Summer Features

Computer Graphics: Classroom and Research Applications

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Computer graphics of interest to political scientists for teaching and research may take several forms including: the addition of screen graphics to computer programs used in the classroom; plotting programs that generate charts that can be printed or plotted; painting programs that can import charts developed by plotting programs and allow the user to modify them; and map generators. Our objective is to recommend books, software, and techniques related to these tasks.

Text and Graphics Modes

Some of the more popular computers including the IBM-PC and Apple II families display images on their screens in several ways. The major distinction is between text and graphics modes, each of which can be divided into additional categories. In a text mode the computer can display only its own basic character set. This consists of capital and small letters, numbers, punctuation signs, and a variety of other symbols which may include arrows, boxes, musical notes, and blocks of various shapes. These forms, called text or character graphics, are adequate for many purposes. Some expensive commercial software packages use nothing more.

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Many computer models offer graphics modes as well as text modes. This graphics mode may require the use of a special graphics board inserted in the computer. In most instances, the standard character set is still available for easy display of text, but, in addition, the screen can display small dots, called pixels. Pixels are much smaller than the blocks into which the screen is divided in the text mode. The number of dots on the screen determines the detail with which a picture may be represented. This is called the resolution, expressed as the number of pixels across and down such as 640 X 200 pixels. The graphics mode (often called pixel graphics) allows as much control of the screen as the resolution (detail) permits. For example, the standard IBM-PC offers two major graphics modes, medium and high resolution. The medium resolution mode breaks the screen down into 320 X 200 pixels, and it can handle color. The high resolution mode is 640 X 200 pixels, but it does not include color.

Adding Graphics to Programs

Graphics added to an ordinary program can go a long way toward giving it a professional look. The program title can be framed, a drawing can symbolize the program's theme (e.g., a city skyline for a city politics simulation), or data entry forms can be highlighted with shading. These effects can be achieved by writing computer code which can be learned from books on programming, or it can be done with programs that generate code.

Books on Graphics Programming

Probably the first place one should look in exploring graphics programming possibilities is the manual that accompanied the programming language being used. For

simple effects the manual may be all that is needed. However, because they tend to explain commands one at a time, manuals often fail to convey what can be achieved by using combinations of commands. And, as with most aspects of programming, manuals rarely cover all points with complete clarity. For both reasons reference books may be needed. For BASIC programming we have found the following books to be useful:

Roy E. Myers, *Microcomputer Graphics* (Reading: Addison-Wesley, 1982). For Apple II series. Very clear. Includes three-dimensional graphics and animation.

John Clark Craig and Jeff Bretz, *IBM PC Graphics* (Blue Ridge Summit: Tab Books, 1984). Includes three-dimensional graphics and animation and features many programs that demonstrate graphics techniques. Its chapter on plotting is especially useful for those who want this capability integrated into their programs.

Carl Shipman, *Color & Graphics* (Tucson: HP Books, 1984). The most informative book on BASIC graphics programming that we have seen. It contains extraordinarily clear explanations of some very difficult concepts. It devotes a great deal of attention to text mode or character graphics, often ignored now that so many computers have pixel graphics capabilities. Its treatment of pixel graphics is also excellent. The explanations of example programs are very detailed and intended to develop programming creativity by explaining the theory behind graphics. It includes a surprisingly powerful drawing program and Microsoft BASIC 2.00 window commands. (Windows allow the subdivision of a screen so that more than one image can be viewed simultaneously.)

Larry Joel Goldstein, *Advanced BASIC and Beyond for the IBM PC* (Bowie: Robert J. Brady Co., 1984). This excellent volume includes three chapters on graphics including Microsoft BASIC 2.0 windows.

A Code Generating Program

One of the most convenient ways to add graphics to a program is through a graphics code writing program such as the impressive public domain program GLUDRAW.[1]

> GLUDRAW. Available from PC-SIG, 1030D East Duane Ave., Sunnyvale, CA 94086. (800) 245-6717 or in California (800) 222-2996. $6.00 plus membership. For IBM-PC and compatibles.

GLUDRAW is a high resolution (and therefore noncolor) drawing program that can also accommodate text. GLUDRAW does not use a mouse. (A mouse is a small box that rolls or slides on a horizontal surface such as a desk top and controls cursor movement in any direction.) Unlike many public domain programs, all operating information is found in help files and prompts at the bottom of the screen. At first, access to help files is required often, but unlike many painting programs, GLUDRAW is quickly mas-

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[1] Generally, the public domain graphics programs we have examined are of little use to professional political science applications. The following examples highlight their problems:

YOURART1. A standard drawing program that does little more than draw, print, and save pictures. Commands are very confusing, and the program is highly crash prone.

ABC Draw. Will save pictures that can be included in programs, but they are saved in a graphics mode that does not permit code modification in the manner allowed by BASIC code generated by GLUDRAW. However, for an opening logo or some sort of illustration they would work.

ABC Draw can use a mouse, but this is not essential or even particularly useful. Character graphics oriented, it will place any ASCII character in any of the 80 X 25 screen cells, like an extended word processor. Successful operation requires considerable practice. At first, surprising things can happen that can destroy previous work. Overall, this program does not do enough beyond drawing.

PC-KEY-DRAW. This is a very competent painting program that works in high or medium resolution. In high resolution it will print standard 80 character to a line text. Unfortunately, although its manual claims that it will import screens created by other graphics programs, this does not include a Lotus PIC file. Thus it is of very limited usefulness in doing touch-up work.

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tered, and the need for assistance declines rapidly.

GLUDRAW is one of the most forgiving graphics program we have tested. If a mistake or even several mistakes are made, the user is allowed to back out of trouble.

GLUDRAW's basic drawing repertoire is very small compared to the commercial painting packages discussed below, but it includes straight and curved lines, circles, boxes, and dots. For such purposes as creating program graphics and professional looking menus, GLUDRAW's limits are not very inhibiting. Shapes can be shrunk, enlarged, moved, and pivoted. Text can be added to drawings in standard 80 characters to a line size.

Peculiarly, GLUDRAW contains no built-in ability to use a printer. To print a drawing, one must invoke the disk operating system (DOS) utility PSC before loading GLUDRAW and then use the PrtSc key. This has the unfortunate effect of printing the GLUDRAW command line along with everything else. However, printing is not the major purpose to which GLU-DRAW would be put.

Once a GLUDRAW drawing has been finished, it may be saved in the BASIC code that is required in BASIC to reproduce the drawing. One then has merely to load BASIC and the drawing is ready to run. For example, if the drawing is an opening program logo, it is only necessary to attach it to the beginning of the program. If it is a menu or some other graphic that appears later in a program, its lines must be remembered to fit the master program, but this is an easy task.

Plotting Programs

Many programs generate plots from numeric data. Lotus 1-2-3 is probably the most widely used program of this type. Lotus generates very presentable graphs on a dot matrix printer and publication quality ones on a pen plotter. Most statistics programs also generate plots ranging from ones limited to character graphics to presentation quality high resolution graphics.

Many users discover that a particular spreadsheet or statistics package has graphics capabilities that are incomplete in some way. For example, Lotus will not connect two data points with a line if one or more points are missing between them. In addition, Lotus labeling capabilities are severely limited. Perhaps worst of all, Lotus can generate only a few basic two-dimensional plots (bar, scatter, line, pie). Even though Lotus offers considerable variety within each of these categories, it is likely that sooner or later the user will want plots of higher quality and with more layout options.

We will discuss several such programs. All run on IBM PC and compatible computers unless otherwise noted. The programs are:

STATGRAPHICS. Statistical Graphics Corporation, 2115 East Jefferson St., Rockville, MD 20852. (800) 592-0050. (301) 984-5000. $695 retail. Not copy protected. Requires at least 384K RAM, 2 disk drives, and a graphics adaptor. It can use an 8087 coprocessor. This program will not operate a printer when running on a Zenith 171 or Morrow Pivot computer.

EnerGraphics. Enertronics Research, Inc., #5 Station Plaza, 1910 Pine St., St. Louis, MO 63103. (800) 325-0174. $170 discount mail order. Not copy protected. Requires 256K, 2 disk drives, and a graphics adaptor.

PC-Paint Plus. Mouse Systems Corp., 2600 San Tomas Expressway, Santa Clara, CA 95051. (408) 988-0211. $89 with Mouse Systems Mouse discount mail order. Not copy protected. Requires 256K, 2 disk drives, graphics adaptor, and mouse.

PC-Paintbrush. ZSoft Corp., 1950 Spectrum Circle, Suite A-495, Marietta, GA 30067. (404) 980-1950. $87 discount mail order. Not copy protected. Requires 320K, 1 disk drive, a graphics adaptor, and joystick, mouse, or digitizer.

Map-Master. Decision Resources, 25 Sylvan Road South, Westport, CN 06880. (203) 222-1974. $245 discount mail order. Add-on components at additional cost. Copy protected. Requires 360K, 2 disk drives, a graphics adaptor.

STATGRAPHICS

In some respects STATGRAPHICS is the premier plotting program available for the IBM-PC and most compatibles. The fact that it is also one of the most powerful and easy to use statistics packages on the market makes its $695 price quite reasonable.

Like most graphics programs, STAT-GRAPHICS can import plain ASCII and DIF format files. In addition, it has the unusual capability of importing a Lotus spreadsheet directly without the spreadsheet having to be printed to disk in ASCII format. However, if a column of data has been generated by formula, it is necessary to save the spreadsheet in ASCII. Otherwise, the formula and not the results will be imported. Data may also be keyed directly into STAT-GRAPHICS. Data importation and all other standard STATGRAPHICS operations are entirely menu driven, although there are substantial differences among the ways different data formats are imported. As a result each import procedure must be learned individually.

STATGRAPHICS can produce the following graphics: various scatter plots including log, 3-D, surface plot, and plots of functions; Box-and-Whisker; various frequency histograms including 3-D and hanging; single and multiple variable bar chart; pie chart; cumulative component line charts; suspended rootograms; and regression analysis plotting (scatter plot with regression line). Many choices for labeling, axis tick marks, and other graph elements are provided, although default values will often be acceptable. STAT-GRAPHICS even includes a modest editing program that permits titles and axis labels to be reworded and moved. Since axis labels are automatically made from variable names which are limited to 10 characters, this feature will be used frequently.

The superb quality of the plots as they appear on the computer screen may be seen in the STATGRAPHICS advertisements in many computer magazines. STATGRAPHICS contains a utility to drive most common pen plotters that produces excellent quality work. Its menu driven input and editing programs allow

easy control of labeling and other aspects of plot context. Plot size, proportion, and page placement are also easily controlled. For example, horizontal or vertical page placement is possible. Printer produced plots are generated in a similar fashion, but due to a lack of printer specific command functions, they are not of as high a quality as screen and plotter graphics.

The program comes on three disks, but only two are used once the program is loaded, and very little disk swapping is required. Unfortunately, the program runs the disk drives a great deal, sometimes after every step. The delays during disk drive operation can become very annoying unless it is run on hard disk. Since it is not copy protected, installing it on hard disk involves nothing more than file copying.

Although our attention here is on this program's graphics capabilities, we remind the reader that it is also an extraordinarily powerful statistics package, rivaling SPSS-PC in variety of statistical techniques and far outstripping it in convenience and graphics capabilities at a substantially lower price. We recommend that the prospective statistics package purchaser obtain the manufacturer's promotional materials in which graphics, statistics, data transformation, and other functions are listed in detail.

EnerGraphics

EnerGraphics is a graphics utility program that allows the importation of spreadsheet data in DIF, Multiplan, and InteCalc formats but the version we tested will not import in ASCII format. Data may be keyed directly into the program.

EnerGraphics produces scatter, pie, exploded pie, and bar charts. Its bar charts may be two- or three-dimensional. Labeling is more flexible than what most spreadsheet or statistics packages provide. Data and information concerning graph appearance are entered via relatively clear menu choices. With Ener-Graphics one can produce a standard chart within a few minutes of opening the package.

EnerGraphics produces some of the most

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attractive charts we have seen. Unlike STATGRAPHICS, it takes full advantage of a particular printer's characteristics. For an extra charge a plotter driving program is also available, but EnerGraphics' printer-generated plots are of high enough quality that many users will not need to use a plotter.

In addition to its charting capabilities, EnerGraphics can be used as a drawing program (a mouse is not required). In drawing mode it even allows modification of its own charts. However, drawing is very difficult. The major problem is that key commands are arranged in a tree structure, and a given key may have different functions depending on where in the tree one is situated. Making matters worse is the fact that the user often has no idea where in the tree he or she is located and therefore what the functions of particular keys are. The drawing routines would benefit greatly by the improvement of the scanty screen prompts that are provided.

EnerGraphics also suffers from a poorly organized and badly printed manual. Despite its weaknesses, this is a powerful and useful program.

Touching Up Graphs

Another answer to the problem of a graph that does not entirely meet the user's needs is to export the image to programs like PC-Paint or PC-Paintbrush and then modify the graphics manually.

PC-Paint and PC-Paintbrush

PC-Paint Plus and PC-Paintbrush, normally considered sketching or painting programs, allow easy importation of graphics images produced by many other programs. Paint accomplishes this importation somewhat more conveniently than Paintbrush. With a mouse (required for Paint) or a mouse, digitizer, or joystick (required for Paintbrush) labels or graphics can be moved or modified and drawings added.[2] An enormous variety of print

[2]A joystick is usually thought of as a game control device, but it can be used for drawing purposes if a particular program permits it. A digitizer translates pictures into forms that can be processed by a computer.

styles and drawing tools are available. Both programs drive many kinds of printers and plotters. These are very useful tools for those who work with graphic images a great deal.

Until recently, the only serious drawback to each program was that alphanumeric symbols were too large. As a result detailed labeling could not be provided as part of a graphic. Both products now permit much smaller text to be added with what amount to elementary text editors. Paint's smallest text is somewhat smaller than Paintbrush's. The appearance of this text on an Epson FX-100 printer could be better, but it is acceptable for many purposes.

Both products perform well. For many users the choice between them would depend on whether a mouse purchase is required and/or whether a joystick or digitizer is already available. A joystick is not as efficient a drawing device as a mouse, but it is adequate for most touch-up tasks.

In terms of subjective performance qualities, we prefer Paint. We find ourselves able to perform tasks more quickly and easily with it. In addition, Mouse Systems, Paint's manufacturer, has very generous updating policies. We received the greatly improved Plus version with the new manual for only $25.

Map-Master

Map-Master is a disk library of maps and map-related statistics such as population data, together with a set of programs for manipulating and printing them. It comes with a map of the United States by states, and various samples such as Louisiana by county and Manhattan by zip code. A few elementary statistics are also provided. Disks containing additional maps such as other states by county and other countries may be purchased from the manufacturer. Additional statistics may be inputted directly into Map-Master by the user or read into it from a spreadsheet or statistics program capable of generating an ASCII, SYLK, or DIF file.

This program would be very useful to the social scientist wanting to show such things as voting statistics or other geo-

graphically based data. It will take data inputted by the user and divide it into categories in a user specified manner. Then the map will be shaded (white, black, and various patterns, or, with proper equipment, color) according to the data and categories. The United States map provided with the program can be displayed in its entirety including Alaska and Hawaii. Any states can be omitted to create specialized maps or regional presentations. The resulting picture can be changed in size and moved anywhere on the screen or printout. Titles and legends are easily added or changed.

Map-Master produces beautiful maps even on a printer. It includes a great many printer and plotter drivers to make the best use of each device. Furthermore, it is menu driven and quickly learned. The only problem that we found in running it was that it requires an extraordinary amount of swapping among its four disks. In one simple operation, making no mistakes, we switched back and forth between two disks six times. Heavy use of this program would almost require a hard disk. Unfortunately, since it is copy protected, its hard disk installation and deinstallation (for moving to another machine) programs are cumbersome.

Map-Master's greatest weakness is that it does not permit user additions to map lines. In other words, it is not possible to take a state map provided by the manufacturer and add such things as congressional district lines. Nor are congressional district maps available from the manufacturer (much less state legislative district maps) except by special order.

User map line drawing would not be easy for the manufacturer to add because statistics and shading subroutines are linked to map subdivisions. Thus user inputted lines simply drawn on the screen would not be connected to the rest of the program. This problem would also arise if a Map-Master map could be retouched by a PC-Paint or Paintbrush, but their importing programs seem to be disabled by Map-Master, so the point is somewhat academic. Map-Master does what it does very well, but the prospective purchaser should be aware of these limitations before investing in it. ☐

Quick Notes

Stat 1 is a low priced, easy to use, menu driven statistics package sufficiently powerful for research, and uniquely suited for teaching. The program can import an ASCII file. It also contains its own data input and editing programs. Data can be keyed in by variable or observation, and editing is very convenient. The rows and columns of the data matrix can be inverted. A rich variety of data transformations is part of the program.

A codebook may be created, although it is not required to operate the program.

Stat 1 can generate normal, rectangular, binomial, and Poisson distributions. It also offers the statistics typical of inexpensive statistics packages including descriptive statistics, crosstabs, the t-Test, correlation, multiple regression, ANOVA, ANCOVA, and smallest space analysis. Its plots are relatively crude character set graphics, but they are adequate for analytical purposes.

As noted above, Stat 1 can be used for research, but it is particularly valuable as a teaching tool both because it is so easy to use and because its manual, which may be purchased separately for $19.95, doubles as a text book. This 264-page clearly printed manual is an 8½ X 11, firmly bound document. Although it does not attempt to substitute for a statistics text, it includes extraordinarily clear explanations of the uses of various techniques, how the program itself is operated, sample problems (the data for which are provided on disk), illustrations, and much more. It assumes no prior knowledge of computer operations, but it will not insult those with experience. The program can be purchased on a site license basis. It is not copy protected.

The new purchaser of this program should be especially careful to make a copy of it before attempting to initialize it. Before the initialization process is begun the user should make sure that a printer has been turned on.

Stat 1 is manufactured and sold by Sugar Mill Software Corp., 1180 Kika Place, Kailua, HA 96734. (808) 261-7536. It

runs on IBM PC and compatible equipment and requires 265K (although more is useful if data are being imported) and two disk drives. A Wang PC version is also available. The program including one copy of the manual costs $179.95. The manual may be ordered through a college bookstore.

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Steve Roski, *Data Structures on the IBM PC* (New York: Brady Communications Company, Inc., 1985). $21.95.

Many political scientists who program in BASIC might not be attracted by a book entitled *Data Structures on the IBM PC,* but it could be one of the most valuable resources in a BASIC programmer's reference library and software tool kit. At first glance, this volume appears to be a clearly written treatment of such relatively advanced topics as string usage, arrays, chains, and pipelines. This material, while valuable, pales in importance compared to a 147-line program called PREBASIC included in the book.

PREBASIC translates the author's variant of BASIC, which he also calls PREBASIC, into a form that will run on a standard BASIC interpreter or can be compiled. PREBASIC offers several advantages over standard BASIC. First, it eliminates line numbers. Anyone who has worked with a large and complex BASIC program will appreciate the importance of this. Among other things, it allows the programmer to develop a disk library of subroutines (also devoid of line numbers) that can be used repeatedly in different programs. Each chapter of the book offers subroutines that can be made part of the reader's library. This possibility encourages the writing of more highly structured programs than is common in BASIC. PREBASIC also allows for better documentation than standard REM statements. These and other advantages are achieved with changes in standard BASIC that can be learned in only a few minutes. Also included is a program that translates standard BASIC programs into PREBASIC. □

The Newsroom: Software for Departmental Newsletters

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Publisher: Springboard Software, Inc., 7808 Creekridge Circle, Minneapolis, MN 55435; phone (612) 944-3912. Price: $49.95.

Machine Specificity: IBM PC, XT, AT, or compatible, 256K RAM, PC DOS 2.0 or higher, color graphics card, at least one disk drive, and a dot matrix printer. Also available in versions for the Commodore 64/128, Apple II +, IIe, IIc.

A common and rather tedious task in academia is the production of internal and external departmental newsletters. Microcomputers are beginning to provide assistance in what has been a rather mundane task through desktop publishing software. Springboard Software's *The Newsroom* attempts to meet the needs of newsletter production. The package allows creation of banners, pictures, cartoons, and even text. Over 600 pieces of clip art and five fonts may be selected from disk. *The Newsroom* also provides a good layout routine and is compatible with almost any dot matrix printer.

The Newsroom is menu driven and divided quite logically by task. The colorful main menu offers routines for selecting clip art from disk, designing pictures, banner design, copy production, layout, and printing. The package even contains a "wire service" routine allowing telecommunication of copy or pictures. The program will accept a mouse or joystick for selecting menu options or drawing, though neither are required.

Selection of clip art in *The Newsroom* is very simple though the manual must be used to select art. The package stores art in clusters on a data disk and the manual must be used to determine the file name

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