Bringing Business Graphics to the Masses

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Introduction

What comes to mind when one hears the expression "computer graphics"? Today, many people feel that computer graphics falls into one of several groups:

1) Simulation Graphics
2) Scientific/Engineering Graphics
3) Analytical Graphics
4) Computer Aided Design/Computer Aided Manufacturing
5) Command and Control Graphics
6) Business Graphics

All of these different forms of graphics have as their main goal the need to quickly transfer information to the user or reader of the graphics. The first five groups have one major difference with business graphics. The readers of these five groups are specialists, meaning that in a sense they are trained to read the graphic images presented to them. This however, is not true of business graphics. Each graph, picture, or chart in business graphics must be totally self descriptive. The engineer's blueprint is the antithesis of business graphics.

The principle use of business graphics is to transfer information. Thus the extensive use of graphics at meetings and presentations fall into the category of business graphics. This paper is an overview of what is needed to bring business graphics out of the artists' shop and into the business office by using computers and their associated peripheral equipment.

A Brief History

The first major introduction of computer based business graphics was in 1970, when Integrated Software Systems Corporation (ISSCO) introduced their package of computer programs called DISSPLA. It was a major improvement over what was then available. Limited libraries of subroutines were available to insulate FORTRAN users from the character string commands to output devices.

DISSPLA was a mojor breakthrough in computer graphics but it still had major drawbacks. Firstly, it was designed only for large mainframe systems which could handle large programs. Secondly, the DISSPLA price was not competitive with the artists' shop. Thirdly, the graphics were not of presentation quality at that time. Lastly a FORTRAN programmer was needed to write a computer program for each chart since DISSPLA was a collection of subroutines with no main line.

Since the late 1970's, many other graphics packages have been introduced. Many of these packages have overcome the short commings of that early DISSPLA package and run on much smaller machines. Nearly all have a user interface that does not require a programmer's background. In this same time frame, devices of desktop size have been introduced to display or draw the charts. Tektronix was the first major manufacturer to sell graphics terminals. To this day Tektronix has the largest number of graphic terminals in the field with respect to quantity and different types. Hewlett-Packard was the first to introduce a one-mil (0.001 inch) resolution multicolor desktop flat bed plotter for less than five thousand dollars. They are still considered by many to be the leader in desktop plotter manufacturers.

The User

The top level management has known and used business graphics for a long time. However, since each chart required the skill of the graphics artist, and this was expensive, the lower levels of management could not justify the expenditures of time and money to have graphic artists make their charts. Thus the Orator Ball on the IBM Selectric typewriter was middle management's tool for one form of business graphics and/or word charts. The

major task for middle management is to get ideas across, not to use fancy charts. Computer generated business graphics appears to be part of the answer of getting these ideas across. Over the last several years costs of computer generated business graphics has steadily decreased. There is now software and hardware in reach of almost every budget. The quality of the graphics produced using computers has improved to the point of being used by upper management and in the board room.

When top level management was using charts made by graphic artists, there was a distinction between the user (top management) and the creator (graphic artist). Today with computer generated business graphics, the user and the creator, is in many cases the same person. Thus, the range of users of graphic packages is vast. On one hand, you will have the modern day graphics artist who makes his living using the graphics package every day. On the other hand, you have the user, who once every few months, wants to make a set of charts. The business graphics package must fulfill the requirements of both users. The capabilities of the package might be forgotten by the occassional user and he must be reminded of them. The capabilities of the package must be extensive. Otherwise, the manager might request a chart to be created which is beyond the capabilities of the graphics package.

There are roughly three levels of sophistication for users of computer generated business graphics. At the basic level, the user has his data on a sheet of paper and wants to see it in some graphic form. He may know that it should be in the form of a pie, bar, or line chart. Other than that, he has no partiular desires as far as the graphic layout is concerned. He might know what size paper he wants. At the other end of the spectrum, the user knows exactly what he wants the chart to look like. Almost no variance from the picture in his mind's eye will be allowed.

In the middle, the user has some specific ideas on what he wants the chart to look like, but at the same time he is willing to compromise, in order to get his chart as quickly as possible. He might want the color of a bar to be solid red, but would not settle for a hatched red fill. Business computer graphics are designed for this middle group where a vast majority of users are to be found.

If the user is the modern day graphics artist, he is the important link between the computer business graphic system and the finished charts that someone else needs. For the graphics artist who uses the system daily, wants the chart design session to be brief. He does not need detailed on-line instructions. On the other hand, if the user needs to create fifteen charts for his tomorrow morning meeting and it is now afternoon, the graphic system must allow this occassional user to meet his needs in a timely manner. If the user has not used the system regularly, he proably will not have time to refamiliarize himself with the package. If the chart cannot be done quickly, then the user will become frustrated. Naturally if the chart cannot be done quickly, it will no doubt be to late to do the fifteen charts. Thus, one must require that the system be easy enough to use to get an acceptable chart finished in an acceptable amount of time.

Output Devices

There are five basic types of output devices; plotters, graphic terminals, film cameras, laser printers, and ink-jet printers. Today the plotter is proably the most common hard copy device, but the multicolor ink-jet printer is gaining in market share.

Plotters are devices that draw with pens on paper, film or other transparent, translucent or opaque media. Plotters come in three forms, flatbed, drum, and a cross between the flatbed and the drum where sheet stock is held between special edge rollers. Flatbed plotters may have the capability of using roll fed paper, not unlike the drum plotter. Flatbed plotters have the ability to handle thick stock such as bristleboard. Drum plotters have the advantage of being able to draw a chart up to 120 feet long. The plotters that are a cross between these two give one the advantage of a D or E sized plotter capability for far less cost than a D or E sized flatbed plotter. These plotters are now available in A and B sizes for less then 2,000 dollars.

Graphics CRT terminals are available in both black and white and color. The recent decrease in computer memory costs has significantly decreased the cost of these devices. Like newspaper photos, a graphics terminal represents the picture by a field of dots or pixels. The more pixels per inch, the better the picture. The quality of the output still does not begin to match a plotter, since a plotter has the equivalent of 1,000 pixels per inch whereas the best available graphic CRT is 1,280 pixels across the whole 19 inch screen. One can expect to see 4,000 pixels on the x-axis in a few years, after the new 256k memory chips become low cost items. With present day CRT's a line that is not perfectly horizontal or vertical will have a step or jag somewhere along the line as one moves from one row or column of pixels to the adjacent row or column. With a limited number of dots, small incremental line segments may fall between pixels and never show. To make small text readable, the number of pixels must be quite large in both directions.

All modern day graphics CRT's store the contents of the pixels in a special memory. This memory is read sequentialy to generate a video

signal that is painted on the screen. There are many devices that can use this video including cameras, video projectors and in the last year, low cost ink-jet printers. Nearly all of these devices have a resolution much greater than the pixel memory of the terminal. Thus the graphics terminal is the limiting factor. Matrix recently announced a product that by passes this resolution problem and generates a 4,000 x 4,000 pixel color photograph or slide.

The last device to be considered is commonly called a laser printer. Here the computer stores the pixels in its memory. Hewlett-Packard's laser printer is an example of this type of printer.

Graphics Software

There are two steps needed to create business graphics. The first step is to "design" the chart by generating the specifications and the data. The second step is to take this data in the form of a file and "drawing" the chart on the output device. Programs that allow users to interactivly draw on the screen, while certainly are graphics, are not included. The most common hard copy device is still a plotter, not a pixel memory dump device which would be needed to catch the information that is only on the screen.

The form of the interface between the user and the design phase of the program is important. There are four forms of this man/machine interface to be considered:

1) **Programmatic**

A programmatic interface is a set of subroutines that are given to a programmer so that he may write an application program to create the charts and graphs. The advantage of this method is that if one has a very specific application and there is no off-the-shelf software, then a program can be written to fulfill the requirement. The disadvantage is that if one has many different types of general purpose charts, the programmer will need to create all of the programs required to create the charts.

2) **Command Driven**

A command driven interface is where the user enters all of the information directly into a file with no prompting. The major advantage of a command driven interface is that if one is knowledgable, one can very quickly define his chart without waiting for questions or screens. The major disadvantage is that a novice user can get completely lost.

3) **Screen Menus**

A screen menu is nothing more than a V/PLUS screen or an equivalent type of formatted screen. The advantage of screen menus is that a chart can be made by just filling in the blanks while jumping from screen to screen. However, if too much screen switching is needed then one may get lost. Working with screens can slow one down since one must switch to another screen to get additional information if one does not understand the selection presented. A major disadvantage of screen menus is the limited number terminals that are usable.

4) **Question and Answer**

A question and answer interface is just that. The sytem asks a question and then waits for the user to answer. The major advantage of this interface is that enough information can be presented so that if the user is a novice the question can still be answered correctly. The major disadvantage of question and answer sessions are when the user is an experienced user. He only occasionally has a need for all the information presented to him. Thus a questions and answer interface, to be effective, must allow the user to select, in a user changeable manner, the amount of information he needs. With short questions the experienced user can design the graphics faster.

Experience has shown that if the total number of choices is below some threshold value, and the user uses the system frequently, then screen menus are best. If the number of choices are above this threshold, and the user may only use the system, for example, for quarterly reports then the question and answer interface is better.

Requirements for a Graphics Package

Firstly, the package must be capable of drawing a large percentage of the charts required. No package will do everything. The package must have the capability to handle bar, line, pie and word charts in a rapid manner either via menu screens or a question and answer session.

Secondly, it must be cost effective. The graphics package must create charts more economically than an artist can do it by hand. Even if special training is needed for the modern graphic artist, costs will normally be much lower since much less of the artist's time is needed on a properly designed graphics system. If all one needs is to see if the line goes up or down, the user's Apple or IBM PC will proably suffice. However, if one does need better lettering, shading, and other more complex features, then a more powerful package is needed.

Thirdly, the graphics system should have easy access to the data. If one has only ten data points, the user should be able to enter data from the terminal keyboard. If on the other hand one has 100 or 1,000 points then the graphics package should be able to read the data from a file either during the design step or the draw step.

Lastly, if the charts are for formal presentation, or an outside client, other capabilities must be considered:

1) The capability of using high quality devices for high quality output.

2) The ability of switching from a horizontal format on an overhead transparency for a presentation, to a vertical format on paper for a report.

3) The capability to draw to film on a plotter without allowing the colors to run together or "bleed".

4) The ability to have enough annotation (title lines, legends, notes, etc.) so the chart does not need to be modified by hand or by another program.

5) The capability of having enough different shading patterns so the chart can stand alone in black and white as well as in color.

6) The use of proportionally spaced characters with the additional ability of displaying data in straight columns.

Summary

There are a few quesitons which one must answer before one purchases hardware and software to produce business graphics with a computer. First, you must evaluate all graphics that you are planning to automate. Are most of the charts very different or quite complex? Is it possible that an off-the-shelf computer graphics package might not meet your requirements? It is even possible that computer graphics might not do the job in a cost effective manner with the development effort involved.

If your charts are similiar to each other, or if the charts do not have much variation from simple line charts, bar charts, or pie charts, then computer graphics may simplify ones work. The next step is to find out what level of sophistication, the software needs to produce the charts. Are the charts needed for top managemnt, and therefore, must be of top quality? Are the charts used for briefing colleagues, and can have computer looking "stick" characters and single stroke lines? If the later is all one needs then graphics software on most microcomputers will suffice. If the answer is yes to both questions, then one needs a package with much more power and flexibility. If one has a limited set of specific charts, a software package which allows creation of a specifications file with later quick data addition would be helpful. A specifications file defines the layout of the chart (number of bars, wedge shading, etc.) Then all one needs to do is enter the data and one has his finished graph. This is also the situation where a subroutine library is most useful. If a programmer is available, programs can be written to create exactly the few charts needed with flexibility only where it is wanted without the overhead of more general graphics packages.

Once one has decided what capabilities the software needs to produce the required charts, the hardware will fall into place. If one needs to produce 35mm slides, one will need a graphics terminal with a camera. If overhead transparencies are needed, then a pen plotter will do nicely.

As one decides what software and hardware one needs, one must remember what personnel will be operating the software. Since they will be the key to success using computer graphics, one should allow them to work with the software before a purchase is made. Many companies will give a trial period at a reasonable cost, to allow for such an evaluation. If the users do not like the software or hardware, the probability of getting a second chance with another system is almost zero.

Business graphics are part of the rapidly growing computer graphics industry. New hardware, software and systems are introduced continuously by many vendors at all levels of performance. "A picture is worth a thousand words" is as true in today's business enviroment as anywhere else.

Alan Alexander Arens was born on June 5, 1959 in Wichita, Kansas.

While attending college, Alan worked for Hewlett-Packard in the Eastern Regional Sales Center in the training center. While at HP, Alan became familiar with the HP 1000 & HP 3000 computer systems.

Subsequently, Alan went to work for Arens Applied Electromagnetics Inc., as a staff programmer. While working on custom software he assisted in the development of the early versions of what is now the company's major off-the-shelf product --- PRESENTATION GRAPHICS by ARENS.

As the company expanded, Alan moved from his programmer's position to become programming manager. This past June, Alan Arens was moved up to the position of Marketing Manager.
