Mac GRAPHICS FOR THE MACINTOSH™

AN IDEA BOOK

JOHN P. GRILLO & J. DOUGLAS ROBERTSON

CBS Computer Books

GRAPHICS FOR THE MACINTOSH

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GRAPHICS FOR THE MACINTOSH

An Idea Book

Dedicated to

Betsy and Celia

Their patience and encouragement reduce the burden that writing imposes on our private lives.

Preface

As every user knows, the Macintosh is a vastly different machine from the traditional personal computer. Its ancestry may include the venerable Apple-II, but it doesn't resemble it in any way.

Never before in the history of computing has a machine's usability been so dominated by its capacity to produce graphic images. The Macintosh is driven by its ability to generate excellent graphics. Even when it produces text and numbers on the screen, it does so by *drawing* them. It relies on its high resolution and superb built-in programs to generate every image that the user sees.

When the Macintosh was introduced early in 1984 (who can forget that Superbowl Sunday?) it had two applications programs that were user-ready— MacWrite, a friendly word processing program, and MacPaint, an incredibly different program to produce graphics. Within a month of the hardware's release date, Microsoft BASIC became available, further expanding the computer's flexibility. It was at this time that we became involved with Holt, Rinehart, and Winston Publishers to produce this book.

This book is the first in a series of books to be written for the Macintosh computer. It is certainly the most enjoyable project we have ever undertaken, given the fact that the Macintosh is so highly graphics oriented. It is not our first book on graphics for microcomputers, but it is certainly the most different of them. We have spent an enormous amount of time developing techniques and programs to produce graphics in the past several years, either for our college courses, or for a book we were writing. Only when we began this book, however, did we feel utterly comfortable with this engrossing topic.

Our goal is to stimulate our readers to explore the Macintosh's abilities. We provide ideas in the form of small sequences of activities for using MacPaint, or small programs in Microsoft BASIC. These activities must not be confused with the well-developed applications that we leave up to the reader to produce. Our aim is to give away some of the tricks that we have learned in our combined three dozen years of computing experience. We simply seed the territory. It's up to our readers to cultivate and harvest the rich rewards of computer-generated graphics applications.

All of the material in this book was prepared on an "as-delivered" Macintosh with 64K of ROM and 128K of RAM. It was delivered in March of 1984 in its standard configuration with a single 3.5 inch built-in disk drive. With the computer, keyboard, and mouse we also got a 9.5 inch carriage Imagewriter printer. The only software we used was the MacPaint (both the 1.0 and 1.3 versions, the latter becoming available in May of 1984) and the Microsoft BASIC. With this hardware and software, we explored the great graphics that the Macintosh can produce.

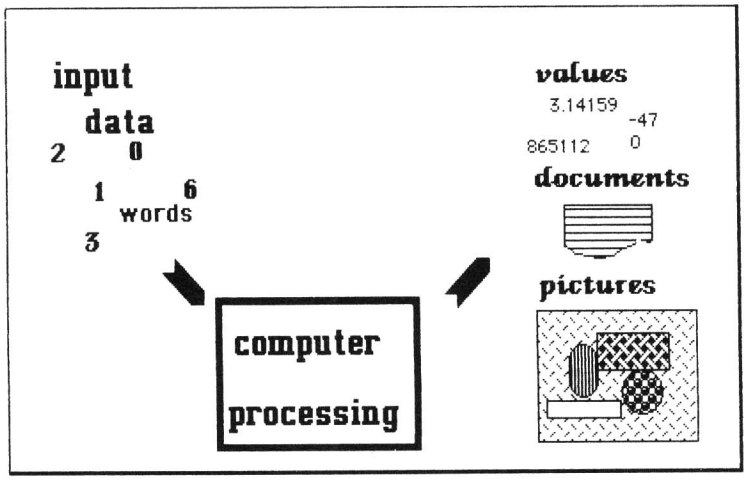
The book is in three major parts: Part I is an exploration of MacPaint graphics; Part II introduces good program design techniques; and Part III describes by example some of the possible graphics projects that you can design using Microsoft BASIC. It is in these last chapters that we pull out all stops and present some

graphics programs that could lead to full-blown commercial programs written by you, the reader. Our philosophy has always been to let the reader in on our development ideas. We begin playing around with techniques, and when we have a working program that uses some of the tricks we've discovered, we move on to something else. Our hope is that many of our readers will pick up where we've left off, and will produce well-designed, useful, rewarding commercial products.

INTRODUCTION

What are Computer Graphics

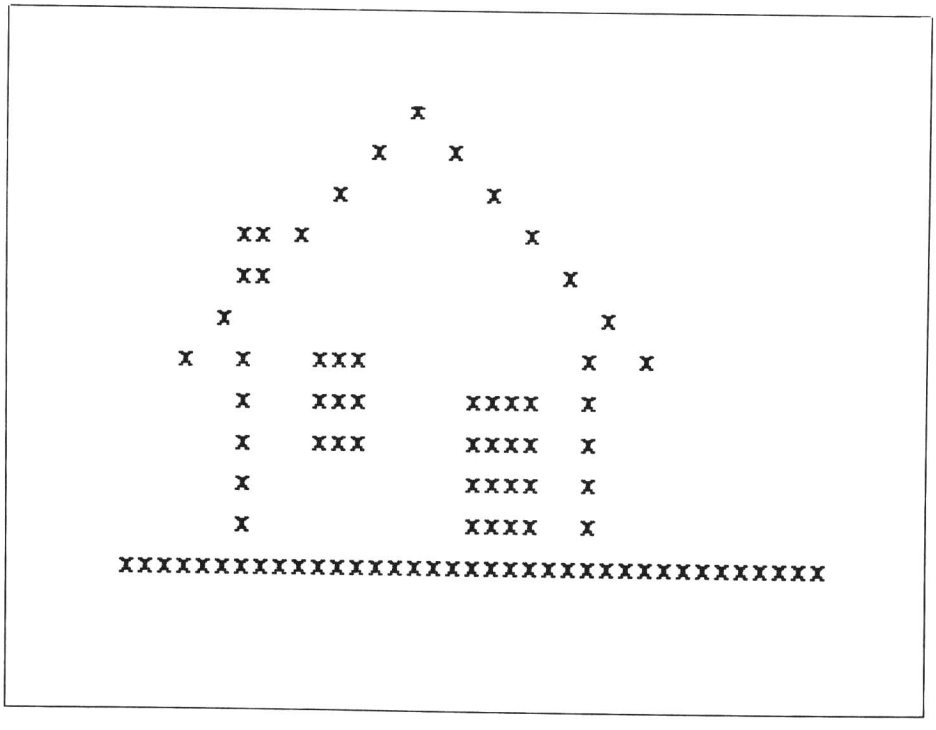
Simply stated, computer graphics is the most exciting output that a computer can produce. A computer — every run-of-the-mill computer — can deal with numbers and words. But it takes a major effort for these machines to generate pictures.



Pictorial output from a computer is the third of the three primary forms of computer output, and it is swiftly becoming the most popular. It is safe to say that the production of computer pictures is a relatively recent phenomenon. Computer graphics was too difficult and too expensive for general use until the 1970's. Before that time, computers were most often used in business to produce reports, and in science and engineering to calculate.

Printer Graphics

When a computer printer "draws" a picture of a puppy, or a spaceship, or any other image by printing a series of letters one line at a time, we refer to it as *printer graphics*. The sketch of the house below is an example of this kind of computer-generated graphic image.



This kind of computer-generated graphic image is simply a different use of the printer. Calculations don't enter into it, nor do special types of hardware or software.

Character Graphics

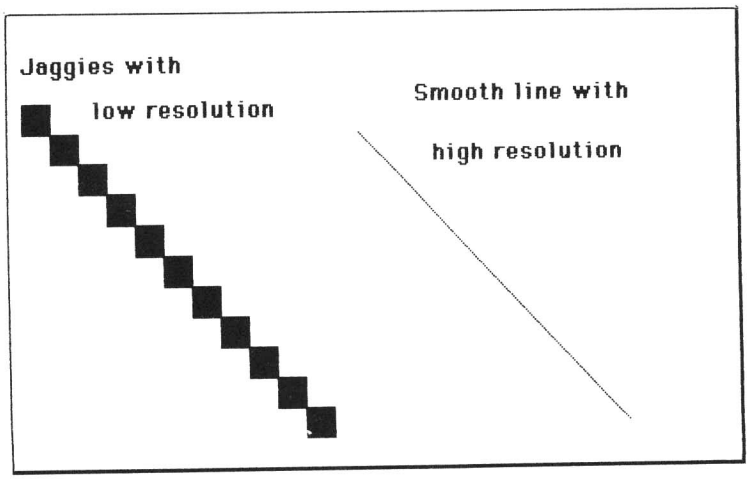
Another form of image that the computer can produce with only slightly more advanced hardware (and some tedious programming) is that sort produced using special characters aside from letters, digits, and punctuation. For example, some printer-computer combinations can make images using special characters like the ones below:

[ ] | / \ _ - + ● ▲ ⌧ ¬ ▯ ◇

Any image that is produced by printing these characters in straight lines one after another is simply an alternate form of the primitive printer graphics we mentioned above.

Pixel Graphics

It's only when the computer works together in concert with the screen and deal with individual spots of light that we can explore its full image-generating potential. All computer screen images are made up of individual spots of light or darkness that are called *pixels,* or *pic*ture *el*ements. Each spot is represented within the computer as a single small piece of information, and several such pieces of



information can work as a group to produce a character. If you look closely at any character a computer forms when it prints, you can make out the pattern of dots that make up the whole.

Normally, a computer has a fixed set of patterns for upper and lower case letters, digits, and special characters. When it produces text or numbers for output, those patterns are projected onto the screen to make up the words and values. However, when such a computer works with graphics images, it assumes a different imaging process, whereby the entire screen is a map or a sketchpad onto which the graphic image is placed one dot at a time. This form of graphics is measured by the screen's *resolution*, or its number of rows and columns of individually addressable spots. Typically, these computers have a resolution of from 100 to 1000 columns and from 50 to 1000 rows.

If a computer has a resolution of 1000x1000, it must be capable of storing one million addresses for each image. This amount of memory is rarely available on personal computers, so most of these have a resolution of 350 to 500 rows by 200 to 400 columns. With this level of resolution, most images lose their jagged edges, or *jaggies,* so that circles look round and lines look straight.

Macintosh Graphics

The Apple Computer Company has made the Macintosh, patterned after its *Lisa,* to be a pure graphics machine. By this we mean that not only does it produce graphics images one small spot, or pixel, at a time, but it also produces its text the same way. There is no set way to print the letter "a" in the Macintosh, as is the case with most other computers. It is this feature above all others that distinguishes the Mac from its brethren. Because of this property, a screen full of text can have graphics painted onto it, and a graphic image can have words around it.

This ability to mix text and graphics is extremely powerful. It means that your drawings can be labeled easily. Also, it means that your traditional computer programs that generate text and values can be embellished with pictures produced by the computer. We explore both approaches in this book, as you will see.

Advanced Graphics

The topic of computer graphics is a highly technical one, and it is governed a great deal by what the computer in question can and cannot do. For example, the Macintosh cannot (as yet) produce color on the screen. Therefore we must consider color graphics images to be beyond the scope of this book.

We also avoid some of the more advanced topics in college-level computer graphics courses, such as windowing, clipping, animation, and three-dimensional

images. This doesn't mean that the Mac can't do these things; rather, the topics are of a technical nature that is beyond the scope of this particular book. The two topics we do cover in detail are MacPaint and Microsoft BASIC graphics programming.

MacPaint

The MacPaint program as supplied by Apple is such a superb piece of software that we cannot recommend it enough. MacPaint is a program with which the user can produce pictures *immediately,* and as an extra bonus can add text to those pictures. We devote the first five chapters to an exploration of this remarkable program.

Microsoft BASIC and Graphics Programming

BASIC is a familiar language to many. Secondary schools are adopting it more and more as a standard introductory programming language because it is so easy to learn and because BASIC programs can run on practically all small computers. Microsoft BASIC has become something of a standard among the varieties of this language, and the Microsoft BASIC that runs on the Macintosh is *extra* powerful because it has good graphics commands and because it takes advantage of the Macintosh set of pre-programmed graphics software.

The last five chapters of this book dig into the use of BASIC as a method for producing graphics. This is not to say that Microsoft BASIC on the Macintosh is limited to graphics. Instead, we are emphasizing the use of graphics programming as an enhancement to the large number of programs that produce text and values. We include several programs that produce business charts in this section of the book to show how graphics and text can mix and how graphics improves the computer output.

We have left many programs in their skeletal state for a purpose. We want you to take them and modify them to suit your needs. We expect you to push here and pull there, to tweak the programs to your liking. We invite your reactions to them, and would consider it a high compliment to see a variation of one of our efforts become a best-selling piece of software.

Table of Contents

CHAPTER ONE

SKETCHING

This chapter starts the book with some of the elementary tricks you can use with that phenomenal piece of software, MacPaint™, written by Bill Atkinson of Apple Computer. If you still haven't invested in this application program, we recommend that you do so as quickly as you can, because it justifies anyone's purchase of the hardware. We will start with some primitive techniques. We can't guarantee that you will turn into an artist overnight. We didn't, as you will see. But we feel comfortable with the computer, and we have felt more free to "be artistic" as a result.

When you select and open MacPaint, either through the pulldown menus or by double-clicking, you are presented with your palette and sketchpad. Around the border you will find the patterns and techniques you can select; the mouse and your imagination are all that are necessary to do some pretty fancy sketches.

The Brush

The most direct tool for drawing freehand with the mouse is the *brush*, which is highlighted in Illustration 1.1. The squares in the left border show the tools that can be used. You can select any tool in the left border by clicking the mouse once. If you select the *pencil*, (found immediately to the right of the brush) as your tool, the shape your pencil will use is always a single thin line. As with the pencil, the shape that your brush will use is *not* the one shown at the bottom left corner of the palette, which is reserved for polygons, ovals, and freehand. To change the brush, you have to click the Edit menu item, (Illustration 1.2) then select the Edit Brush Shape as shown in Illustration 1.3.

In our initial play sessions with MacPaint, we discovered how forgiving the program can be when dealing with rank amateur artists. Consider the drawing of a tree. You have to draw the trunk, some large limbs, some smaller and smaller ones (more and more of them) until you are faced with all of the thousands of leaves. And if you want a foreground and horizon, you have those to contend with also.

To draw the trunk, select the fattest brush shape (from Edit Brush Shape), and make sure the pattern is pure black (the large square at the bottom left is black,