

# LOGO

*Theory &  
Practice*

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Dennis  
Harper

# **LOGO**

## ***Theory & Practice***



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***Brooks/Cole Publishing Company***  
***Pacific Grove, California***

*Sponsoring Editor:* Michael Sugarman  
*Editorial Assistant:* Mary Ann Zuzow  
*Editorial Supervisor:* Joan Marsh  
*Production Service:* InfoTech/Paul Quin  
*Manuscript Editor:* Antonio Padial  
*Interior Design:* Paul Quin  
*Cover Design:* Anderson Associates/Barry Anderson  
*Typesetting:* Zetatype Desktop Publishers  
*Printing:* Interior, Arcata Graphics/Fairfield;  
Cover, Phoenix Color Corp.

## **Brooks/Cole Publishing Company**

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Printed in the United States of America.

10 9 8 7 6 5 4 3 2 1

### *Library of Congress Cataloging-in-Publication Data*

Harper, Dennis O.

Logo: theory and practice.

Bibliography: p.

Includes index.

1. LOGO (Computer program language) I. Title.

QA76.73.L63H37 1989 005.13'3 88-30477

ISBN 0-534-09720-0

# Preface

Logo conferences, Logo books, Logo newsletters, Logo articles, Logo presentations, Logo research, Logo Moratoriums, Logo curricula, Logo. . . . How is a teacher to synthesize the barrage of Logo information? *Logo Theory and Practice* gives the teacher with classroom experience in using Logo a detailed summary of what researchers, teachers, educational leaders, and children are saying about Logo. An additional purpose of this book is to present Logo to student teachers and inservice teachers who, realizing that Logo is more than a programming language, are interested in learning about its theory and practice.

After teaching mathematics, studying educational systems, and visiting more than 80 countries, I became convinced that there must be a better way to teach mathematical concepts. During my travels, a 1978 Apple computer advertisement caught my eye, and my wife and I decided to return to the United States to see what this new technology had to offer education. In 1980, I read *Mindstorms* (Papert 1980) and, as many others had, found in it something personal. *Mindstorms* affirmed my thoughts about teaching mathematics to both students and teachers, and I became fascinated by the potential uses and benefits of Logo and the microcomputer. Many other dissatisfied teachers have found in Logo the opportunity to change for the better the way they teach.

I began working on a doctorate that would emphasize the use of Logo in educational programs in developing nations. After conducting a 1983 Logo study in Malaysia (Harper 1984) and finishing my degree, I became concerned that Logo use was moving ahead of teacher training and curriculum development. Much was being written about Logo, but only a small amount was being said that teachers could use. Schools were not providing the environment envisioned in *Mindstorms*. In addition, Logo teachers were not connecting Logo tasks to other things kids were learning, both in school and in the home.

I could find no comprehensive treatment of Logo's educational, psychological, epistemological, and philosophical questions in any one book or document. With this in mind, I took out my Logo cassettes, videotapes, articles, books, interviews, dissertations, proceedings, and activity kits. All the literature searching, conferencing, conferring, teaching, and researching I have done over the past eight years have culminated in this book. It is the compilation of the more than 1000 entries listed in the *Logo Bibliography* compiled by Tom Lough and myself in 1986 (with subsequent revisions in early 1988) as they relate to both theoretical and practical issues.

More than anything else, the philosophy of Logo has excited many educators and practitioners and led them to implement Logo. In Papert's words, "Logo is simple enough so a five-year-old could write a program in the first few minutes of contact with a computer, and sophisticated enough so a computer scientist would find the system congenial and rich" (Greth 1983). That's why a range of educators, from kindergarten teachers through university professors, have become enthusiastic about Logo. In a 1983 speech, Alan Kay stated, "Logo became part of the kids' daily fare and became a religion to me, and still is, and there is no reason to do anything in computer science that is not accessible to kids and have it in their natural domain." However, implementing Logo in schools is no guarantee of an upgraded education.

Although Logo is an unsurpassed way to introduce students to computer programming, the real reason for the enthusiasm of educators in the claim that Logo develops problem-solving and logical-thinking skills. Throughout the world, schools have selected Logo for their classrooms. What makes Logo so good? What makes Logo so different? "Because it can take on a thousand forms and can serve a thousand functions," Papert says, "it can appeal to a thousand tastes" (Greth 1983).

Although Logo's potential and enthusiastic welcome are well documented, many educators have raised questions about the gains that can be

expected from Logo use. The following authors emphasize these controversial concerns:

“Everyone else is doing it” is not a good enough reason to immediately run out and buy the first Logo system available. Remember that Logo implementations often do not work as nicely and easily as you hear about (Billstein 1983).

I shall question Logo on three grounds: its tendency to experiential impoverishment; its uncritical “head-start” philosophy; and its idolatry of “powerful ideas” and computer thinking (Davy 1984).

When students experience shortened class periods, limited machine access, [and] the increasing amounts of course content to cover, the marvelous gains that educators expect from Logo may not be as evident as we would like (Billstein 1983).

All things considered, it looks like teaching Logo might not be such a good idea, particularly if the teacher is underprepared, the objectives of instruction are unclear and the cognitive utility of computer languages in general is in serious question (McCauley 1985).

Particularly salient are largely unsubstantiated claims concerning the cognitive benefits of computer programming (Clements and Gullo 1984).

The current mixture of technology, education, and politics is a sure recipe for disaster (Allen 1984).

One reason, then, for the rapid and prolific infiltration of microcomputers into classrooms is the widespread belief among educators that these machines of the future will somehow succeed where teachers have failed. To date, however, there is little evidence to support this supposition (Tettenbaum and Mulkeen 1984).

The many ways computer education can go wrong is frightening. When computers are treated as something outside the traditional goals of education, we have taken a dangerous step. As we are just getting started with Logo, let's not lose sight of the big goals (Tipps 1982).

Despite these criticisms and concerns (which are addressed in this text), Logo has been adopted by schools and individuals throughout the world. “It seems that the world has given Logo an enthusiastic albeit *conditional* acceptance, based more on the *promise* of Logo than on actual demonstration of its accomplishments” (Leron 1985). Many problems still remain unsolved for the Logo community to address. This book identifies these issues in the hope that researchers, educators, and parents will funnel their efforts more productively toward the goal of greater benefit to your learners. By looking at the broad spectrum of Logo, we give teachers and learners greater possibility to make Logo special and important while avoiding a potential resistance that would nullify any of Logo's potential gains.

Educators will play the key role in determining the success of Logo and computer-assisted learning. The potential of Logo and Logo-like languages to provide highly educational experiences depends on teachers' knowledge. It is the teacher who will determine whether Logo becomes more than just a tiny part of the mainstream. Schoolteachers and administrators must realize that Logo will not immediately improve achievement scores and that time is needed to realize Logo's potential. In the meantime, Logo does many things effectively.

During the past six years, the *Logo Exchange* (LX) has provided Logo educators and enthusiasts with challenging and thought-provoking articles. Many of the LX feature articles appear in this text. Practical examples and class activities are given throughout the book, not just at chapter endings.

This text does not provide detailed step-by-step instructions on how to use Logo primitives in numerous Logo dialects. (This would be impossible with nearly 100 versions of Logo in several languages now available. Documentation is supplied with all Logo packages; teachers and students should refer to the manuals for details of syntax and file management.) Instead, this book includes explanations, hints, and projects dealing with most of Logo's procedures and concepts. An Integration Grid appears following the Preface to help teachers locate information, exercises, and projects that reinforce specific Logo concepts. In addition, many of the LX chapters (5-12) are arranged into activities whose objectives, along with Logo primitives used in the activity, are listed in tables at the beginning of the chapters. The LX chapters are organized by



author rather than topic to retain consistency of writing style.

This book is written to stand alongside the documentation and combine both Logo theory and practice into flexible text for students and teachers of any level or discipline. Major contributions by Glen Bull, Paula Cochran, Barbara Elias, Donna Lanyi, Tom Lough, Jim McCauley, Robs Muir, Seymour Papert, Steve Tipps, Jane Toth, and Molly Watt give *Logo Theory and Practice* a diverse range of expertise on which the user can draw.

I would like to thank the major contributors listed above and especially Tom Lough for his efforts and critical reading of the text. I would also like to acknowledge the reviewers of the book, whose suggestions were greatly appreciated: Glen Bull, University of Virginia; Barbara Burkhouse, Marywood College; Jane Ann McLaughlin, Trenton State College; Karin Wiburg, United States International University; Arthur Wiebe, Fresno Pacific College; Ray Wilson, Ft. Lewis College.

This book is an attempt to provide teachers the knowledge necessary to transform their classrooms into a new environment that encourages the discovery methods of learning. As Steve Tipps (1984a) points out, "Papert raises our eyes to the stars, but does not provide many hints about how to get there. The task of working with Logo is left to mortals who have much to learn."

## Using Logo Theory and Practice

Teacher trainers using this book for a course or series of workshops could take their students through the book sequentially. However, since Chapters 5, 6, 7, 9, 10, and 11 are organized by author rather than topic, it would perhaps be more beneficial to assign practical (nontheoretical) work and readings by Logo topic. For the user's convenience, the following features are provided to help integrate major Logo topics.

- ▲ **Integration Grid** This spreadsheet-like grid on the following pages lists the Logo topics that are highlighted in all major sections of the book. A \*\* in a grid box indicates that section contains a major discussion of that topic. A \* indicates a mention of that topic. A blank indicates no mention of the Logo topic in that section.
- ▲ **Chapter Introduction** Chapters 6, 7, and 8 begin with a chart indicating the objectives of each activity and specifying which Logo procedures are discussed.
- ▲ **Comprehensive Index** Specific Logo topics, people, and projects can be found in the index.

# Integration Grid

	<i>File management</i>	<i>Turtle commands</i>	<i>Modular programming</i>	<i>Variables</i>	<i>Recursion</i>	<i>List processing</i>	<i>Logo utilities</i>	<i>Problem solving</i>	<i>Logo environments</i>	<i>Research</i>	<i>Mathematics</i>	<i>Science</i>	<i>Humanities</i>
<b>Chapter 1</b> Cognitive and Affective Effects of Logo								**	**	*			
<b>Chapter 2</b> Logo Research								**	**	**	*	*	*
<b>Chapter 3</b> Teachers' Role								*	**				
<b>Chapter 4</b> Logo: A Project Approach					*						*	*	*
<b>Chapter 5</b> TurtleTips	*	**							*		*	*	*
1. Precomputer Activities								**			*		
2. The Turtle Plate Angles											**		
3. Keyboarding													
4. Mazes													
5. Small Group Instruction													
6. Task Cards/PRINT Command		**											
7. The Logo Editor	**												
8. Sharing Logo Ideas													
9. Logo Fair													
10. Reviewing Logo Concepts													
11. More Keyboarding													
12. Instant Gratification													
13. Logo into the Curriculum												*	*
14. The REPEAT Command		**											
15. Circles and Arcs		*									**		
16. Procedures		**											
17. Coordinate Geometry		**									**		
18. SETCURSOR and PRINT	*	*											*
19. Procedure of the Month		*	*								*		
<b>Chapter 6</b> Tips for Teachers	*	**	*	*	*	*	*	*	*	*	*	*	*
1. Combining Process and Product		**	*								*		
2. The Truth about Numbers		*									**		
3. Both Sides Now	*	**		*							**		
4. The Issue of Instant		**	*				*						
5. Triangle Thinking		*	*	*	*			**	*		**		
6. Unsquare Square: The Story of Scrunch		*		*	*		*				**		

	<i>File management</i>	<i>Turtle commands</i>	<i>Modular programming</i>	<i>Variables</i>	<i>Recursion</i>	<i>List processing</i>	<i>Logo utilities</i>	<i>Problem solving</i>	<i>Logo environments</i>	<i>Research</i>	<i>Mathematics</i>	<i>Science</i>	<i>Humanities</i>
7. How Now, Output	*	**		*									
8. Starting a New Year		**							**	*	*		
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10. Number High, Number Low		**		*							**		
11. Numbers in Between		**	*	*							**		
12. Wonderful Wiggles		**		*							**		
13. Survey of Surveys	*	**	*	*							*	*	*
14. Survey Sense		**	*	*	*	**					*	*	*
15. Dash Away All		**		*				*					
16. Rooms for Logo		**	**	*				*					**
17. Geo-Logobords		**	*	*							**		
18. Overland Map-Making		**						*			*		**
19. Getting to Know You		**		*		*							
20. Circular Quirks		**									**		
21. RANDOM Redux		**		*		*					**		
22. Goaltending								*	*	*	*		
<b>Chapter 7</b> Microworlds		**	*	*	*	**	*				*		*
1. The Utilitarian Turtle		**	*	*	*		**						
2. Numbers and Lists		**		*		**					**		
3. Grade Averager and Report Generator		**	*	*	*	**							
4. Adventure Stories	*	**	*	*	*	*							**
5. Logo Characters	*	**		*	*								
6. Centering Titles		**	*	*	*	*							*
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<b>Chapter 8</b> Listful Thinking		**	*	*	*	**	*		*		*	*	**
1. Poetry Sparks		**	*	*	*	*							*
2. Pick a Treat		**		*		**							**
3. Count your Blessings		**	*	*	*								*
4. Making a List and Checking It Twice		**	*	*	*	**							
5. Adding DELETE to Your Toolkit		**	*	*	*	*							
6. Power Tools		**	*	*	*	*							*
7. Powerful Selections		**	*	*	*	*							*
8. Word Machines		**	*	*		*							**
9. Suffix Busters		**	*	*		*							**



[illegible]

	<i>File management</i>	<i>Turtle commands</i>	<i>Modular programming</i>	<i>Variables</i>	<i>Recursion</i>	<i>List processing</i>	<i>Logo utilities</i>	<i>Problem solving</i>	<i>Logo environments</i>	<i>Research</i>	<i>Mathematics</i>	<i>Science</i>	<i>Humanities</i>
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9. Random Rings and Things		**	*								*		
10. Ad Romanum											*		*
11. Of Sunshine and Shadow											*	*	
12. Single-Switch Logo		*					*						
13. Stand in the Corner											*		
14. What? If?		*	**			*							
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17. The BASIC Challenge													
18. Ella and the n-gon		**		*							**		
19. Making List Operators		**				**							
20. It's Only Words		*				*							*
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22. It's a Plot!		**		*							**		
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P/13. Multiple Turtles without Sprites		**	*	*	*	*	*						
LT/1. A Parent Looks at Logo								**	**				

## Integration Grid (continued)

	<i>File management</i>	<i>Turtle commands</i>	<i>Modular programming</i>	<i>Variables</i>	<i>Recursion</i>	<i>List processing</i>	<i>Logo utilities</i>	<i>Problem solving</i>	<i>Logo environments</i>	<i>Research</i>	<i>Mathematics</i>	<i>Science</i>	<i>Humanities</i>
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