

HOWARD T. FISHER

MAPPING INFORMATION

The Graphic Display
of Quantitative
Information

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MAPPING INFORMATION

The Graphic Display of
Quantitative Information

Foreword

When Howard Fisher suddenly passed away in 1979, he was in the process of writing a major work on thematic map design. He had planned to circulate some ten analytic papers, followed by a dozen demonstration sets that applied a wide variety of design techniques to sample areas, both real and imaginary. He intended to get comments and criticisms on the papers in their preliminary form and then use the revised versions as raw material in the drafting of his book. The first three papers had been issued before his death; the rest were in various stages of completion, as were the demonstration materials.

Howard's family and friends realized that the book he had intended to be the culmination of his career should be made available to others. His work on the organization and graphic representation of knowledge for which geographical location and spatial variation are relevant had already been recognized as original, creative, important—and frequently controversial—but few realized the full sweep of his ideas. He was not shy about challenging the sacred cows of traditional cartography, much to the discomfort of many who preferred tribal incantations to the systematic principles of map symbolism that Howard felt to be essential. As the creator of SYMAP—the first and still most widely used computer mapping program—he sought ways to forestall abuses of thematic cartography which the use of computers seemed likely to encourage.

With perhaps 75 percent of the intellectual effort for Howard Fisher's book completed at the time of his death, the services of Jacqueline Cohen, a technical editor, were enlisted to prepare his work for publication. Her skills were supplemented by those of several of Howard's former associates, principally Eliza McClennen. Their task was not to complete Howard's writings as he might have, but to accept Howard's general structure, as well as what he had written, and to select, reduce, and generally organize the voluminous materials left by Howard into the book that he had been developing. *Mapping Information* is the result.

The work is organized as a logical progression, from the most basic to the complex, to help the cartographically inexperienced reader learn. Byways are explored to help the reader think more clearly about graphically effective map design. The chaotic nature of classical thematic cartography is discussed, and fundamental principles are proposed. There is an attempt throughout to reveal how little is known, as well as to suggest guidelines for current practice. Those of us who worked with Howard recognize that each of these features reflects an element of his personality: a warm and supportive teacher; a sensitive and creative designer; a vigorous and demanding professional; and an inquiring researcher probing the unknown. We are richer for having known him. To his qualities this book bears witness.

Brian J. L. Berry
School of Urban and Public Affairs, Carnegie-Mellon University
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Preface

This book is an attempt to deal with the issues involved in thematic cartography through a logical progression gradually increasing in complexity. It necessarily reflects my personal opinions, though I have tried to include those of others as well. The material has been arranged and the text composed primarily for the cartographically inexperienced reader. A serious effort has been made, however, to achieve both completeness and accuracy.

A second goal was to explore those bypaths that contribute to achieving the most graphically effective results. But each bypath led to others no less interesting. I determined to follow these paths individually, even when they merged with others for stretches that inevitably led to repetition. Such repetition appeared to offer important advantages. By probing and traversing the terrain from many angles and along many routes, a better understanding seemed possible. Given this approach, it should not be surprising if the book has turned into a hybrid, comprising elements of a textbook, a manual, and an encyclopedia.

Those unfamiliar with the mapping process might imagine that the spatial and quantitative facts are always given in final form, and the problem is merely to select suitable symbolism and execute the map accordingly. This is a great oversimplification, however, since these facts may be better represented after being manipulated in any of several ways. Spatial information may be modified through aggregation or interpolation, for example. Quantitative information may likewise be modified through aggregation into classes of equal or unequal size.

The basic premises expounded in this text apply to most thematic mapping problems and should serve as a solid foundation on which to build in more complex situations. Map design is illustrated by applying various procedures to a limited number of problems, producing alternative solutions. The virtues and limitations of different procedures can thus be meaningfully compared. Issues evoked by these mapping problems are discussed as encountered, even when they lead to consideration of more advanced concepts.

In recent years, much cartographic research has tended, not surprisingly, to deal with fragments of the total process. Yet, without an adequate intellectual framework, continuing progress in basic theory may be seriously handicapped. In view of the rapid acceleration of research and applications, significant amplification of the ideas in this book is expected. It is hoped that exceptions, however, will be rare.

The importance of employing basic terminology clearly and differentiating consistently can hardly be overemphasized. Many difficulties that continue to plague practical and theoretical work undoubtedly stem from semantic confusion. Similarly, certain traditional definitions have doubtful validity and should be avoided. New terminology has been employed here with care, however, and only when the change seemed vital to clarify thought.

As is well recognized, the issues involved in thematic cartography can be exceedingly complex, particularly because of the myriad possible relationships among situations, procedures, and symbolisms. It is hoped that this book may assist in sorting out those relationships, not only for difficult assignments but for more typical problems as well. Perhaps the chaotic terrain of thematic mapping will turn out to be an integrated and fascinating unity of diverse elements—all rational, interrelated, and mutually supporting.

Howard T. Fisher
Cambridge, Massachusetts

Biographical Notes

Howard Fisher was a designer by profession, and his concern in this book is the design aspect of thematic cartography. As his earlier professional work included neither geography nor cartography, readers may be interested in a brief resume of his background.

Born in Chicago in 1903, Fisher studied art history and architecture at Harvard, receiving a B.S. degree *magna cum laude* in 1926. Incidental to a distinguished career in architecture, which included extensive research and developmental work (in recognition of which he was made a Fellow of the American Institute of Architects in 1974), he became increasingly involved in city planning activities—and thus in the extensive use of maps.

As an outgrowth of education work undertaken for the United Nations, in 1957 he was invited to join the faculty of Northwestern University's Technological Institute. There he taught, among other subjects, the terminal design problem in civil engineering and a course in creative problem solving as a general process. It was while at Northwestern that he developed, in 1963, the SYMAP computer mapping system, originally conceived as an aid to consulting work being carried out for the City of Chicago's Planning Department. During the following year and a half his efforts were devoted primarily to effecting improvements in that program, to teaching its use, and to exploratory work with interested geographers, cartographers, and planners.

In February 1965 Fisher joined the faculty of the Department of City and Regional Planning in the Graduate School of Design at Harvard University. Shortly thereafter he founded the Laboratory for Computer Graphics, for which he received a grant of some \$308,000 from the Ford Foundation the following autumn. Over the ensuing three years his efforts were devoted primarily to administrative duties, to launching the work of the Laboratory generally, and to assembling its staff of geographers, cartographers, and computer specialists. During this period, however, Fisher also worked on

the refinement of programs, taught courses in Harvard's Faculty of Arts and Sciences as well as in the Graduate School of Design, and organized a number of national conferences.

Retiring from active administrative duties in 1968, Fisher was appointed Associate Director of the Laboratory and later Research Professor of Cartography. From that time forward, he worked exclusively on theoretical studies in relation to thematic cartography, both produced by hand and by computer.

During the summer of 1969, following a series of lectures given in Spain for the U.S. Department of State, Fisher devoted himself to research in the Map Room of the British Museum, to the organization of a major conference on computer mapping for the British government, and to visits with members of the geography or cartography departments of several British universities.

With further financial aid from the Ford Foundation and others, and with the assistance of a small technical staff operating within the Laboratory, he then began the research and writings that engaged him until his death in 1979, and of which work this book is the result.

Throughout his professional career, Fisher most enjoyed the challenges of design work and research activity directed toward design improvement. During the period of his initial cartographic work at Northwestern University, however, and later while serving as the Director of the Laboratory, he found but limited opportunity for library research of a theoretical nature. In fact, in contrast to the urgent need for problem solving at the level of practical accomplishment, theory as such probably seldom entered his mind—except in connection with the difficult issue of interpolation. Later, when he had the opportunity for more leisurely library research, he encountered difficulties in attempting to apply what he found in books and journal articles to the problems that he had under study. There appeared to be basic differences between traditional assumptions and what he found necessary for progress. The discussions in this book are in large part the result of his efforts to reconcile those differences, and to establish a sound theoretical foundation upon which future work might be based.

Allan H. Schmidt
Executive Director, Laboratory for Computer Graphics
and Spatial Analysis

Acknowledgments

During the years devoted to his research in cartography, Howard T. Fisher sought stimulation and criticism from many people who shared his interest in mapping. He was always free in crediting the contributions of others to his work. In assembling the names that follow, the editors have tried to adhere to his example, and they extend their apologies to those whose names are inadvertently not recorded here.

Much of the form of this book is owed to the expertise of editor Jacqueline Cohen who, ironically, never had the opportunity to work with Howard Fisher. She undertook the enormous task of cataloguing and organizing ten years' worth of papers that ranged from published monographs to scant notes. Gaps in the material prevented her from following precisely the outline for the book that Fisher had projected. She did, however, use the maximum amount of available text and illustrative materials consistent with a reasonable degree of completeness to express Fisher's ideas in his own words.

In this task she was assisted by cartographer Eliza McClennen. Having prepared much of the artwork that appears in this book, she was able to coordinate the figures with the text and assist Cohen in understanding Fisher's methods and objectives. With cartographer Herb Heidt, McClennen worked full time with Fisher for four years, starting in 1970. Their continued close involvement with the project has been of great assistance in preparing the manuscript for publication and seeing the book through to publication.

At varying times, their fellow staff members were Jonathan Corson-Rikert, Alan H. Fisher, Ronald Gore, Elizabeth Durfee Hengen, Sis Hight, Ann Molineux, Mary Raymer, and Carolyn Weiss. Along with the numerous staff and participants in Fisher's 1970 Special Program in Thematic Mapping, they were all involved in the research and cartographic work included in this publication. The typing of manuscripts was carried out by a staff that included Betty Barnes, Nan Dealy, Julianne De Vere, and Lucy Richardson.

While pursuing his research, Fisher kept abreast of developments in the

rapidly evolving fields of computer graphics and automated cartography through his continued close association with the Harvard Laboratory for Computer Graphics and Spatial Analysis, of which he was the founder and first director. Allan H. Schmidt, Executive Director, and former Director Brian J. L. Berry provided much support. Staff members, past and present, including Nicholas Chrisman, Geoffrey Dutton, James Dougenik, William Nissen, David Sheehan, and Donald Shepard, all provided invaluable aid.

Local assistance also came from the staff of the Harvard Map Library and curator Dr. Frank E. Trout. Other helpful members of the Harvard community were Roger Fisher, Richard Land, William Mercer, Frederick Mosteller, and former Dean of the Graduate School of Design, Maurice D. Kilbridge.

Fisher enjoyed lengthy correspondence and discussions with many academics in the field of cartography. Among these were Dr. Kang-tsung Chang of the University of North Dakota, Dr. David Cuff of Temple University, Dr. George McCleary, Jr., of the University of Kansas, and J. T. Coppock and D. R. Macgregor of the University of Edinburgh. Their interest was always greatly appreciated, as was that of Walter D. Fisher of Northwestern University.

Howard Fisher's research was supported by grants from the Ford Foundation and by anonymous donation. This help was most gratefully accepted and used.

The papers as Howard Fisher left them at his death faced an uncertain future. Much of this uncertainty was resolved by the vigorous initiative of his sister, Margaret Fisher. Her generosity supported the organizing and editing of the papers into a form capable of being considered for publication. That this book has now appeared is due in the greatest degree to her kind and timely act.

Contents

Tables	ix
Figures	ix
Foreword	xix
Preface	xxi
Biographical Notes	xxiii
Acknowledgments	xxv
PART I: INTRODUCTION	1
Chapter 1: Beginning Spatial Analysis	3
What is a Map?	3
What is Thematic Cartography?	6
Function and Form in Map Design	6
The Sponsor's Role	10
Chapter 2: A Dialogue Between a Sponsor and a Designer	12
PART II: THE GIVEN INFORMATION	15
Chapter 3: Introduction to Cartographic Language	17
Chapter 4: Base Maps	20
Chapter 5: "A Dialogue" Revisited: Subjects and Titling	22
Differentiating Single- and Multi-Subject Maps	22
Creating Effective Titles	23
Chapter 6: The Study Space and Locations	26
Describing the Study Space	26
Assignment to Locations	27

Chapter 7: Values	32
Addable and Nonaddable Values	33
Nominal and Ordinal Values	36
Intralocational Variability	40
Interpolation	41
 PART III: CREATING THE DISPLAY	 47
Chapter 8: Steps in the Design Process	49
Step 1: Symbolism	49
Step 2: Study Space Assignment	52
Step 3: Location Assignment	52
Step 4: Value Classing	53
Other Considerations	56
Figure and Ground	57
 Chapter 9: Varieties of Symbolism: The Foursquare Study	 60
The Study Space: Locations and Values	60
Introduction to Graphic Symbolisms	61
Seven Basic Symbolisms	64
Spot-Extent: Circles (1-SE3, Given Values, Unclassed) ...	64
Spot-Extent: Bars (1-SE1a, Given Values, Unclassed)	68
Field-Darkness: Plane Conformant (8-FD4, Given Values, Classified)	70
Field-Extent: Raised Conformant (7-FE4, Given Values, Unclassed)	72
Spot-Count: Count (3-SC3, Given Values, Classified)	73
Field-Darkness: Dots (8-FD5, Given Values, Classified) ...	77
Spot-Extent: Sectors (1-SE4b, Given Values, Unclassed)	80
Interpolated Symbolisms	80
Band-Extent: Fins (4-BE12, Given and Interpolated Values, Unclassed)	81
Band-Extent: Ribbons (4-BE10, Interpolated Values, Unclassed)	83
Field-Darkness: Plane Interpolated (8-FD7, Given and Interpolated Values, Unclassed in Part and Classified by Darkness)	84
Field-Extent: Raised Interpolated (7-FE6, Given and Interpolated Values, Unclassed)	85
Contouring	89
Field-Extent: Raised Interpolated, Contoured (7-FE6, Given and Interpolated Values, Unclassed and Classified by Contours)	98
Field-Extent: Raised Interpolated, Contoured (7-FE7, Given and Interpolated Values, Unclassed in Part and Classified by Steps)	99

The Validity of Interpolation	99
Collaborative Symbolisms	104
Choosing the Best Symbolism	112
Value Keys	112
Chapter 10: Value Classing	116
Introduction to Classing	116
Why Class?	117
How Many Classes?	119
Value Positions and Value Curves	123
Equal Classing and Subclassing	147
Rounding	148
Unequal Classing	151
Chapter 11: Single-Subject Mapping	171
Procedure	171
Sparse France: A Problem with Alternative Solutions	174
Dense France	231
All France	234
Chapter 12: Multi-Subject Mapping	267
A Note on Procedure	267
Appropriateness and Limitations	267
Symbolisms	273
PART IV: PRACTICAL AESTHETICS	279
Chapter 13: Designing in Black-and-White	281
Gray Scales and Dot Screens	281
Elements of Effective Symbolism	284
Chapter 14: Color for Quantitative Differentiation	291
Introduction to Color	291
Dominance	292
Hue	293
Darkness	295
Intensity	298
Selecting Quantitative Color Schemes	301
APPENDICES	307
Appendix 1: Using Reciprocal Curve Classing	309
Appendix 2: Classing by Specific Mathematical Curves	329
Appendix 3: Classing for Value Curves with Major Reversal	331

Appendix 4: Classing Charts.....	350
Appendix 5: Hand Contouring by Linear Interpolation.....	358
Appendix 6: Hand Contouring Form.....	365
Appendix 7: Constructing Proximal Maps.....	367
Appendix 8: Traditional Dot Mapping by Hand	372
 Bibliography.....	 374
Index	378

Tables

9-1	The Foursquare Values	62
10-1	Foursquare Values—Alternative 1A	125
11-1	Sparse France: Registered Voters, by Departments	178
11-2	Quantile Classing for Sparse France.....	195
11-3	Dense France: Registered Voters, by Departments.....	234
11-4	The All France I Value Set, with Breakpoints for Quantile Classing	242
A1-1	Reciprocal Curves—Lower Limits of Classes	312

Figures

1-1	U.S. Army Shirt Sizes	4
1-2	Average Twenty-four-Hour Weekday Traffic Volumes, in a section of Washington, D.C.	7
1-3	Section of Washington, D.C.	8
6-1	Locations from Figure 1-3 Assigned to Base Centerline	29
7-1	U.S. Birth Rates, Derived Values	34
7-2A	Experimental Farm: Presence of Corn.....	39
7-2B	Experimental Farm: Presence of Five Crops.....	39
7-3	Contour Lines with Addable Values, Base Centers Shown	42
8-1	Spot Symbolism	50
8-2	Band Symbolism.....	51