Technologies, Inc., contributed his expertise for the book production system unit.

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SECTION 1 GRAPHIC ARTS INDUSTRY

UNIT 1 INTRODUCTION TO GRAPHIC ARTS

Graphic arts is a means of communication. It includes all arts and processes that give information by means of images printed on surfaces. Graphic arts is an essential part of visual communication. It uses a wide range of methods and tools. Craftsmanship, mechanical aptitude, and a sense of the possibilities for using materials are needed to produce professional graphic arts products.

THE PURPOSE OF GRAPHIC ARTS

- The main purpose of the graphic arts industry is to create products that communicate visually. Not all graphic arts products communicate by words or pictures, however. The industry also makes non-communicating products such as paper bags, towels, dinner napkins, and plain paper.

Most graphic arts communication materials, such as sheets of paper, have two dimensions

(length and width). Many others, such as bottles and packages, have three-dimensions (depth) as well.

Examples of common image-using products are books, magazines, newspapers, and packages (Fig. 1-1). Photographs, illustrations, and words are used on countless printed products that fill newsstands and stores everywhere (Fig. 1-2).

THE INFLUENCE OF GRAPHIC ARTS

Studies reveal that people learn 80 percent of what they know through their eyes. An industry that produces visual images is one that has a strong effect on society.

Our culture relies greatly on graphic arts products. The information explosion has increased the output of both hardcover and paperback books (Fig. 1-3). There are more magazines and technical journals. The communication revolution has also expanded markets for



Fig. 1-1. Just a few samples of the many products of today's graphics arts industry.



Fig. 1-2. Magazines are a graphic arts product that entertains and informs.

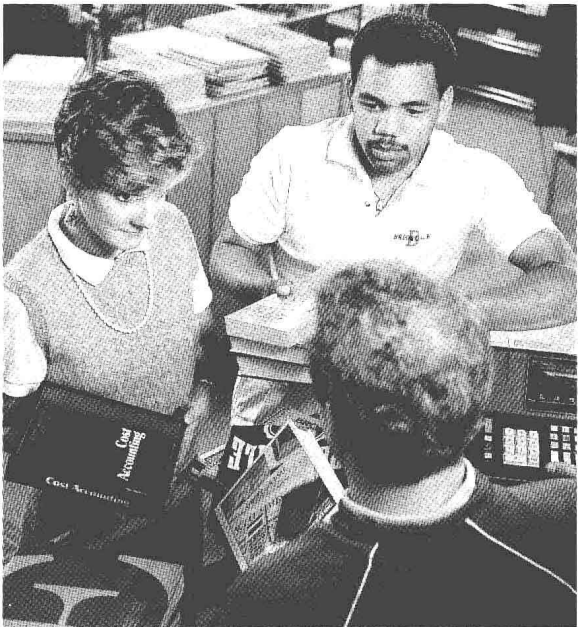


Fig. 1-3. Books are among the most essential products of the graphic arts.

advertising and promotional copy, brochures, catalogs, and dictionaries. The printed page (graphic reproduction) has never been more prominent in society than it is today.

EARLY GRAPHIC ARTS

Graphic arts has grown along with human civilization. Printed playing cards were among



Fig. 1-4. Playing cards were one of the first printed products of the graphic arts.

the first graphic arts products (Fig. 1-4). One of the earliest forms of graphic arts was branding (Fig. 1-5). This means of identification was used as early as 2000 B.C. Tombs in Egypt show ancient brands and the process of branding. The book of Genesis tells how Jacob, the great herdsman, branded his stock. The Romans, Greeks, and Chinese marked their animals, and even their human slaves, by branding. The first branding of cattle in America was done by Hernando Cortes, conqueror of Mexico.

<p>KT K-T-BAR belonged to Katie Barr</p>	<p>I-O I-BAR-O (I borrow) owner borrowed money to get into cattle business</p>	<p>SX ESSEX used by settlers from Essex. England</p>
<p>+B CROSS B belonged to a Mr. Crosby</p>	<p>X BUZZARD ON A RAIL</p>	<p>4D FORD belonged to a Mr. Ford</p>
<p>↓ TURKEY TRACK</p>	<p>U STIRRUP</p>	<p>A MUSTACHE-A</p>
<p>7 SEVENTY SIX</p>	<p>A WALKING-A</p>	<p>⊠ BLOCK - X</p>
<p>ε CRAZY - E</p>	<p>└ SWINGING-L</p>	<p>≡ M OVER W</p>
<p>◉ HOG EYE</p>	<p># PIG PEN</p>	<p>JK J-H-K</p>
<p>III LAZY LADDER</p>		<p>W RUNNING-W</p>

Fig. 1-5. Brands were among the first trademarks produced by a graphic arts process.

UNIT 2 THE SCOPE OF GRAPHIC ARTS

Graphic arts exists wherever there is civilization. People use graphic materials to communicate in their daily lives. Newspapers, books, magazines, advertisements, clothes labels, letters, and other printed products are everywhere. Who can go through a day without seeing some kind of printed material?

People find more and more uses for graphic arts as new technologies develop. The computer, for example, has had a great impact on business, industry, and everyday life. People in the graphic arts industry quickly recognized the value of this new tool. Today the computer plays a major role in all phases of the graphic arts industry (Fig. 2-1). In fact, this book was manufactured with equipment controlled by computers. Typesetting machines use computers, as do graphic arts cameras, film processors, platemakers, printing presses, and bindery equipment.

A BUSINESS ENTERPRISE

Several types of businesses make up the graphic arts industry. *Commercial printing plants* and *newspapers* are the most common graphic arts businesses. Commercial printing plants produce all kinds of printed materials, from simple letterheads and business forms to complicated advertising materials and books. Newspaper publishers print millions of copies daily. Everywhere materials are printed to inform and entertain us.

Most printing is done on paper. Paper manufacturers all over the world make the millions of tons of paper used each year (Fig. 2-2).

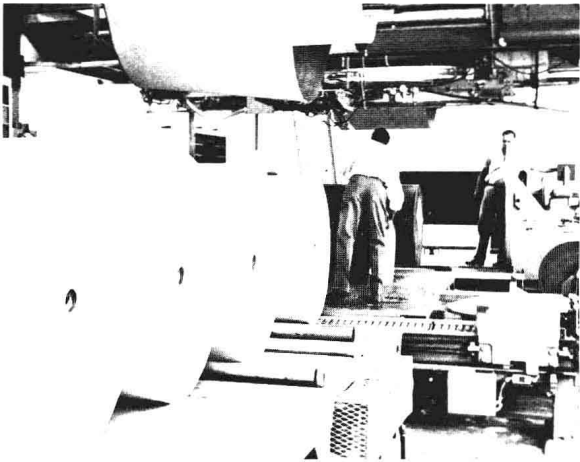
Graphic arts also uses large amounts of *ink*. Without ink, there would be no way to put information on paper and many other surfaces.

Equipment and *chemical* manufacturing also are important parts of the graphic arts indus-



BEDFORD COMPUTER CORPORATION

Fig. 2-1. As do other industries, the graphic arts relies more and more on computers like these.



MEAD CORPORATION

Fig. 2-2. Millions of tons of paper in sheets and rolls are used each year.

try. They make the machines and raw materials needed to produce printed materials.

GRAPHIC ARTS PRODUCTION

Graphic arts products usually go through six production phases (Fig. 2-3), each carried out by specialists skilled in that particular area. Printing plant personnel may call them different names, but these are the six steps most printed jobs pass through.

New technology has enabled some steps to merge. Some copy preparation equipment can be used to create visual images (type, artwork, and halftone photographs), film negatives and positives, and printing plates. As technology advances, the distinctions be-

tween the six basic production areas may lessen further. They remain an excellent model to understand the manufacture of most printed products.

1. Design and layout. Planning the *design* and preparing the *layout* are the first and most important steps. The design and layout artist must be creative, have skilled hands, and know the basic reproduction methods. (Fig. 2-4). To master these skills, it is important to know the principles of design and color, the characteristics of type, and the way to prepare a basic layout.

2. Copy preparation. Putting copy into printable form is the second production phase. There are many methods of typesetting, and a wide choice of type sizes and styles. Sophisticated equipment allows the typesetter or *compositor* to set type and even to prepare artwork and photographs for printing (Fig. 2-5).



Fig. 2-4. When planning a company brochure, a design and layout artist must understand the customer's needs.

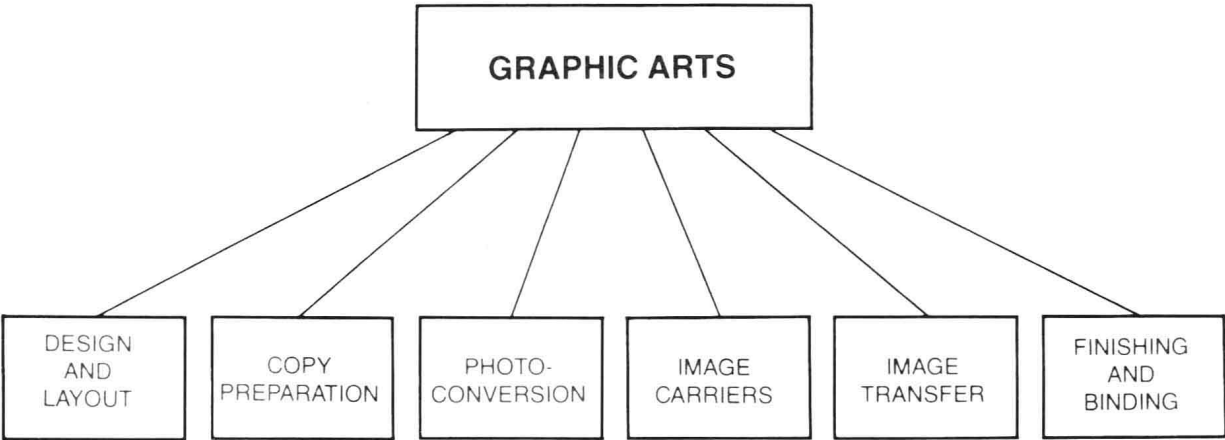


Fig. 2-3. The six production phases of graphic arts.