COMPUTER GRAPHICS AND REPORTING FINANCIAL DATA

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PREFACE

This book was written to be a handbook, a continuing source of ideas for the design of a Graphic Management Information System (GMIS). To that end there are a lot of samples and examples to help you use the concepts described in the book. It is not a book about the technology of computer-generated graphics; it is a book about how to apply that technology to improve the productive use of information by all levels of management as they make critical operating and strategic decisions.

Chapters 1 through 4 are structured to lead you from the definition of a Graphic Management Information System (GMIS) to "how to design one."

Chapter 1 defines business graphics and describes how they are now being used in business and can be used in the future. The perspective in this chapter should provide a working view of the tremendous potential promised by this new computer graphic information transfer tool.

Chapter 2 sets the GMIS within the context of the management functions. Key factors and key indicators are described as they assist in the management decision making process. The three key differences between a Management Information System (MIS) and a GMIS are established. For those of you who are familiar with management theory, this chapter is worth reviewing because of the thrust toward "graphic decision making."

Chapter 3 describes the basic graphic symbols used to communicate business data. The symbols are used to build the foundation for a graphic language that will communicate data through imagery as simply, correctly, and quickly as we learn to distinguish among the shapes of trees, people, and letters in the alphabet. The chapter concludes with a graphic description of the financial statements required by the American Institute of Certified Public Accountants (AICPA) to report the results and status of a business. Table 3.1 is worth copying as a working tool during the design and installation of a GMIS.

Chapter 4 describes how to use the graphic language to describe any database. The concept of data disaggregation is used to show how a review of key graphic indicators can lead quickly to a description of business problems and opportunities. A GMIS design sheet is presented and examples of how to use it are given.

I highly recommend that the first four chapters be read before you attempt to use the rest of the book. You must have a clear idea of what the graphic symbols show and how they are combined to describe data before the rest of the chapters will be fully useful. Chapters 3 and 4 are absolutely essential to understanding this book.

Finally, Chapters 5 through 15 describe the foundation for a complete GMIS based on the financial and operating data normally used in business. Each chapter describes a complete subsystem that links together through the key indicators shown in Chapter 16. The specific chapters should be reviewed depending on the system you are considering. For example, if you are considering a top level financial graphic system, see Chapter 5; if you want to design a graphic inventory control system, see Chapter 8, and so on. Each of the systems chapters (5 through 15) presents a complete graphic description of that subsystem. The linkage to other systems is described if you wish to pursue it.

Chapter 16 is the key indicator/key ratio chapter that ties all of the more commonly used critical business ratios to the GMIS described in the systems chapters (Chapters 5 through 15). Chapter 16 contains an index to the key indicators, a description of a management instrument panel, and a visual summary of the power of graphic communication. This chapter could be briefly reviewed to see the basic structure of the key indicators described throughout the book, and then referred to as you study any of the systems chapters.

Chapter 17 shows the five critical concerns for media presentation of information. Examples are provided showing the effect on the transfer of information of size, quality of reproduction, type font, sequence, the use of color, and other media. Chapter 17 could be reviewed by itself except that the change in information transfer will not be apparent unless you are familiar with the ratio chart formats. The ratio chart is the only format used to describe the effect of the appropriate use of media. Chapter 17 deals only with basic media concerns. This chapter is the cornerstone for output media design. As noted in Chapter 2, the proper use of media offers, perhaps, the single most important benefit of a GMIS, a benefit worth taking the time to understand. (A book should be published showing the full potential of information transfer using media.)

HOW TO USE THIS BOOK

This book should be of immense value for anyone involved in *Graphic Management Information Systems.* The professional accountant, the CEO, the line manager, the MIS or DP director, and the college faculty member will all benefit. The book provides a comprehensive introduction in Chapters 1 to 4. Chapters 5 through 15 provide details about the structure of disaggregation as well as specific functional information. Note that the shaded areas of the design sheets indicate those charts that are used as examples for each chapter. Chapters 16 and 17 summarize by providing a basic foundation for using and presenting the information. There are numerous ways to use Chapters 5 through 15. However, they should always be closely tied to the first four and the last two chapters.

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I.M.J.

CONTENTS

CHAPTER 1

BUSINESS COMPUTER GRAPHICS

The purpose of this chapter is to describe a basic problem in the use of information for making business decisions as currently supplied by Management Information Systems (MIS) and to describe a potential solution to the information problem. This book shows how to design and install a Graphic Management Information System (GMIS) concentrating on the financial planning and control aspects of the business. These same graphic design concepts can be transferred to any organized database.

There is a growing problem in the design, installation, and management of large management information systems. The principal problem in data management is the sheer volume of internally generated data presented to management in traditional tabular form. The average manager is not physically capable of reading (now considered a left brain function) all of the data printed by even the slowest computer printer. As a result it is not possible for the valuable information in the printouts to be transferred into the manager's brain where it can be merged with other information, interpreted, analyzed, and finally acted on based on the cumulative experience of the manager. The frustration of having so much information presented to busy managers has resulted in certain fundamental attitudes about data presentation that need to be re-examined in light of the new technology discussed in this book. The attitudes are: (1) tabular reports are poorly designed and contain information that is not required to operate efficiently and effectively, and (2) all of the relevant information required to evaluate organizational performance can and should be condensed onto one (or very few) page(s).

Attitude 1. Tabular reports are poorly designed and contain information that is not required to operate effectively.

Although it is probably correct that some of the information in those stacks of tabular reports is redundant, it is a crucial error to conclude that the information is not useful or necessary. In most instances those reports were designed by competent financial, operations, and systems people with the full support of management. I would propose a counterproposition that the information presented in those mounds of tabular reports is the minimum

amount required to fully understand all of the organizational interrelationships. As noted earlier, the manager is physically unable to read and absorb all of the information. Thus it can be stated that the problem is not that the information contained in the tabular reports is inappropriate or that the reports themselves are poorly designed; more likely the problem is the physical inability of the manager to read the reports. Displaying the same information in the same formats on CRTs has certainly not resolved the problem. In some cases it has actually made the information less mobile. The human visual system simply cannot *read* fast enough. Thus the negative attitude about the current information system is based on the human inability to input the current presentation formats into our brains using the current reading skills.

Attitude 2. All of the relevant information required to evaluate organizational performance should be condensed onto one page.

This "one-page" attitude is the direct result of Attitude 1; if the information is no good, just condense it onto one page. (One page may be two or three pages but certainly few.) In many cases this attitude has resulted in a one-page report so crammed with numbers in rows and columns that the information is indecipherable. In other instances there is so little information that the report is useless.

The one-page attitude also results from the ever increasing time crunch of most managers. They certainly do not have the time to read all of the available tabular reports but they still have a basic intellectual need for information so they are seduced into reading only a few pages to save time. The attitude is understandable but again it is based on the physical handicap of our current reading skills that limits the amount of information that can be input to our brains by "reading" tabular reports.

1. A POTENTIAL SOLUTION

A potential solution to the problem described above is a financial graphic language that utilizes the full pattern recognition ability of the human system, such ability generally described as a function of the right brain. The human system has an enormous and so far untapped ability to input large amounts of information rapidly and accurately based on our ability to recognize patterns. The more highly trained systems will instinctively take action based on either the recognition of a certain pattern or a change in a pattern. For example, airline pilots are trained to "see" the instrument panel. The only time the pilots "read" an instrument (a left brain function) is when the pattern changes—and a problem has been noticed. The human system helps us drive a car and it puts our feet on the brakes when a child runs in front of the car—an abnormal pattern. There is a constant interaction required between the right brain and the left brain functions to create the human system. A proper combination of the right and left brain functions are necessary for flying and driving, and humans can be trained to achieve that balance.

This same pattern recognition ability can be utilized to permit a considerable amount of information to be input into the brain by "seeing" the expected graphic patterns that describe the performance of the business—a graphic management instrument panel. A standardized financial graphic language

will permit the human system to input a considerable amount of data as rapidly as the chart or graph can be seen, a rate of input so fast and accurate that it is hard to imagine. Appropriately designed patterns will also input the relative size and importance of activities, and unusual relationships or patterns will be recognized and matched to experience. Action (decisions) will be based on a more informed basis and a more balanced functioning of the left and right side of the brain.

Because of the new computer technology, it is now technologically and economically feasible to create and use a financial graphic language and to present business information graphically in a fair and consistent way. This new opportunity is found within the confines of what is now called *computer business graphics.*

2. DEFINITIONS OF COMPUTER BUSINESS GRAPHICS

Computer business graphics is *the science and art of transferring information through the sense of sight.* The approach of defining a field or profession as the combination of art and science has been used over and over again but continues to be a useful device for highlighting specific points around which a debate may flow. The same definition could have been used for the word graphics or the phrase business graphics. Thus each word and phrase must be examined to see how the meaning of the definition changes, if at all, by combining the three words—Computer Business Graphics.

3. A SCIENCE

The concept of graphics as a science comes from the fact that the components of good graphics are based on a number of the hard and social sciences. The hard science includes most prominently the sciences of color, mathematics, sight, neurology (i.e., right brain/left brain functions), statistics, physics, and cartography. The social science includes psychology, sociology, education, and a number of business disciplines. The contributions each of the sciences makes to quality graphics is the subject of a number of books and research papers. Though a broad range of science need be considered, they are all used to understand how information is consistently transferred from a graphic representation into the human brain and how the brain receives the input, organizes it, and uses it in performing specific tasks.

4. AN ART

As complicated as the supporting sciences might be, the art of graphics is even more complex. The artist must blend a knowledge of the related science with a specific knowledge of the information source, how useful that information is to the performance of the specific task, how the human brain can best receive the information to perform the task, and the graphic format(s) that best meet those requirements. The search for quality in graphics is one that pays high dividends because the human seeing the graphics can receive the message and quickly put it to proper use. Translated into business words, quality graphics is a most efficient way to increase the productivity of humans through the consistent and dependable transfer of information.

As with all art forms, one person's art is another person's wasteland, and so it is today with computer business graphics:

Except for one not so small difference —the message to be transferred by computer business graphics is purposeful and measurable and the use of the message is predictable.

Thus there can be no compromise in quality, for the result of poor quality graphics is predictable—no message is transferred—or even worse, the wrong message is transferred.

5. GRAPHICS

But what is graphics? Do business graphics differ? And what dimension does computer business graphics add? The results of a small unscientific survey I took during a number of my recent Executive Briefing seminars indicate that of those who attended and responded, over 90 percent considered graphic arts to be concerned with the presentation of data in a chart or graph format, a most narrow view. The graphic arts, in fact, include the entire range of data presentation and publication, including the written word, chart, graphs, drawings and paintings, photography, and films, plus the complete range of crafts including pottery, weaving, woodworking, and so on. Such a wide view of graphics is obviously different than the narrow views brought to the Briefings, and, perhaps, about as useful. All of the graphic arts are not practically useful for the consistent and dependable transfer of business information in our modern society. However, during the Dark Ages when the printed word was, for all intents, banned, the Sufis found the arts and crafts an effective way to record the history of the time and to display their consistent layers of meaning.

The concept of graphics used in this book includes the wide range of data presentation and publication available in the ever-changing business world. Such a view of graphics permits us to examine the potential use of quality graphics at every information transfer point in the organization. Such a broad view obviously permits a wide latitude in using graphics in business and also carries with it the responsibility to fairly present alternative solutions to an information transfer problem and to critically examine the effects of proposed graphics solutions.

6. BUSINESS GRAPHICS

But this book is concerned with business graphics (and, mostly, the financial control graphics associated with a GMIS) rather than generalized graphics and, as such, one could justify the concept that the broad potential range of graphics must thus be narrowed. No so—if anything, the addition of the adjective *business* to the noun *graphics* expands the view of graphics, for business, in its broadest sense, encompasses our entire economic system, a system of such magnitude that we would surely not find any severe limitations in where to look for business graphic applications. As small to international-

sized businesses become more complex and the time to receive information and make decisions becomes more compressed, the need for appropriate business graphic communication will expand experientially. Thus the limitations of the scope of this book are due to time, space, and understanding, not definition.

7. COMPUTER BUSINESS GRAPHICS

Finally, the word *computer* is attached to the phrase *business graphics.* It was not uncommon during the early days of computers in business, when older models were being replaced at an ever-accelerating speed, to find an installation where the latest system was an emulation of an earlier computer, that was in itself a simulation of an even earlier computer, that was an exact copy of a punched card system, that was an exact replica of a bookkeeping machine system, that was an automation of a hand-operated bookkeeping system designed in the late 1800s. The criticism of those systems was that such an approach did not make full use of the powers of the computer; it only made the old out-of-date system run faster. Since the 1870 census, the truly new chart and graphic formats designed to present data to the public can be counted on one finger of one hand. But now we can do them all on a computer, and faster. Somehow the story sounds familiar.

When computers were first introduced, one of the great hopes was to use them to produce quality charts and graphs. The available equipment was simply not sufficient. Finally, the equipment became sufficient and we experienced another rise in expectations. This time the software was not available. Now the technology and the software have merged together with microtechnology to put computer graphics in even the smallest computers; ironically, having both equipment and software so widely available at so affordable prices may cause computer business graphics to fail for the third time. Until now there has been no definition of quality computer business graphics and we are repeating (faster) the graphic errors of the 1870s.

But what potential does the addition of computers offer to business graphics? First, the computer offers the same potential benefits (and problems) for business graphics that it does for MIS—for they are the same system. Business graphics cannot present data points if they are not collected and organized by the MIS.

Second, and equally important, is the media potential. A properly designed GMIS includes a full range of media presentations from which an information appropriate selection of media can be made. For example, daily "flash" reports and key graphic indicators might be presented to operating management on a color graphic CRT as a management instrument panel. Weekly senior staff meetings might be suported by the instrument panel and a set of predefined visuals (slides, overheads) and an interactive "what if" session with the system. A monthly or quarterly board meeting could be supported with large updated wall hangings, a fully automated slide show controlled by the computer on a large screen, a four-color book quality printed take-along report, an interactive "what if" session, and a take-along videodisc for home viewing, all prepared automatically each month by the predefined GMIS. Animation is also possible if the imagination and budget are in harmony. The power of the computer has opened the entire range of the graphic art and presentation media to the business community. Thus the addition of the

computer to business graphics enlarges even more the range and complexity of the art.

In the three meeting examples given above, it is assumed that data will be presented, analyzed, and interpreted using charts, graphs, pictures, words, and tabular presentations of numbers. The graphic art skill will be used to assure that the information so presented is easily assimilated by the viewer and that the message is correctly received. Type fonts, page design, graphic formats, shadings, sentence and word spacing, underlines, headings, color, all must be blended to achieve the optimum information transfer, and once the appropriate presentation is established, it will be repeated consistently by the GMIS. As Marshall McLuhan* said, "The medium is the message." The concept of media is explored in Chapter 17.

8. A BIGGER FIELD

Until now, the case of computers for Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM) were not considered specifically to be part of business computer graphics. How interesting since business is where CAD/CAM is useful. With only a little extra effort CAD/CAM can be tied directly to the financial reporting system through the GMIS. The use of mapping techniques in marketing have not been closely tied to the MIS, rather they have been designed as a freestanding system independent of the business system. How interesting since marketing is integral to business and the product pricing, motivation, and costing strategies must be fully integrated to affect market share. The analysis of sales mix variance shown in the sales system, Chapter 13 would be useful to any sales manager. Once again a GMIS application.

By now it should be apparent that business computer graphics is a vast field encompassing the full range of information transfer required to run a complex business organization. Artificial boundaries will not hold up under even cursory examination. The skills necessary to design and manage such a vast enterprise are, at this point in time, sorely lacking. Few if any have had the opportunity to design and install a complete graphic management system using the full potential of the computer graphic medium, observe it in use over time, correct deficiencies, and test the results. Some of us are working on it. But the systems are complex. It takes a long time to design and install them, even longer to see how they work, and most important, to discover how well management can use them.

*Marshal McLuhan, *The Medium Is the Message*, Random House, New York, 1967.

CHAPTER 2

MIS VS. GMIS

The primary role of the Chief Financial Officer (CFO) is to assist the Board of Directors and the corporate management in optimizing the return on the invested capital of the owners, the shareholders. This responsibility includes, among others, the duties of protecting the assets, and recording and reporting the performance of all of the corporate activities. The CFO is also held accountable for preparing and communicating the budget, and in most instances is required to summarize and communicate the long range plan. The reporting and communication function depends most heavily on the formality of the accounting system and the data accumulated through the normal activities of the firm. In the past decade the CFO has become a critical member of the management team charged with the design and installation of the management information system.

This book concentrates on the communication aspect of the CFO. The introduction of a computer-generated graphic management system changes all of the communication ground rules.

1. THE LANGUAGE OF BUSINESS

Accounting is sometimes referred to in an almost offhanded manner as the language of business. However, the reference deserves serious attention and can shed considerable light on the motivations for using computer graphics in financial reporting. Improperly used, computer graphics can distort the picture of performance by presenting a language that business people simply do not understand. Linguistics, the systematic study of language, offers a useful insight into the appropriate way to use the power of computer graphics to enhance, rather than damage, the information conveyed in accounting reports. Accounting has as its primary purpose the systematic collection and communication of information of a specific type to be used for analysis and decision making. It is the communications aspect of accounting that poses some of the most critical problems and important opportunities in the current business environment.

Spoken language comprises a universal and primary human behavior that is both complex and sophisticated. The study of spoken language reveals system and structure at levels so deep that we are unable to explain the

underlying mechanisms. The purpose of language is to achieve language efficiency while communicating across a large group of people in diverse situations. Such efficiency is achieved by using consistent speech patterns. The human brain demonstrates an incredible facility for pattern recognition across all the senses, to the degree that the facility is used at an unconscious level much of the time. Dr. R.W. Sperry recently received the Nobel Prize for his pioneering work in establishing the roles of the right and left brain in human communication. In spoken language, a relatively small number of sound elements are used from among those humans are capable of producing. To be understood, the sounds must form a discernible pattern or there is no language. Once established, the standard patterns are hardly noticed (except when an unfamiliar accent is heard) and they serve as a more or less transparent vehicle for content. However, the slightest change in the expected pattern can convey a message different from the actual words spoken (i.e., when someone is angry, it is usually easy to tell by the change in inflection). The written language depends exclusively on a set of graphic symbols defined by humans to represent the spoken language. The Compact Edition of the Oxford English Dictionary (Oxford University Press, 1971, p. xii) makes the following observations:

> The pronunciation is the actual living form or forms of a word, that is, the word itself, of which the current spelling is only a symbolization—generally, indeed, only the traditionally preserved symbolization of an earlier form, sometimes imperfect to begin with, still oftener corrupted in its passage to our time...But the living word is sound cognizable by the ear, and must therefore be itself symbolized in order to reach the understanding through the eye.

The full range of graphic symbols are called the *alphabet* and consist of vowels and consonants. A highly structured set of rules, most often strictly adhered to but sometimes broken, determine the usage and sequence of the alphabet to create a useful living symbol of the word. Additional rules, called grammar, are used to link the words into a defineable and understandable pattern representing language.

Accounting, in its theory and practice, gives a clear reflection of the purpose and structure of a language. Anthony (in *Financial Accounting*) explicitly identifies accounting as a communication process, a "language [that] encompasses precisely written phrases and symbols used to convey information about the resource flows measured for specific organizations." Accounting as a profession recognizes unique responsibilities well beyond those of other professions (including the legal questions of a public license) to provide to users adequate, understandable and dependable financial information. This uniqueness has the following major implications for the use of computer graphics. First, to the extent that the use of computer-generated graphics can make a substantial contribution to the more effective and understandable communication of accounting information, it must considered by the profession. Computers were originally used by accountants because they offered a solution to the problems of collecting, processing, storing, and reporting the ever-growing volume of accounting data. Today, however,the solution has become part of the problem. The computer churns out more and more tabular reports that do not communicate because they cannot be read. A properly structured financial graphic language offers the potential of communicating the financial information hidden in the rows and columns of the tabular reports.

Then if the technology is to be applied to the presentation of financial information, the second major implication is the absolute need for standards, for structure and system in the use of computer graphics. Expressed in linguistic terms, attention must be given to the alphabet—the graphic symbols of numbers, grammar—the elements of expression and the rules for their combination, and semantics—the actual meanings conveyed. Computer graphics offer almost limitless possibilities in terms of the shapes, colors, and other attributes that can be employed to portray data. Language, as noted above, implies the use of a limited set of elements selected from the total available, and their use in systematic and structured ways to produce discernible patterns. Decisions about the new graphic language must be made on the basis of adequate knowledge of accounting and graphic presentation requirements. The degree to which the proper, intended meaning is accurately conveyed by the entire financial graphic system cannot be left to chance. This book is designed to show how graphic symbols are used to represent living "symbols" of "data", to give a set of grammatical rules that express the data and combine it into meaningful information, and to demonstrate an approach to the semantics of graphic symbols to enhance the meaning of the information.

The next section of this chapter presents a brief discussion of management, managers, and management information systems. The final section presents the critical distinctions between an MIS and a GMIS.

2. MANAGEMENT, MANAGERS, AND MANAGEMENT INFORMATION SYSTEMS

The following discussion about management and managers is used to set a context for the building of a GMIS.

Management is the art of planning, organizing, staffing, directing, and controlling an organization to best meet its stated purpose and goals. The management functions include the following activities:

PLANNING. The art of recording vision and foresight in a systematic way, or deciding in advance as a basis for doing. (Vision is defined as what should be; foresight as what will most likely be. A good manager blends the two and creates reality.)

ORGANIZING. The configuring of available resources in anticipation of action.

STAFFING. Placing people in the best possible position to facilitate carrying out the organization's plan.

DIRECTING. The action part of management; seeing that people use the resources to meet the plan.

CONTROLLING. The appropriate use of information about the results of using the firm's resources (money, material, and people) to alter the operation of the organization so as to better achieve its purpose, goals, and objectives.

The chief executive of an organization can share (delegate) the authority and responsibility to plan, organize, staff, direct, and control, but the final accountability cannot be delegated. Therefore, the MIS must be designed to clearly communicate how managers have performed their assigned roles.

Supervision and management are, in reality, synonymous terms. By convention, the term supervision is used to describe the process of exercising