

David D. Thornburg

Computer Art and Animation

A User's Guide to

Radio Shack Color Logo



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Color Logo*

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Preface

This is a book about computer graphics written for two types of people—artists who are interested in computers and computer enthusiasts who are interested in art. Since there is a possibility that you fall in neither of these categories, this book may serve to stimulate your interest in both areas.

Many artists feel that computers are outside their range of comprehension, and many computer enthusiasts feel that way about art. If you fit either of these groupings, perhaps the rest of this preface will help you to see another view.

Artists Anxious about Computers

I've met many very creative artists who freeze up when they hear the word *computer*. The idea that a faceless, emotionless symbol-manipulation tool could be used for creative expression is met with disbelief. Of course, some people think that hammers and chisels are pretty cold and faceless, too, but that doesn't keep hammers and chisels from being useful to sculptors.

The point is that the computer is a tool, just like a paint brush or a silk screen frame—no more and no less. To deny its utility to the artist is as senseless as to treat it as a thinking machine. The recent interest in this expressive medium is traceable to the fact that the cost of computer graphics systems has dropped to the point that they are showing up in hundreds of thousands of homes. The computer has become an affordable expressive tool that can be used effectively by any artist who is willing to invest a little time learning how to use it.

You may be of the opinion that computers are “number-crunching” machines that require the constant attention of people who have exceptional technical skill. Although some computers fit this description, it doesn't mean that *all* computers are primarily mathematician's tools or that *you* have to be a wizard to run one.

In fact, the inexpensive Radio Shack Color Computer, using the Color Logo language, is a marvelously simple tool to

use. Furthermore, it can be used to create graphic designs of exceptional beauty. All that is required on your part is that you be able to press keys on a keyboard and that you acquire the vocabulary of the Logo language. This book will provide the framework to allow you to learn this language easily and naturally.

Once you have mastered the computer and its language, you will have opened the door to a new creative medium—computer graphics.

There is one characteristic of computer graphics that you should know about before we start. It is different. It is different from watercolors, oils, pastels, block printing, weaving, pottery, and every other art form we have ever had. Because it is different, computer graphics will never replace any of these other art forms. Because it is different, computer graphics will let you express ideas in totally new ways—ways that are as far removed from your present art form as pen and ink drawing is from marble carving.

So don't think I'm going to ask that you give up any expressive tools in your kit—I'm not. What I hope will happen is that you will find the computer useful in expressing ideas that aren't readily expressed by the methods currently at your disposal.

Computerists Anxious about Art

I've met many people who feel that they can't express themselves artistically. That's unfortunate, because humans have expressed themselves artistically since our ancestors found that images could be scratched on a cave wall with a rock. Of course, not everyone *wants* to be an artist, and that's fine. Not everyone wants to be a brain surgeon, either.

The problem is that many people who don't express themselves artistically think that they *can't* express themselves this way. There is overwhelming evidence that this is not true.

Get a pen and a sheet of paper and draw a line on it. That wasn't hard, was it? Is the result art? Maybe not, but if you drew the right lines it would be. How does one draw the right lines? Regardless of stylistic differences, there is one thing that

artists have in common. They not only look at the world around them, they *see* the world around them. Thus, the key to good artwork is often good seeing.

The mind's eye—the imagination—is a marvelous tool for seeing. Can you imagine?

Can you imagine an ice cream cone the height of the Empire State Building?

Can you imagine the taste of the color green? What is the sound of red? How about the color of love?

Once you start imagining and seeing, you are ready to start expressing yourself creatively. If you are new to art, try many tools—crayons, paints, clay, pens, whatever you have available—even computers.

After all, computers are useful artistic tools, and you have something to express.

Acknowledgments

Books don't appear unassisted on an author's desk; they are influenced by the support of many people. This book is no exception. The assistance of Radio Shack was most appreciated.

The freedom to create is the most powerful freedom of all. For tolerance, acceptance, support, and encouragement in this task, I want to thank all those people who helped me across the border from technology to art.

There is one for whom my thanks is greatest. May I always be helped to see the world through the eyes of love.

*Los Altos, California
August 1983*

D.T.

Contents

Preface iii

I. Introduction 1

Computer graphics: Here, there and everywhere 1

Computers in the home 1

Radio Shack Color Logo 3

What we will do 4

II. Getting Started with Color Logo 5

Locating the computer system 5

Making the right connections 5

Starting Color Logo for the first time 6

A brief introduction to Color Logo 7

Introducing the turtle 8

III. Making Drawings with the Turtle 9

Some basic commands 9

The turtle's pen 14

The turtle's limits 19

Relocating the turtle 21

Some art projects 25

IV. Teaching the Turtle New Tricks 27

The power of procedures 27

Defining procedures 28

Saving and recalling your Logo workspace 34

Variables 36

Projects using procedures 41

V. The Four Little Polygons and How They Grew 47

Polygons 47

Blossoms 55

POLY and the single procedure 62

A pentagonal tile 65

Some projects with polygons 69

VI. Circles, Arcs, and Stars	71
<i>Circles</i>	71
<i>Arcs</i>	76
<i>A flower</i>	78
<i>Stars</i>	84
<i>Some projects</i>	88
VII. Squirals and Spirals	89
<i>Squirals</i>	89
<i>Closed spirals</i>	101
<i>Open spirals</i>	108
<i>Projects involving growth</i>	112
VIII. Additional Drawing Aids	115
<i>A thing of beauty is a joystick forever</i>	115
<i>Single-keystroke procedures</i>	118
<i>Some projects</i>	125
IX. Multiple Turtles and Animation	127
<i>Moving shapes</i>	127
<i>Making your own shapes</i>	134
<i>Many turtles</i>	137
<i>One turtle, many shapes</i>	139
<i>Projects using shapes</i>	143
X. The Creation of Animated Sequences	145
<i>Storyboards</i>	146
<i>Starting projects</i>	148
<i>Short scenes</i>	149
<i>Longer works</i>	151
XI. Artwork Recording Techniques	153
<i>Recording static images</i>	153
<i>Recording moving images</i>	156
Index	163

I.

Introduction

Computer Graphics: Here, There, and Everywhere

Computer-generated graphics are all around us. Businesses, long accustomed to typewritten documents, are now discovering that computer-generated plots of business data can be comprehended faster than data presented in a table. Educators, long-time fans of pictorial information, are discovering that computer graphics can enhance the teaching of subjects as diverse as logic and chemistry. And, of course, the entertainment applications of computer graphics are well known. To pick just one example, computer-driven videogames illuminate millions of homes every day. The appeal of these games comes, in large part, from their colorful graphic images. Whether jumping frogs across a pond, jumping a man over a barrel, or smashing space bugs, the colorful animation holds the players' interest time and time again. Videogame players are controlling their own cartoons!

Games are far from the only entertainment application of computer graphics, of course. The motion picture industry is now spending millions of dollars on massive computer systems to bring high-quality computer-generated images to the silver screen. In such films as *Star Wars*, *TRON*, and *Star Trek II*, the computer has established itself as a powerful ally for those who create video magic.

Beyond commercial applications, computer graphic systems have been used effectively as an expressive tool by many artists who are fortunate enough to have access to them.

Computers in the Home

Far from being the tools of a privileged few, computer graphic systems are available today for the cost of a clothes dryer. The personal computer industry grew from its modest beginnings a few short years ago to the point at which millions of computers

are being purchased every year. The appearance of computers in homes means that millions of people now have access to technology that once was found only in industrial and academic environments. For the graphic artist, it means that one can create computer-generated artwork in the privacy of a home or studio, instead of having to travel to a remote laboratory to gain access to this technology.

There are two major ways of generating computer graphics on a home computer system. One way involves the use of a *computer graphics program* that lets you use a graphics tablet or a joystick to sketch images on the screen. Using special commands in this program, you might be able to fill outlines with color, rotate images, replicate parts of the image in other areas of the screen, and otherwise do many powerful things. The only problem with these programs is that they do not provide access to additional features that you might like to incorporate in your artwork. Because these programs are generated by other people, you have to be content with other people's concept of the graphic tools you need. Nonetheless, many of these programs are excellent and appropriate for artists who feel the need to create artwork by moving a pen over a surface.

The second way to create computer graphics is to work directly with a computer language that is richly endowed with graphics commands. Certain computer languages have the property of allowing you to define your own procedures, which may then be recalled by simply typing the procedure's name. This approach to computer graphics, *graphics programming*, brings you in closer touch with the raw power of the computer. It even allows you, should you wish, to create programs that do the things done by existing graphics programs, with the important difference that *you* are the one who determines which features to incorporate.

Contrary to popular belief, computer languages are not hard to learn. With the appropriate language, you can be creating interesting graphics programs in the first ten minutes of exposure to the system. One of the most appropriate languages for the creation of computer graphics is called Logo. The feature of Logo that makes it so powerful is called *turtle graphics*.

The turtle is an imaginary creature that resides on the display screen whose sole function is to obey your commands. By instructing the turtle to move in its present direction or to turn by some angle, you can create on the screen any image you desire. The turtle can be instructed to leave a trace of its path in any of several colors, to erase a line, and to obey a predefined series of commands called a *procedure*.

Is the turtle easy to use? If you understand such words as FORWARD, BACK, RIGHT and LEFT, you are well on the way to getting the turtle to create pictures on your television screen.

Radio Shack Color Logo

This book will focus on a powerful graphics environment—that provided by the Radio Shack Color Computer using the Color Logo language disk or cartridge. In many ways, Color Logo resembles the graphics environment found in the language Logo. Although there are some differences in the capabilities of the two languages, Color Logo allows you to create many beautiful patterns and pictures using an inexpensive computer system. You will soon be making beautiful pictures using a language that you will master with just a little effort on your part.

To make use of the material in this book, you will need the following equipment:

- Radio Shack Color Computer (with 16 K RAM if you are using the cartridge version of Color Logo, 32 K RAM otherwise)
- Radio Shack Color Logo cartridge or disk
- Color (or black-and-white) television set
- Tape recorder cables and tape recorder, or disk drive (for recording your artwork)

Depending on your needs and desires, you may also wish to record your artwork on film or videotape. In this case, you will need a camera with a tripod or a video cassette recorder. Fortunately, the cost of a video cassette recorder has fallen to the point that it is now a reasonably priced accessory for your computer system!

What We Will Do

The remainder of this book will deal with the following topics:

- Getting familiar with the equipment
- Turtle graphics and the creation of static images
- The creation of animated shapes
- Designing animated sequences
- Projects in computer graphics
- Projects in animation
- Recording your artwork on film or on a video cassette recorder

We will take things step by step, and before long you will have mastered this tool. So set aside some time and prepare to enter the world of graphics programming. It is likely that you will find it fascinating.

II.

Getting Started with Color Logo

Locating the Computer System

It is important that you find a good place to locate your computer system. Since you will be using it for creative applications, you should pick a place that is free of distractions. If you have a studio, find a quiet corner where the equipment won't be disturbed. At home, set up a study or spare room away from heavy traffic flow. Your location should be as dust-free as possible and should be indirectly lighted. Find a tabletop that is large enough to comfortably hold the computer system and any related equipment you may be using (such as a video cassette recorder). Be sure you can reach the keyboard easily. Your creative ideas won't flow at all well if your arms have to strain to reach the keys! The television set should be placed where the screen may be seen easily, without any strain on your neck or eyes. Be sure that no room lights reflect off the screen.

Although your computer space needn't be dark, it shouldn't be so bright that the screen colors appear washed out. Most important, the computer should be in a place you like—a place that is conducive to the free flow of ideas.

Making the Right Connections

I wish we could start making pictures right away, but in this regard computers are different from pencils and paper. Computers have to be set up and turned on. Fortunately, unless you move your equipment around a lot, your system will have to be set up only once. The manuals that came with your Radio Shack Color Computer system show you how to set up the equipment, and those instructions won't be repeated here. There are two types of equipment setups you could have, depending on whether you are using the disk-based or the cartridge-based version of Color Logo. If you are using a disk-based system, you should remember to turn the equipment on in the following sequence:

1. Turn on the disk drive.
2. Turn on the computer.

You should also turn on your TV set, of course, or you won't be able to see your pictures.

If you are using the cartridge version of Color Logo, you will be saving your pictures on tape, so you will only need to turn on the computer and your television. Remember to have your Logo cartridge plugged in before you start.

Starting Color Logo for the First Time

If you have used Color Logo before, feel free to skip this section. What we will do here is show what happens—and what can go wrong—when starting the Color Logo system.

If you are using the Color Logo cartridge, you will see the following message when the computer is turned on:

```
COLOR LOGO COPYRIGHT 1982  
LARRY KHERIATY & GEORGE GERHOLD  
ALL RIGHTS RESERVED  
LICENSED TO TANDY CORP.
```

LOGO:

If you have the disk-based version, you must insert the Color Logo disk in the drive (with the label facing to the right). After you close the disk drive door, enter

```
LOADM "LOGO
```

(If you haven't used the computer before, you need to know that you must press the key marked ENTER at the end of each line.)

The disk drive light will go on and the drive will make a whirring sound as the Color Logo language is loaded into your computer. Once the whirring stops, enter

EXEC

You should now see the same screen display as that shown earlier.

If you look at the display, you will see a black flashing underscore sign () next to the word **LOGO:**. This is called the *cursor*. Its function is to let you know where a letter will appear when you type something on the keyboard. This symbol lets you know that the computer is waiting for you to give it an instruction.

You should take a few minutes to get familiar with the keyboard, since it is the principal tool through which you will convey your desires to the computer. Other ways include yelling at the system (not very effective), turning off the machine (effective, but final), and the use of joysticks (to be covered in a later chapter).

At first glance, the keyboard resembles that of a typewriter, at least in terms of the placement of the letters and numbers. The **SHIFT** key on the computer keyboard works similarly to the shift key on the typewriter, except that all the letters you type will appear in uppercase.

Remember that the key marked **ENTER** must be pressed at the end of every line of instructions you give the computer. If you see an error before pressing this key, you can back up and fix it. Once **ENTER** is pressed, however, the computer will try to do the things you have entered in your commands.

If you make a mistake while typing, just press the key containing the arrow pointing to the left until you have erased the wrong letter. Continue retyping to finish the line.

Remember that Color Logo uses only uppercase characters. Since our main concern is graphics, not text, this shouldn't present any problems to us.

A Brief Introduction to Color Logo

When you first start Color Logo, the language is in what is called the **BREAK** mode. This mode is reached any time you press the red key marked **BREAK**. (Go ahead and press it—you

really won't break anything.) The BREAK key lets you interrupt the computer so that you can change activities.

The two activities of principal interest to us use the EDIT mode and the RUN mode. These modes are entered by pressing either E or R when you are in the BREAK mode. The EDIT mode lets you create your own graphic procedures, and the RUN mode lets you use these procedures and other commands to create pictures on your television.

Introducing the Turtle

Of all the features of Logo, the turtle is central to computer graphics. As mentioned before, the turtle can be thought of as an object to which we send messages. These messages come either directly from the keyboard or as a result of letting Logo use a procedure we have defined.

The turtle draws its pictures on a portion of our display screen. Since we are in the BREAK mode when Logo is started, we need to shift from the text display to the graphics display mode. To make this transition, simply press the letter R on the keyboard.

As soon as you have entered this command, you will see a small black figure in the middle of the screen, and the cursor will be at the left edge of the screen, roughly three-quarters of the way down. We have now entered a mode in which we can see both the pictures drawn by the turtle and a few lines of commands as we enter them.

The turtle is shown as a small rectangle with a point at one end. The location of the figure shows that the turtle is in the center of the screen, and the direction of the pointed end shows that it is pointing toward the top of the screen. As soon as we entered this mode, Color Logo was instructed to pass all relevant messages to the turtle for execution.

What kinds of messages can we send to the turtle? Let's find out!

III.

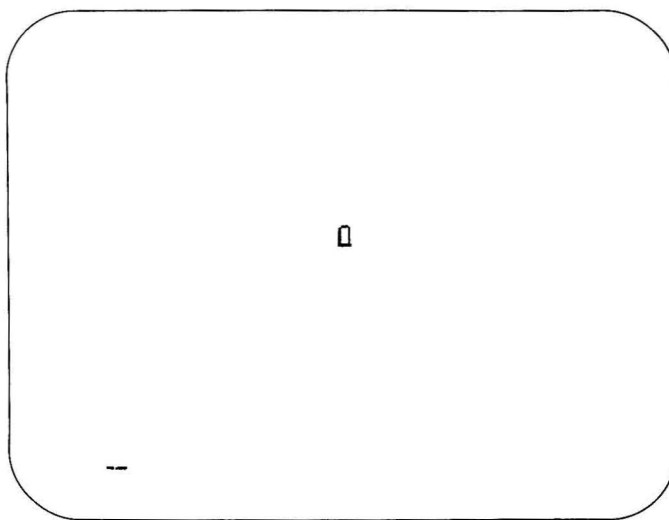
Making Drawings with the Turtle

We are now at the point where we can start to create pictures. To do this, we need to learn the words in Color Logo that make the turtle draw lines on the display screen.

Some Basic Commands

Since we now want to explore the turtle's world a bit, enter the RUN mode. (Remember that you do this from the BREAK mode by pressing the letter R.)

As soon as you did this, your screen was divided into a graphics and a text region, and the turtle was placed in its home position and orientation.



Now let's find out how to move the turtle forward. We could try using the word **FORWARD**, but how much would the turtle move? The **FORWARD** command must be followed by a