contents

inside:

- Feature Article—Communications
- Unique software support
- Data transportability
- Fractals
- Alpha sorting
- Computer-graphics primer

basic EXCHANGE

HEWLETT PACKARD

Corvallis Division   Summer 1981   Vol. 2 No. 2

HP Series 80—The Total Solution

What do you need today more than a good 5-cent cigar? How about a good, low-cost printer for Series 80 Personal Computers? Announcing the **HP 82905A Printer**! It uses the HP-IB interface — if you already have a disc and/or a plotter in your system, just add the **HP 82905A Printer** to the bus. Part of the beauty of HP-IB is that you can connect all your peripherals on the same

interface, using only one port in the back of the machine.

The HP 82905A fits in well with your Series 80 Personal Computer in many other ways too, like its small size. Measuring only 4.2-inches high by 14.7-inches wide by 12-inches long, it really conserves desk space. Its price is in line with the rest of your Series 80 system—only $945.00 †. And it is serviced by the same HP repair centers that handle the rest of the Series 80 product line. Not that it's likely to require service. It incorporates such innovative design concepts as a disposable print head. After printing 50- to 100-million characters, snap it out and throw it away. You can replace it in just a minute with one hand.

Let's look at some other features. The **HP 82905A Printer** prints 80 characters per second and speeds the throughput rate by printing bidirectionally (like the HP-85's built-in thermal printer) and by performing a logical-seeking function to minimize the travel distance between print positions.

Although it is referred to as an 80-column printer, you can get 132 characters across an 8 1/2-inch page using a compressed type style. In fact, you can select densities of 5, 8.25, 10, or 16.5 characters per inch. Multiple type fonts mean you can print bold characters too!

COMPRESSED PRINT

NORMAL PRINT

EXPANDED-COMPRESSED PRINT

EXPANDED PRINT

Because it is an impact printer, you can print multi-part forms—an original and two copies. A tractor drive (sprockets that engage holes along the sides of the paper) adjusts from 4 to 10 inches to accomodate all manner of forms and mailing labels. The printer also features a form-feed capability.

The 9X9 dot matrix print head prints sharp-as-a-tack characters with true descenders; that is, the tails of letters like "g" and "p" extend below the line. The **HP 82905A Printer** also permits programmable line spacing, so you can print subscripts, superscripts, and special labels.

Last, but most exciting, this printer does raster graphics with either 72X60 or 72X120 dots per inch. It's possible, then, to dump graphics from the CRT to the printer for hard copy output. ■

Software Support Services

Now, in addition to hardware service contracts, Hewlett-Packard is offering a new approach to Series 80 software support. It's a program based on past successes in helping customers achieve maximum productivity using other HP desktop computers.

One of the most valuable parts of this new program is the Phone-In Consulting Service (PICS). You can get help by phone from a PICS center as you need it. Each contract designates one customer as a PICS caller and another as an alternate. HP's experience with this type of service has shown that you can realize higher productivity when you receive timely answers to questions; we guarantee a response time of within 4 hours.

Also included in this program is a formalized three-part documentation service. First, HP's *Communicator* magazine, issued quarterly, will keep you updated on current revisions in HP-supported software and firmware. Articles written by HP engineers and programmers will feature application stories, technical articles, and programming tips.

Second, HP's manual update service will send you either new manuals or update sheets as changes occur so that your documentation will reflect the most accurate and clearest information available.

The third part of this service is a formal software bug-reporting system. This system catalogs all known bugs and, when possible, the work-arounds.

These services: phone-in consulting service, *Communicator* magazine, manual updates, and software notes, have been packaged into a new service called **System Information Services (SIS)**. For basic systems you would purchase HP 98090K SIS at $25.00 per month. Products supported include mainframes, enhancement ROMs (except for the I/O and Assembler ROMs), standard peripherals, and selected system-type software. For full I/O support you would purchase HP 98091K SIS at $25.00 per month (you must also purchase HP 98090K SIS). Products supported include all interface modules, the I/O and Assembler ROMs, and the Data Communications Pac. Note that with the exception of selected software pacs, application pacs are not covered. A minimum contract period of 3 months is required, but we recommend a 12-month contract to get maximum benefits from the program.

■

HP Series 80 Beginner's Course

Designed for the business or technical professional with no BASIC programming experience and little or no knowledge of HP personal computers, this course introduces HP Series 80 Personal Computers with an intense two days on the HP-85. Covering all of the essentials, topics include:

● fundamental operation of the computer, from display editing through using the tape drive;

● BASIC programming tools, from flowcharts, variable assignment, and data input through branching, loops, and subroutines;

● some of the more special features of a Series 80 computer, using the special function keys and graphics;

● and software and peripherals demonstration.

This is an ideal course for the person who wants to discover the fundamentals of operating and programming a computer. The course length is 2 days or 4 evenings, with approximately 70 per cent of the classtime hands-on experience. The price is $260.00. Contact your local dealer or Hewlett-Packard sales office for ordering, availability, and scheduling information.

Computer System Consulting Service

On-site assistance is available through two consulting services: HP 98096A General Purpose Consulting Services and HP 98097A General Interfacing Consulting Services. Prices for these services are based on time and materials. Typical costs run from $600.00 to $800.00 per day.

What you get are recommendations on applications design, suggestions for improving performance, and explanations of system operation. This assistance is specific to your application and need, a personalized approach from an HP systems engineer trained and experienced in that specific area.

Clearly, these are unique services in the personal computer industry. We offer them because we realize you want solutions—not just hardware. A total solution includes hardware, software, and support!

Who can benefit from SIS? Software suppliers; O.E.M.s; those who continually change and develop programs; and those with complex I/O applications. You'll benefit from increased productivity through training in effective programming techniques and conferring with HP systems engineers on specific applications and questions. You'll learn how to successfully use your HP Series 80 Personal Computer and software for solving specific problems and gain insight into new ways of using your system to make your job easier. And, finally, you can minimize down-time due to software reliability problems. ■

Users' Library

Looking over the questionnaires returned from the last issue, we were surprised to discover how many users don't know what the Users' Library is about. The Users' Library is a service we provide to facilitate your getting software; it helps you get the most out of your computer. One of the ways the Library does so is by publishing the *Series 80 Software Catalog*. The Catalog consolidates all of the software we know about for HP Series 80 Personal Computers. The Catalog uses an 8 1/2- by 11-inch, 3-ring binder format to allow for expansion and updating. The pages are color-coded: brown pages for Application Pacs like the Graphics Presentations Pac; yellow pages for third-party software, written and marketed by vendors qualified through our Software Supplier Program; and orange pages for programs developed and contributed by users as well as programs like the binary utilities developed by Hewlett-Packard. (See back page.*)

The Catalog is available to everyone—you can look over a copy at your local HP-dealer. To obtain your own copy, join the Users' Library. You then have a reference to consult to find out what's being done with HP Series 80 Personal Computers. It will stimulate your thinking . . . "That's a good idea—I can do that too." If a program doesn't sound like it does exactly what you want, get it to see how the author attacked the problem, and then modify it for your own use. The information included in the Catalog includes program title, abstract, price, memory usage, hardware requirements, and the contributor's name and address. To sum up what the Users' Library is, it is access to lots of programming ideas.

A subscription costs $40.00† in the United States and Canada and $60.00 international. In addition to getting your own copy of the Catalog, you receive a discount on all library programs. Program listings and complete documentation for most contributed programs cost members $6.00†, non-members $10.00. Programs recorded on tape cartridge and disc are also discounted, the first program costs $14.00 and $6.00 respectively for members, $18.00 and $8.00 for non-members. This charge covers the cost of the media; additional programs in your order are recorded at no extra charge.

A program order form appears on the back page of this issue. You can photocopy it and use it to order programs. If you want to join the Users' Library, just say so on that order form and indicate the serial number of your Series 80 computer and the purchase date. Then you can pay member's prices for any programs you order. You'll also get complete new-member information, documentation forms for contributing programs you've written, and your copy of the *Series 80 Software Catalog*. If you're in a hurry, use the charge-by-phone service. Call the Users' Library toll free at (800) 547-3400 (except Alaska, Hawaii, and Oregon call 758-1010).

May Update

Users' Library members and dealers should have received the May update to the *Series 80*

Software Catalog. The update included a new index, about 60 changes, and about 60 additions.

Some of the third-party software in this update includes a data manager and desktop planner from **Scelbi Publications**, general ledger and accounts receivable software from **Business Software, Inc.**, a real estate investment system from **Palmer Berg Company, Inc. Northwest Software, Inc.** offers accounts payable, general ledger, accounts receivable, inventory control, and payroll software for both disc-based and tape-based systems. There's a chemical engineering pac available from **KELIX Software Systems**, a number of civil engineering programs from **Northwest Software, Inc.**, including COGO, Bluetopping, Earthwork, and Hardy-Cross analysis. **Robert Vaeth & Associates** offers a word processing system. Whew!

Software Supplier Program

In the way of additional information about these products, let me insert a few words about the Software Supplier Program. The purpose of this program is to help software suppliers develop Series 80 software and to make it available to you. To participate in the program, a supplier must develop, sell, and support his own software. You can obtain this software directly from the supplier or from your local HP Series 80 Personal Computer dealer. If you need help with a supplier's software, you contact the one who knows the software best: the supplier.

As part of the U.S. program, summaries of supplier software are included in the *Series 80 Software Catalog*, alongside Users' Library contributed programs and Application Pacs. This way, you need look in just one place to find a complete list of available Series 80 software.

Since software solutions, support, and language vary by country, implementation of the Software Supplier Program is also by country. Currently, programs have been instituted or are under development in 10 European countries, Australia, Japan, South Africa, and the United States.

Highlights

Here are a few highlights of user-contributed programs that you'll find in the May update:

900-0029 *Command File Binary*, by **Ole Anderson**. This program allows system input to be redirected from the keyboard (normal mode) to a data file containing a sequence of commands stored as strings.

900-0037, 900-0038 *Variable Name Cross-Reference for BASIC Programs*, and *Line Number Cross-Reference for BASIC Programs*, by **James A. Donnelly**. These two programs generate cross-reference tables of all variable names and all statement references in a BASIC program. The tables are generated by reading a program file stored on tape using the "DGTSAV" binary utility (Catalog number 900-0022; $12.00 plus media cost). Cross-references are very useful when developing and debugging large programs and greatly enhance the structural analysis of a program.

Here are some highlights of programs that weren't in time to be included in the May update:

900-0041 *String Arrays and Fast String Manipulation Without Temporary Memory*, by **Mike Steed**. "HANDY" is a binary program that implements six BASIC commands allowing: 1) a string variable to serve as a one-dimensional string array; 2) insertion of characters into or onto a string without using temporary memory; and 3) faster string manipulation.

000-0058 *Print VisiCalc Worksheet to a Plotter with HP-GL*, by **Peter Bock**. This "program" is really a monograph on 14 of the more useful HP-GL instructions (Hewlett-Packard Graphics Language is the "native" language used by all Hewlett-Packard plotters, part of their firmware). It explains how to use the VisiCalc ⁄P print command and HP-GL to transfer your VisiCalc worksheet, or any portion of it, to a Hewlett-Packard plotter, so you can make large-scale copies of your worksheets and slides for overhead projection.

The HP-GL commands are placed directly on the worksheet. You can control plot direction for horizontal or vertical plots, and you can control character size and slant. You can also draw boxes in various linetypes to frame your worksheet or to create tables.

000-0059 *Data File to VisiCalc /SL File*, by **Peter Bock**. This program allows you to take string or simple numeric data from a Series 80 data file and create a VisiCalc ⁄SL file. It saves you from having to key in data to VisiCalc that already exists in a data file. The program will not accept numeric array data but can be modified to do so.

900-0044 *SOURCE COMM*, by **Curtis Adams**. This program makes using networks—The Source in particular—straightforward and convenient. It turns your Series 80 Personal Computer into a "smart" terminal with local file control and full use of the soft keys for accessing program features. You can "download," that is, save incoming information on tape or disc, and "upload," that is, go the other way, sending a file you have on tape or disc out over the network. Incoming text can be printed on the built-in thermal printer or an external printer. And you can transfer programs by first converting them to data files using the "DGTSAV" binary utility.

All you have to do is turn on your machine and dial the phone—the program auto-starts and logs on for you. All the data communications parameters (like parity and handshake protocol) are set to make The Source play. The program listing is annotated to indicate where modifications are required to use CBBS (Community Bulletin-Board Systems). A companion program, "TXTED3", can be chained-in to create text files off-line; that is, while you are not logged onto The Source and not paying for connect-time. The program requires the binary program "IPBIN," the serial interface, the I/O ROM, and a modem.

900-0043 *Screen-Mode Text Editor*, by **Curtis Adams**. "TXTED3" allows you to enter text as you would on a typewriter. When the cursor is within five spaces of the right margin, a "bell" rings.

HP Computer Museum
www.hpmuseum.net

For research and education purposes only.

Pressing (END LINE) drops the cursor down to the next line at the left margin. Any character can be typed, including quotes and commas. You can edit it with the power of a screen-mode text editor—move the cursor to any position in the text and make any changes you like, including deleting or inserting characters. The text can be easily saved on tape or disc and printed on the built-in printer. Files containing up to eight screens of text can be created using this program without a 16K Memory Module. The program was written as a companion to *SOURCE COMM*, but can be used alone. It requires the binary program "IPBIN."

One thing should be obvious at this point. You now have quite an array of software for your Series 80 Personal Computer. The number of applications you have should be taking off now, growing exponentially. ∎

Data Exchange Utility Software

Combined with the HP 9895A Flexible Disc Drive, **Data Exchange Utility Software** from Hewlett-Packard provides a means of transferring data between HP Series 80 Personal Computers and systems that use "IBM" 3740 formatted flexible discs. Now, data generated on your HP-85 or HP-83 can be translated into 3740 format for use in larger systems, including HP Systems 35 and 45 Desktop Computers and HP 3000 Series mainframes, as well as IBM and DEC systems.

You can TRANSFER entire discs or specific files from 3740 format data files to HP-format data files, and vice versa. You can PURGE or RENAME any 3740 or HP file. And you can CATALOG on the CRT the file name, file type, number of bytes per record, and number of records per file for HP discs, or the file name, file type, first record address, first unused record address, and last record address for 3740 discs. All these capabilities are provided by a single, easy-to-use program. The program also enables you to initialize a single-sided, 8-inch disc to 3740 format.

The hardware required in your Series 80 system includes a 16K Memory Module, the I/O and Mass Storage ROMs, an HP-IB Interface, and an HP 9895A Flexible Disc Drive. The software is available from your local dealer or HP sales representative for $95.00 (part number 88095A). It can also be ordered for the same price with the HP 9895A by specifying option 185. ∎

Vertical Business Applications

Application Pac	Management/ Administration	Marketing/ Sales	Finance/ Investment
VisiCalc™ PLUS	Budgets Forecasts	Sales forecasts Contribution analysis Volume pricing Customer qualification	Cash flow planning Targeting R/E worksheets Income tax prep. Variance analysis
Information Management	Personnel lists Mailing lists	Customer activity Price lists Distribution analysis Mailing lists	Chart of accounts Mailing lists Investment offerings
Graphics Presentations	Presentations	Presentations	Presentations
Data Communications	Electronic mail Travel arrangements International and domestic news Computerized-data base access Corporate communications	Electronic mail Order transmittal Airline sched. Business news Field support O.E.M. support On-line marketing	Electronic mail Financial telecommunications Stock and bond prices Multiple listings Financial news and reports
Financial Decisions		Break-even analysis	Capital budgeting Lease vs. buy Loan analysis Bond analysis
Linear Programming	Profit optimization Resource allocation Production planning and sched.	Product mix Advertising media mix Territory assignment	Portfolio selection
Stat Pacs	Trend analysis	Forecasting Variance analysis	Trend analysis Customer Selection (M.L.R.)

Here's a different way to contemplate which application pacs you could use. Look under your business activity for the capabilities you can benefit from having. The application pacs named to the left would provide you with those capabilities.

™VisiCalc is a trademark of Personal Software, Inc.

Snowflakes and Flowsnakes

Those of you who read Martin Gardner's "Mathematical Games" in *Scientific American* have run across fractals a couple of times over the last few years (December, 1976 and April, 1978). You may recall that these strange curves have some rather bizarre mathematical properties. One of the most interesting attributes of a fractal is its self-similarity — if you enlarge any portion of it, the pattern still looks the same. This effect is demonstrated by the surface of the moon, which looks pretty much the same from 50 miles above its surface as it does from the Earth.

Many physical phenomena share this property of being statistically self-similar; fractals turn out to be a good device for analyzing such things as the flood levels of the Nile and Brownian Motion. Even some of the best computer-composed music stems from the study of fractals- the degree of unexpectedness or randomness is tempered by the familiarity or repetition that is inherent in fractals.

Well, here's your chance to study some of the properties of fractals right on your CRT. **John Sechrest** has written a program for HP Series 80 Personal Computers that draws an nth order fractal on the graphics screen. When asked ORDER TO PLOT?, try 1 first to see the basic curve. The curve shown here has order 3. Higher orders are created by replacing the straight line segments with similar (identical except smaller) curves. The curve generates itself using this completely recursive procedure, until, in the limit, it is infinite in length and completely fills a finite area.
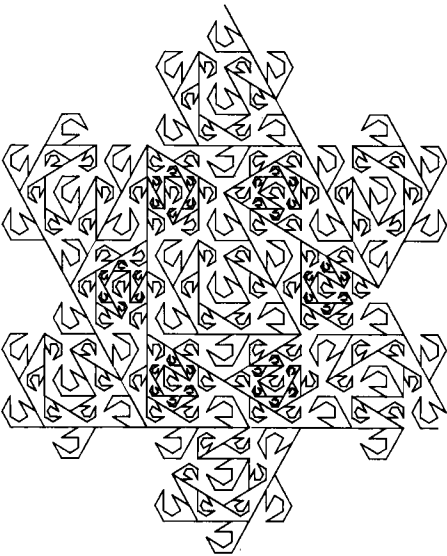

```
10  DIM S(13,7),D(13),L(13),F(13
    )
20  DEG
30  CLEAR
40  DISP "ORDER TO PLOT";
50  INPUT N
60  CLEAR
70  SCALE -1,14.74,-11,1
80  H0=10
90  RESTORE
100 FOR I=1 TO 13 @ READ D(I),L(
    I),F(I)@ NEXT I
110 L0=H0
120 X0=H0*SQR(3)/2
130 Y0=0 @ X=X0 @ Y=Y0 @ K=1
140 MOVE X,Y
150 S(1,1)=N
160 S(1,2)=90
170 S(1,3)=L0
180 S(1,4)=1
190 GOSUB 220
200 BEEP @ DISP "DONE !"
210 STOP
220 IF S(K,1)=0 THEN 360
230 J=1
240 IF J>13 THEN 340
250 S(K,5)=J
260 S(K+1,1)=S(K,1)-1
270 S(K+1,2)=S(K,2)+D(J)*S(K,4)
280 S(K+1,3)=S(K,3)*L(J)
290 S(K+1,4)=S(K,4)*F(J)
300 K=K+1
310 GOSUB 220
320 J=S(K,5)+1
330 GOTO 240
340 K=K-1
350 RETURN
360 D1=S(K,2)+120
370 X=X+S(K,3)*COS(D1)
380 Y=Y+S(K,3)*SIN(D1)
390 PLOT X,Y
400 K=K-1
410 RETURN
420 DATA 60,.3333,-1
430 DATA 60,.3333,1
440 DATA 0,.3333,1
450 DATA 300,.3333,1
460 DATA 150,.19245,1
470 DATA 150,.19245,-1
480 DATA 210,.19245,-1
490 DATA 270,.19245,-1
500 DATA 0,.3333,1
510 DATA 210,.19245,1
520 DATA 210,.19245,-1
530 DATA 0,.3333,-1
540 DATA 0,.3333,1
550 END
```
■

Personal Data Communications -Part 1

by Curtis Adams, Editor

Your HP Series 80 Personal Computer opens the world of personal data communications to you. If this new world is unfamiliar landscape, you should read this two-part series. Part 1 provides background information and covers computerized data bases in some detail. Part 2 will focus on computer conferencing and electronic mail. All three main features are available to you now, if you're ready.

Networking—The Concept

Computer networking involves linking together computers via telephone. It also involves linking individuals with information and, as we shall see, has the potential to substantially impact society. By way of getting started, I'll just list some of the functions that networking can provide:

- Electronic mail—less expensive, faster, and easier than conventional mail.

- Electronic bulletin-boards—to maximize the awareness of products, services, and events.

- On-line conferencing—to develop and exchange ideas.

- Bartering—to save taxes and stimulate business.

- On-line newsletters—timely, convenient, comprehensive, and focused.

- On-line marketing—including on-line product data bases, on-line order processing, and electronic funds transfer.

- Computerized data bases that can be searched to provide personalized news and information.

- Entertainment unique to the media— including interactive novels.

- Educational resources—for example, management simulation games.

All of these features are available now. You can access them with your HP Series 80 Personal Computer equipped with the serial interface, an I/O ROM, a Bell-103-compatible modem, and the software that makes it all play. In this article we'll look at a few of the above functions and exactly how you would set up your HP Series 80 Personal Computer to access them. But first, let's look briefly at the significance of the medium.

Computer networking will affect the way we interact, the way we're informed, educated, and entertained. Lets just list some effects first and then go on to consider how they arise by looking at specific examples.

- Fewer middlemen and retailers, with accompanying lower retail prices.

- Lower white-collar overhead, with lower cost of manufactured goods.

- Increased cottage industry and self employment.

- Reduction in automobile/truck use, with lower energy consumption.

- An increased rate of change; an increased need for continuing education; increased personal communications.

- Changes in advertising, controlling copyrights, and enforcing taxes.

Imagine the potential effects on our culture, on time, on entertainment.

Let me illustrate some of these points. Imagine that you're a retailer, and that computer networks are firmly in place. You don't need a store-front, because customers won't be getting in their cars to go shopping. You don't need advertising or salespeople because customers' computers can find goods without either. Customers will fill out their own orders on your computerized order blanks, and electronic transfer of funds completes the picture.

Or consider this: when it doesn't take four days to transmit a letter across the country, or five tries to reach a person on the telephone, network members should be able to keep in touch with four or five times as many people.

Imagine the possibilities for new kinds of games. At Xerox's Palo Alto research center, there's a version of computerized Star Trek that never starts or ends. People join in from their desk terminals and search around the simulated universe for another player to engage in battle.

Networks take employees out of the office (they decentralize things in general), making commuting more than once or twice a week unnecessary. Ultimately, many of the details of society will be handled by networks. Then, people will belong to half a dozen or more networks to fill their needs; anyone not participating in networks would be shut out.

The Medium

What we're talking about here is a new medium. When you sit down in front of your HP Series 80 Personal Computer and log onto a network, something strange happens. You lose track of your physical surroundings and move inside one point. Inside that point you have all your files, your entire office, and all the space you need to meet with other people. [1] You enter the domain of pure thought. It is in this regard that networks are so profound—they are a thinking-prosthetic. Computer networks are tremendously useful for organizing and formalizing your thoughts.

This is why electronic mail really shines. It's as fast and more efficient than the telephone, but because it's a written medium, people have more time to spend refining their thoughts than they do in oral conversation. The material they transmit is more highly developed. On the receiving end you can digest the information much faster because you can zoom in on what you want or need to focus on. You're not encumbered by the pauses and hesitations that occur in oral conversation.

The computer-network medium provides two things: information and communications. Let's look first at information, at its value in our society, and how information is affected by the medium. **Alvin Toffler** has presented in *The Third Wave* [2], compelling arguments that we're on the threshold of a post-industrial society. Like capital in an industrial society, information is the working fluid of the post-industrial society. Those who have information will be in control, and the gap

between those with information and those without it will be as significant as the gap between rich and poor in an industrial society.

Here's an example. Suppose that you're an investor with a lead on what you feel is a brilliant technique for desalinating water, but before you sink much money into it, you want to feel more confident that it's technically feasible. Even though you are technically competent in recombinant DNA, what you require is expert knowledge in biophysics. An expert, who guards that special knowledge and, in a sense, controls that information, is likely to be very expensive. But knowing your way around computerized-data bases, you can pull together dozens of reports, gathering enough information to assess the state of the art, the feasibility, what technology exists, and what technology remains to be developed. Your search might also point you in new directions and generate new and better ideas.

What we have here is not just information but information reshaped by the computer network medium. Networks are a way of bringing together all the knowledge in all the highly-specialized fields and branches within fields. They give us a handle on all this information and they save us from having to re-invent things. They will prove to be the exponent of the information implosion.

Scientists have been among the first to establish networks. Instead of having to spend great chunks of their time combing journals for relevant research reports, scientists can now have their own customized electronic journals that present only the information they require. No wading through scores of journal articles for tidbits. And, the information is more current.

Because data are being obtained at such a phenomenal rate, it is no longer even practical to publish data in journals. Now there are many publicly available data bases that allow machine searching of that huge body of scientific and technical data. It is now possible for scientists to automatically search several data bases and create their own personalized information base organized for their needs. Since data obtained over the network is already in machine form, it can be analyzed without having to be re-entered. And these data bases can be accessed from anywhere in the world, making us one worldwide community. You can read about the **Dialog™ Information Retrieval Service**, one of the largest technical data bases in the world, in the June, 1981 issue of *BYTE* magazine.

™—*Dialog is a registered trademark of the* **Lockheed Missile and Space Co, Inc.**

Available Networks

All networks have their own specialties. Costs also vary; some are even free. The information utilities are aware of the great potential they have and are scrambling to bring new data bases on their systems. They're working with reservation agencies, real estate listing services, press services, and libraries. They're all experiencing growing pains too. The most common problem is

that capacity is not growing fast enough to keep up with demand, and systems become unresponsive. Users are annoyed by delays and have to endure slow systems. Another problem is that there is no standard protocol — commands on one network generally are not the same as commands on another.

CBBS (Community Bulletin-Board System)

As the name implies, these systems mostly contain information of interest to the community—want ads, greetings, and general graffiti. Some contain data bases on special topics like medicine, aviation, and ham radio. It is a grass roots electronic mail movement. Anyone who wants to can get on the system and leave or read a message. They can search for messages from a certain individual or about a certain subject. Roaming around on a Los Angeles CBBS network, I ran across a message from someone I'd lost contact with years ago.

At first, I couldn't understand why people operated these networks at no charge. The resounding answer — they do it for fun! There are no operating expenses beyond the initial hardware purchase. Someone with a personal computer and an auto-answer modem simply makes his system available to anyone who wants to call up and use it. The software is such that the protocol for using all CBBS networks is the same and is hardware independent.

Current CBBS phone number directories are available from several sources. Try the **MAG-MEDIA-80 CBBS** (415) 573-8768 or contact me on The Source.

The Source

There are many networks; the one we'll review in this issue is The Source. Subscribers can dial one of 300 local phone numbers in North America and throughout the world and gain access to scores of data bases and can communicate with each other via electronic mail and on-line conferencing. The Source qualifies as a consumer data base on two counts—it's affordable and it's easy to use. Using the SOURCE COMM program in the Users' Library (page 3), all you have to do is turn on your HP Series 80 Personal Computer and dial the phone. The program turns your machine into a smart terminal with local file control. That is, you can create, edit, and save files off-line (no connect time charges), log onto The Source, and transfer these files out (called uploading). You can also capture information displayed on your screen and save it in local files (called downloading). These files may be letters, reports, orders, application programs, etc.

The Source offers access to several data bases, including the following business and financial information: stock market quotations, commodity reports, bond prices, exchange rates, stock market averages, closing statistics, news, quotations, and summaries.

There are daily news features including UPI wire service, Washington hotline, sports news, a daily news summary, and business and financial news. The New York Times Consumer Data Base is also on line, one of the world's largest data bases. There's a customized information research service, a discount buying service, and a travel club for electronic reservation and confirmation services. Subscribers planning a trip can learn about special events at their destination or the local restaurants and can often make advance reservations.

Entertainment hasn't been neglected. There's a complete computer games library, wine-tasting information, gourmet meal recipes, syndicated features on home entertainment, chess club, bridge, and a restaurant guide.

We'll use The Source to look at computer networking from a very practical, user's point of view.

Located in McLean, Virginia, five-inter-connected mainframe computers are silently churning, transferring packets of information in short bursts. Just pick up the phone, dial a local number, and place the receiver in an acoustic coupler, and your HP Series 80 Personal Computer is plugged into a vast network. Now you can maneuver through the corridors of information looking for treasures. In this greatest of all adventure games, you're armed with some extraordinary weapons, like HELP and key-word searching. HELP is the resident wizard. Whenever you don't know what to do next, type HELP and the rules and your options are explained. There are very few ground rules, and knowing these, brand new users can get where they want to be in just a few minutes. Suppose, for example, that you want to know what is going on with the space shuttle, and you've never used The Source before. In fact, I'll assume that all you know is that the master index of all The Source's data bases can be accessed by typing DATA LIBALL. Type it and here is what you get ☞

A few libraries look promising but you decide to try United Press International first and type DATA UPI for the instructions on how to use that data base. You'll learn that the data base is divided into National, Regional, or State news or Features, and further classified as General, Business, or Sports. Type UPI N G hoping that space shuttle news is filed in the National, General section.

Now, one of the most powerful features of computerized-data bases is at your disposal, key-word searching. Type space shuttle and every article in the UPI wire service that mentions space shuttle will be presented to you. There you have the information you were after. I must admit that key-word searching is something you have to learn to use. The first time I tried this, I typed shuttle and got an article on *shuttle* diplomacy. (See next page.)

Roaming around The Source is a lot of fun, and proficiency comes very quickly. But data base access is only half the story. The other half is communicating with others, electronic mail, and computer conferencing. We'll talk about them in the next issue.

It's Here Now

Why don't you get a Source account and send a "letter" to me? My Source address is TCX248. I'll send you salutations, a warm welcome, and a copy of "TXTED3" and the documentation over the wire. (The program is reviewed on page 4.) What you need in the way of equipment in addition to your HP Series 80 Personal Computer is the HP 82939A Serial Interface ($395.00), the I/O ROM (part number 00085-15003; $295.00), and any of the commercially available Bell-103-compatible-modems (costing $100 to $300). If you don't already have a ROM drawer, you'll need it too. The

software required is available from the Users' Library. You can order it using the Users' Library order form on the back cover. *SOURCE COMM* and "IPBIN" are necessary; "TXTED3" and "DGTSAV" are highly desirable (Catalog numbers 900-0044, 900-0024, 900-0043, and 900-0022; $6.00, $12.00, $6.00, and $12.00, respectively).

The last expense is a one-time, $100.00 fee to subscribe to The Source. More information on The Source can be obtained by writing to Source Telecomputing Corportion/ 1616 Anderson Road/ McLean, Virginia 22102. Their phone number is (703) 821-6660.

```
>data liball

                        *** THE SOURCE ***

ADVANCED APPLICATIONS & PROGRAMS.................DATA ADAPPR
ADVICE COLUMN....................................DATA LORE
AIRSCHEDULES.....................................DATA AIRSCHED
ANNOUNCEMENTS (UPDATED FREQUENTLY)...............DATA ANNOUN
ASTROLOGY LIBRARY ...............................DATA ASTRO-LIB
AWARE FINANCIAL SERVICE GLOSSARY.................DATA GLOSS
BARTER-TRADE NETWORK.............................BARTER
BRIDGE ACCORDING TO THROOP.......................DATA BRIDGE
BUSINESS & FINANCE...............................DATA BIZDEX
CALCULATOR.......................................DATA CALCUL
CAREER NETWORK...................................EMPLOY
CLASSIFIED ADS...................................DATA CLASSI
CONSUMER INFORMATION.............................DATA CONSUM
CROSS X-ASSEMBLERS...............................INFO X-ASSEMBLERS
DINING OUT:   WASHINGTON, D.C....................RESTGD
              NEW YORK CITY......................NYRESTGD
              CONTINENTAL U.S. & CANADA..........USREST
DISCOUNT SHOPPING SERVICE (MONEY SAVERS).........DATA BUCKS
EDUCATION........................................DATA EDUCAT
ENERGY SAVING NEWS & TIPS........................ENERGY
FINANCIAL NEWS...................................DATA BIZDEX
GAMES............................................DATA GAMES
HOME ENTERTAINMENT...............................DATA HOMENT
INFORMATION ON DEMAND............................DATA IOD
MAILCALL.........................................DATA MAILCALL
MAIL DELIVERY....................................INFO DATAPOST
MOVIES REVIEWS BY JAY A. BROWN...................MOVIES
MUSIC TO ORDER...................................MUSICSOURCE
NEW YORK TIMES NEWS SUMMARY......................DATA NYTNS
NEW YORK TIMES CONSUMER DATA BASE................NYTCDB
PERSONAL CALENDAR & NOTEBOOK.....................DATA PERSON
PERSONAL FINANCE.................................DATA PERSFI
POLITICAL ACTION REPORT..........................DATA PAR
PORTFOLIO MANAGEMENT.............................DATA FOLDEX
RADIO PROGRAMS TO ORDER..........................RADIOSOURCE
RAYLUX FINANCIAL SERVICES........................DATA FINANCIAL
SCIENCE & ENGINEERING............................DATA SCIENG
SELF-PERCEPTION..................................PLAY ICHING
SMITHSONIAN EXHIBITS AND TOURING EXHIBITS........DATA MUSEUM
SPECIAL APPLICATIONS.............................DATA COMPUDEX
SPORTS...........................................DATA SPORTS
STUDENT AID......................................COLLEGECASH
SUGGESTION BOX...................................DATA SUGBOX
TRAVEL CLUB......................................DATA TRAVEL
UNISTOX..........................................UNISTOX
UNITED PRESS INTERNATIONAL (UPI).................DATA DANEWS, DATA UPI
VOICEGRAM........................................DATA VOICEGRAM
WEATHER..........................................DATA WEATHR
WINE.............................................WINE
WISDOM OF THE AGES...............................WISDOM
```

```
>UPI N G

KEY WORDS (PRESS RETURN FOR ALL STORIES):
SPACE SHUTTLE

ENTER STARTING & ENDING DATE - OR PRESS RETURN FOR TODAY
3/20/81-

PICK A STARTING STORY NUMBER - FROM 1 (THE EARLIEST)
TO    35 (THE LATEST).
35

READ FORWARD IN TIME (RF), READ BACKWARD (RB),
SCAN FORWARD (SF) OR SCAN BACKWARD (SB)?
RB


  35 -02-81 10:19 aes
By AL ROSSITER JR.
UPI Science Editor
    CAPE CANAVERAL, Fla. (UPI) _ Space shuttle astronauts John Young
and Robert Crippen enter medical quarantine tonight to minimize their
exposure to contagious diseases during the final week before launch
April 10.
    The astronauts will remain in Houston until they fly to the Kennedy
Space Center Tuesday and take up lodging in remodeled quarters where
Young twice stayed before flying to the moon.
    Doctors say the spacemen must stay 30 feet away from anyone not on
a special list of people who have been checked to make sure they do not
have any infectious diseases. More than 700 people, including the
pilots' families, are on that list.
    After surmounting one technical problem after another during the
past few years, project officials want to make sure the shuttle's maiden
54 ( hour orbital test flight is not delayed by a sick crewman.
    NASA acting administrator Alan Lovelace said Wednesday that weather
appears to be the factor most likely to interfere with the launch of the
```

With this equipment and software, you can also access hundreds of free Community Bulletin-Board System networks.

If you can't afford to invest several hundred dollars to improve your information access, be patient; the entry fee will be dropping rapidly in the near future. The number of networks suited to your needs will also be increasing dramatically as information access is integrated into a much broader system for entertainment, education, and commerce. Unlike the long time it took for telephone and television networks to get in place, computer networks could explode into place almost overnight; they can just ride "piggyback" on these earlier-established networks.

Even though the telephone has been around for a hundred years, telecommunications is something in which you can still pioneer. It is my feeling that, if you can, you should jump in with both feet right now and learn the in's and out's of the medium—the first to enter will develop the most effectiveness.

You probably didn't realize it when you bought your machine, but over the next few years, communications will become your most important application. For many of you it could be your most important application right now. ■

1. Art Kleiner. NCC '80 Personal Computing Digest. AFIPS Press; Box 9657; Arlington, Virginia 22209
2. Toffler, Alvin. The Third Wave. New York: Morrow 1980

Questions and Answers

As a result of the questionnaire in the last issue, along with some good data I received hundreds of questions. Fortunately for me, most of them were the same; I'll answer them here. If you have further questions, ask them, and look for the answers in the next issue.

Q. Other languages?

A. Now that the Assembler ROM is available, some among you will use it to develop languages beyond BASIC for Series 80 computers. In fact, in the May update to the Series 80 Software Catalog, you'll find HP-83/85 FORTH (Catalog no. 900-0040; $50.00 including 5-1/4" flexible disc). FORTH is a computer language that is used for controllers and anywhere else relatively high-speed and dense code is required. This version is adapted from the FORTH Interest Group's (FIG) FORTH Model. Included are an assembler, a FORTH decompiler, a string handling package, and alpha and graphics CRT control. The program is not designed to teach programming in

FORTH, but a manual entitled "Using FORTH" is available for purchase through an order form included in the program documentation. A 16K Memory Module, Mass Storage ROM, and HP Series 82900 Flexible Disc Drive are required. This software was contributed to the Users' Library by Larry Woestman and Tom Houser. Please note that user-contributed programs are not supported by Hewlett-Packard.

Q. Terminal emulator?

A. By far the most frequently asked question concerned data communcations. Not so coincidentally, the subject is one of the main themes of this issue. It is one of the applications that crosses the business/technical user boundary. If you aren't aware of what is happening in this area, you owe it to yourself to read the "Personal Data Communications" article. If you're ready to do it, the software is available from the Users' Library— SOURCE COMM allows you to use The Source and the free Community Bulletin Board Systems for access to a wealth of information and electronic mail. Refer to the Users' Library column for a complete discussion of this software. The only hardware required is an I/O ROM, the serial interface, and any of the commercially available Bell-103-compatible modems.

Q. Merge programs?

A. A column in the first issue of BASIC EXCHANGE discusses a technique for merging two programs or inserting part of one program into another, using the CRT memory as a buffer.

The binary program "DGTSAV" (Catalog no. 900-0022; $12.00 plus media cost) can also be used for this purpose. If you didn't pick that up from the last issue, please re-read the Binary Utilities discussion (V2N1, page 6)—there's a lot of hidden gold in those binary programs.

Q. Back issues?

A. All three back issues of BASIC EXCHANGE are available and presently free. Just send us your request, attention Curtis Adams, Editor.

Q. Keyboard masking?

A. The I/O ROM adds keyboard masking to your system's capabilities. With the ENABLE KBD command, you can disable certain keys while a program is running to prevent inexperienced operators from unwittingly crashing the program, destroying data, or otherwise having a hard time. The binary program "IPBIN" (Catalog no. 900-0024; $12.00 plus media cost) also provides this capability. ·

Q. Accessories/Prices?

A. Your local HP dealer has two brochures in particular that are real jewels. The HP Series 80 Hardware brochure (5953-1969) and the HP Series 80 Software brochure (5953-1966) are 16-pages each, containing detailed descriptions of current Series 80 peripherals, firmware, interfacing, and application pacs, with technical specifications. Your dealer also has current price lists.

Q. The disc stops?

A. The motor that spins the disc in the Series 82900 Flexible Disc Drive stops when the disc is not being accessed. This is done for two good reasons—it eliminates media wear and it extends the life of the bearings and brushes in the motor. The system waits for 2.5-seconds after an access before stopping, so that during frequent accesses the disc spins continuously with no time spent stopping and starting the motor. The inertia of the disc and motor is low, so the disc is up to speed quickly, and operations like head positioning overlap motor start up. Access time can be computed from the following table:

Track to track	5 milliseconds per track
Head settle	15 milliseconds
Latency (the time	200 milliseconds maximum
for the desired	100 milliseconds average
sector to rotate	
to the head)	
Motor start up	250 milliseconds

Q. Error 19: MEMORY OVERFLOW ?

A. When using string variables on the HP-85, some operations require a temporary memory space for processing. Therefore, it is possible to have a memory overflow even though the program with dimensioned string variables seems to be well within memory limits. String concatenation using "&", READ#, PRINT#, and OUTPUT all require this "scratchpad" memory. The problem arises when the operand is a very long string variable, because the scratchpad memory is required in addition to the dimensioned variable space. Here are some tricks that can be used to minimize temporary memory requirements:

1. Concatenating strings without "&".
   Use substring operations instead; for example, to add a string to the end of A$ whose length is 10,000:
   ```
   A$[10001,10013]= "END OF STRING"
   ```
   When accessing data files using READ# and PRINT#, break the string into pieces and concatenate with substring notation. For example, the following routine will read a 25,000-character string (broken into 250-byte pieces) and will require only 595 bytes of temporary memory, including the buffer.
   ```
   10 DIM Z$ [25000]
   20 ASSIGN# 1 TO "DATA"
   30 FOR X=1 TO 100
   40 READ# 1,X ; Z$ [X*250-249,X*250]
   50 NEXT X
   60 ASSIGN# 1 TO *
   ```

2. PRINTing or OUTPUTing substrings.
   Rather than attempt to OUTPUT the whole string, OUTPUT segments, as follows:
   ```
   OUTPUT 702 USING "#,K"; A$ [1,250]
   OUTPUT 702 USING "K"; A$ [251,500]
   ```
   Or, use SEND instead of OUTPUT; SEND does not use temporary memory.

3. Deleting characters in mid-string. Use substring notation as follows:

```
Z$ [1500, 2499] = Z$ [1501, 2500]
Z$ = Z$ [1,2499]
```

The second statement is necessary to adjust LEN (Z$).

4. Inserting characters in mid-string: There is no way to avoid using "&" here, except by using the binary program "HANDY". "HANDY" includes several commands for string manipulation and string arrays, and is available from the Series 80 Users' Library.

Q. Black-printing thermal paper?

A. You have a choice of thermal papers for your HP-85, one that prints blue and one that prints black. Because some photocopiers don't pick up blue tones, you may require the latter. Order HP 82951A Paper (6-rolls, 120-meters each); $90.00.

Q. 112K bytes of memory?

A. In the CPU architecture article (V1N2), I said that two bytes of address information could be sent on the bus. This limits the addressing to 64K bytes, yet Series 80 machines can have up to 32K of RAM and up to 48K (6 * 8K) of option ROMs in addition to the 32K operating system. This all adds up to 112K bytes of memory space. How is this achieved?

The CPU architecture supports block-switching of memory segments. The map below illustrates where everything is located in the 64K memory space.

I/O addresses	-65535
	-65280
upper 16k memory (optional)	
	-49152
lower 16k memory (standard)	
	-32768
O.S. ROM 3 and all other ROMs	
	-24576
O.S. ROM 2	
	-16384
O.S. ROM 1	
	-8192
O.S. ROM 0	
	-0000

Note that the upper 16K does not get a full 16,384 bytes. 256 bytes are "stolen" from this address range for all I/O addresses. The internal and external I/O is memory mapped and resides in this range.

The main operating system ROM number 3 and all option ROMs share the address range of 24576 to 32767. Only one of the ROMs is selected at a time. When the main system wishes to access a particular ROM in the block switch range of addresses, it writes a select byte into reserved I/O address. This reserved address is recognized by all the ROM chips that reside in the 24,576 to 32,767 range.

Q. Need to duplicate data files?

A. J. H. Randall of Stellenbosch, South Africa, has written a data file editor and contributed it to the Users' Library. GENFED (Catalog no. 9000-0039; $15.00 plus media cost) allows you to examine the contents of a file, modify it, and create a copy. Note that the binary program "VFYTYB" (Catalog no. 900-0007; $12.00 plus media cost) is required by the program.

Q. Alpha mode cursor control?

A. You can move the cursor to any location on the CRT with MOVE CURSOR, a BASIC command supported by the binary utility program, "LINKEY". MOVE CURSOR column, row makes full use of the 32 columns and 16 rows of the CRT, allowing you to do fast graphics in alpha mode.

If you require something fancier still, a second program, "IPBIN", provides the following BASIC commands:

CCURSOR numeric expression positions where the next character will be written. The numeric expression can evaluate to a number from 0 to 2047; that is, the cursor can be positioned anywhere in CRT memory (four screens). CCURSOR does not affect where the current display window is.

CLINE numeric expression positions where the CRT display window starts, with the numeric expression ranging from 0 to 63.

CCLEAR clears the entire CRT (CLEAR only clears the current window) and positions the window and the cursor position to the start of display memory.

CCPOS is a function that returns a numeric value indicating the current cursor position from 0 to 2047. This function allows relative cursor positioning.

CLPOS is a function that returns a numeric value that indicates the current window position (which line is the first line displayed on the screen, from 0 to 63). It allows you to establish a reference point for the current display window.

The binary program "IPBIN" is Catalog no. 900-0024 and costs $12.00 plus media cost.

Q. String arrays?

A. Another binary utility program, "HANDY" (Catalog no. 900-0041; $12.00 plus media cost), allows a string variable to serve as a one-dimensional string array. "HANDY" is described in the Users' Library column on page 3. ∎

More On Sorting

After reading the sorting article in the last issue, a couple of readers wrote letters expounding on the virtues of using the Matrix ROM (part number 00085-15004; $145.00) for sorting applications. Professor Bruce Liebert of the University of Hawaii compared his four-line sort routine (below) with the Shell-Metzner routine with these results:

No. of elements (N)	Time (minutes)	
	Matrix	Shell-Metzner
100	0.44	0.68
200	1.73	2.21
500	10.65	5.81
1000	42.33	14.27

The sorting speed is the same regardless of the order of the data. Also, a second array is available that may be useful when the routine is used as part of a larger program. The Matrix ROM makes loading the data quick and easy and accesses stored data quickly.

```
10 OPTION BASE 1
20 DIM A(1000),B(1000)
30 DISP "HOW MANY NUMBERS (MAX=
   1000)";
40 INPUT N
50 REDIM A(N),B(N)
60 RANDOMIZE
70 FOR I=1 TO N
80 A(I)=IP(100*RND+1)
90 NEXT I
100 Z1=TIME
110 FOR I=1 TO N
120 B(I)=AMIN(A)
130 A(AMINROW)=INF
140 NEXT I
150 Z2=TIME
160 Z3=(Z2-Z1)/60
170 MAT DISP B
180 PRINT
190 PRINT "SORTING TIME WAS";Z3;
    "MINUTES FOR";N;"RANDOM NUMB
    ERS USING MARTIX ROM FUNCTIO
    NS."
200 END
```

Here is a program that uses the Shell-Metzner sort to alphabetize a list of names. To do so, the program puts alpha strings into a numeric array by converting the string characters into their decimal codes, an idea developed by **Wesley Lindsay** of San Jose, California. Note that a maximum of six characters can be converted into a 12-digit number, but six characters so converted require only eight bytes of storage. The program uses an interleaved storage technique (which can be extended further) to accomodate strings of up to 18 characters.

You'll find this routine limited, but useful for simple things like distribution lists. To use the program, after you've entered all the names, just type "SORT", and they will be displayed in alphabetical order (based on the first six characters). The binary program, "LINKEY", permits commas to be used. Just delete lines 30 and 40 and change "LINPUT" to "INPUT" if you don't have the binary.

```
10 OPTION BASE 1
20 DIM A$[32],C$[2],A(600)
30 ON ERROR GOTO 50
40 LOADBIN "LINKEY"
50 ON ERROR GOSUB 270
60 FOR I=1 TO 200
70 DISP "NAME(LAST, FIRST)";
80 LINPUT A$
90 A$=A$[1,18]
```

```
100 IF A$[1,4]="SORT" THEN GOTO
    280
110 B=0
120 FOR J=1 TO 6
130 B=B+NUM(A$[J,J])*10^(12-2*J)
140 NEXT J
150 A(I)=B
160 B=0
170 FOR J=7 TO 12
180 B=B+NUM(A$[J,J])*10^(24-2*J)
190 NEXT J
200 A(I+200)=B
210 B=0
220 FOR J=13 TO 18
230 B=B+NUM(A$[J,J])*10^(36-2*J)
240 NEXT J
250 A(I+400)=B
260 NEXT I
270 IF ERRN=56 THEN RETURN ELSE
    DISP "ERROR";ERRN;"ON LINE";
    ERRL @ STOP
280 ! SORT ROUTINE
290 OFF ERROR
300 N=I-1
310 M=N
320 M=INT(M/2)
330 IF M=0 THEN GOTO 440
340 FOR S=1 TO M
350 I=S @ J=S+M @ Z=0
360 IF A(I)<=A(J) THEN GOTO 390
370 Z=1 @ R=A(I) @ A(I)=A(J) @ A
    (J)=R @ R1=A(I+200) @ A(I+20
    0)=A(J+200) @ A(J+200)=R1
380 R2=A(I+400) @ A(I+400)=A(J+4
    00) @ A(J+400)=R2
390 I=J @ J=J+M
400 IF J<N+1 THEN GOTO 360
410 IF Z THEN GOTO 350
420 NEXT S
430 GOTO 320
440 ! CONVERT A(I) TO C$
450 FOR I=1 TO N
460 A$=""
470 B=A(I)*10^-10
480 GOSUB 540
490 B=A(I+200)*10^-10
500 GOSUB 540
510 B=A(I+400)*10^-10
520 GOSUB 540
530 GOTO 610
540 FOR J=1 TO 6
550 IF NOT IP(B) THEN GOTO 610
560 C$=CHR$(IP(B))
570 B=FP(B)*100
580 A$=A$&C$
590 NEXT J
600 RETURN
610 PRINT A$
620 NEXT I
630 END
```
■

Survey Results

BASIC EXCHANGE SURVEY
AGE DISTRIBUTION

BASIC EXCHANGE SURVEY
EXPERIENCE LEVEL
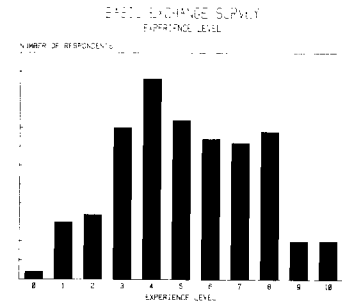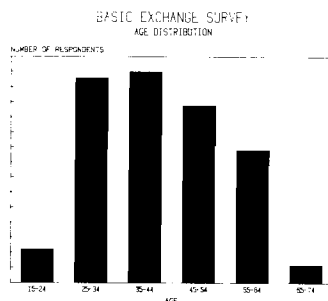
Thanks! The survey in the last issue drew a 10-percent response. That's more than enough data to get a statistically-significant picture of BASIC EXCHANGE readers. Above you'll find some histograms that will give you an idea of the company you're keeping.

There were some surprises. A lot of you program (85-percent), and according to your self-evaluations, you're good at it. And even though 82-percent of you use it either at work or both at work and at home, 18-percent use it exclusively at home! ■

## Excerpts From "On the Uncertainty of Science"

by Lewis Thomas

"What I would like to know most about the developing earth is: Does it already have a mind? Or will it someday gain a mind, and are we part of that? Are we a tissue for the earth's awareness?...

"I would like to think that we are on our way to becoming an embryonic central nervous system for the whole system [the planet earth]. I even like the notion that our cities, still primitive, archaic, fragile structures, could turn into the precursors of ganglia, to be ultimately linked in a network around the planet...

"But I do worry, from time to time, about that other possibility: that we are a transient tissue, replaceable, biologically representing a try at something needing better means of perfection, and therefore on our way down under the hill, interesting fossils for contemplation by some other kind of creature... [Perhaps a silicon-based life-form?] The great successes in evolution, the mutants who have, so to speak, made it, have done so by fitting in with, and sustaining, the rest of life. Up to now we might be counted among the brilliant successes, but flashy and perhaps unstable. We should go warily into the future, looking for ways to be more useful, listening more carefully for the signals, watching our step, and having an eye out for partners. [Computers?]"

Lewis Thomas is chancellor of the Memorial Sloan-Kettering Cancer Center in New York. "On the Uncertainty of Science" was presented in June, 1980 as the Harvard Phi Beta Kappa Oration. Excerpts from *Harvard Magazine* are reprinted with permission.
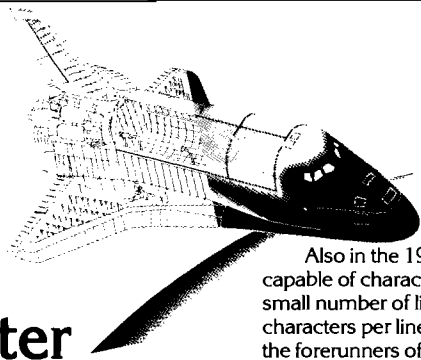
What is Computer Graphics? Part 1

by Craig Schmidt, Product Marketing Engineer, and Virginia Pollack, Senior Technical Writer, Hewlett-Packard, San Diego Division

This is the first in a four-part series of articles written to familiarize you with computer graphics. We will look into what computer graphics is, its origin, the various types of computer graphic devices and their uses, and most importantly, what computer graphics can do for YOU! You don't have to be a computer whiz to read this; you don't even have to like computers; just sit back, take a few minutes, and enjoy.

Let's start by saying that computer graphics is a pictorial or graphic representation, displayed or produced by a computer . . . a clear and lively, artistic rendition of numbers, images, or pictures. How many times, when trying to discuss a complex problem, have you drawn a picture, a graph, or a chart to get your point across? There you have it, graphics at work!

To get clear and lively artistic images, we need some way to draw or display the graph—a CRT, a line printer, or a graphics plotter. The computer converts numeric information into graphic format, modifies existing graphic information, or simply retrieves any graphic information previously stored. With these two elements, we can enter, anaylze, save, and display, in many forms, various types of charts, graphs, pictures, or artistic representations of simple or complex data.

A Brief History

Like many of the new technologies of recent years, computer graphics were first developed for U.S. military applications. In the mid- and late fifties, the SAGE (Semi-Automatic Ground Environment) air defense system used a display screen to give visual indication of the positions of aircraft. Following this, in the early 1960s, Ivan Sutherland, in a federally funded project at MIT's Lincoln Labs called Sketchpad, pioneered the areas of data structure and software necessary for today's high-performance graphics systems.

Computer graphics at that time required the largest and most expensive computers, and only universities, governments, and large industries could afford the high price tag. Several computer-aided design (CAD) systems for automobile, aircraft, and missile design came about independently during the 1960s. These systems allowed engineers to alter design parameters and then see the effects displayed on the screen. Data on how the new parameters would affect such areas as cost, strength, and aerodynamic efficiency were also immediately obtainable.

Also in the 1960s, a variety of display screens capable of character generation, but limited to a small number of lines with a fixed number of characters per line, were developed. These were the forerunners of today's high-resolution raster graphics devices. (We'll get to "raster" later). In the late 1960s a new type of display appeared on the market place, the storage tube display. This was the first low-cost terminal priced between $4,000 and $15,000. Its introduction stimulated the development of other technologies, such as lower-cost stroke writing refresh tubes and raster scan converters, the two main types of display devices used today.

Hewlett-Packard's efforts during this time centered on medical displays, the first of which appeared in 1966. These small-screen, high-resolution displays, which used analog input, were the forerunners of today's medical monitors and were used for such things as fetal monitoring. In 1970 HP entered the large-screen display area with a high-resolution radar display. HP introduced its first graphics terminal for commercial data processing in 1978. A small color vector display was introduced in 1979 and a desktop computer with color CRT in 1980.

New applications of computer graphics continue to be found. In fact, business applications of computer graphics first became significant in the late 1970s. The growth of computer graphics has been made possible by both the expansion of available software and advances in technology. Software ranges from packages that simplify the generation of plots to complete turnkey systems. Hewlett-Packard has developed graphics software, graphics peripherals, and graphics systems for OEMs (original equipment manufacturers) and end users. Programming languages and subsets of languages have been developed specifically to plot graphics. Hewlett-Packard has made a significant contribution in this area with the development of Hewlett-Packard Graphics Language (HP-GL).

Microprocessor technology and the drastic price reductions for computer memory have made possible dramatic reductions in the cost of computer graphics. Use is no longer limited to governmental agencies, large corporations, and universities. Graphics displays and plotters are both available for under $3000. Computer games and electronic toys, as well as commercial systems, use forms of computer graphics unimagined 25 years ago.

Raster vs Vector

Computer graphic output devices are of two main types, raster and vector. A vector device creates graphics by drawing continuous lines from one defined point to another. In general, vector devices provide high-quality output with high resolution. On a vector display, lines are drawn on the CRT by an electron beam moving directly from one point to the next. The beam excites phosphors on the face of the CRT so the lines become visible. A vector display is sometimes called a stroke writer. They are found in the most expensive turnkey systems.

A vector display has a limit to the total length of lines that can be drawn without flicker becoming a problem. Unless all lines can be redrawn within the refresh cycle (normally 1/60 of a second), the plotted data will appear to flicker on the screen.

On a vector plotter, lines are drawn with a pen just as when you write with a pen. Pen speed on a vector plotter is sacrificed somewhat for line quality. The HP 7225 Graphics Plotter is an example of a vector plotter.

A raster device has a fixed number of dots or locations, arranged in a fixed number of rows and columns. You can think of raster as being a two-dimensional matrix or as an area divided into smaller areas, like a sheet of postage stamps. A raster is sometimes described by the number of rows and columns. Thus, a sheet of one hundred postage stamps is a 10×10 raster. The resolution of a raster device depends on, and increases with, the number of rows and columns per unit area. Imagine a giant sheet of postage stamps spread over a section of a college football stadium. This sheet of postage stamps has greater resolution than the card cheering section located in the same area (where each student sitting in the section holds a large "card" over his head to produce a picture) because there are more stamps than cards per unit area.

A raster device creates graphics by selectively turning dots on or off. On a raster graphics printer, dots that are "on" are printed on paper; dots that are "off" result in blank paper. On a raster display, dots correspond to screen locations that are either on or off (illuminated or not illuminated). To determine if a dot is on, a raster device "scans" or examines an area of computer memory many times each second. A raster is usually scanned from top to bottom, one row at a time, left to right in each row. The larger the print or display area, the greater the resolution.

Because a location in computer memory can change value instantaneously, raster graphics on the CRT can be updated in real time. In fact, the image could change every refresh cycle. Raster devices can create filled areas quickly; there is no limit to the amount of a screen's area that can be illuminated. Flicker is not a problem.

Raster printers generally can plot complex graphs more quickly than vector plotters, but with less resolution. The HP 82905A Printer is a raster device. It can print the contents of the graphics display in HP Series 80 Personal Computers.

What's Next? Part 2

In the next article, we will be looking into the many applications for computer graphics in business, engineering, scientific applications, and in the home. Line charting, bar graphing, and pie charting will be discussed in light of their various uses with "Good Graphic Form." Single color versus multiple colors graphic impacts will be evaluated, and also the multi-dimensional aspects of current computer graphics. ∎

SERIES 80 USERS' LIBRARY ORDER FORM

Series 80 Library programs with documentation and complete program listing are priced from $10.00 each ($6.00 each to members when you include your member number). Consult your *SERIES 80 SOFTWARE CATALOG* for program numbers. Always use the correct Library identification number when ordering programs. *Hewlett-Packard offers no warranty, expressed or implied and assumes no responsibility in connection with the program material listed. PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.

NAME _____ MEMBER NUMBER _____

COMPANY (if applicable) _____

STREET ADDRESS _____

CITY _____ STATE _____ ZIP _____

COUNTRY _____

Media Type (Specify cartridge or disc)	Qty.	List Price Ea.	Extended Price

Up to 30 programs may be recorded on each cartridge or disc. If no media type is specified, orders will be filled with program documentation only.

Program Catalog No.	Qty.	Description/Title	List Price Ea.	Extended Price
ADD YOUR STATE AND LOCAL SALES TAXES				
10% Handling Charge for orders outside the U.S. and Canada				

NOTE: If you need more room, attach another sheet of paper.   TOTAL

PAYMENT OPTION (Please check one)
_____ **Cash Payment.** Check or money order enclosed. (Please be sure to include your state and local taxes.)
_____ **Bill my credit card.**
CHARGE TO: _____ American Express   _____ VISA/BankAmericard   _____ Master Card—Include 4-digit number from card
Your credit card account will be billed when your order is shipped.

MY COMLETE CARD NUMBER IS [_____]   EXP. DATE [_____]

SIGNATURE   TITLE   BUSINESS PHONE NUMBER

INTERNATIONAL ORDERS: For addresses outside the U.S. and outside Canda, please add 10% to your order for additional postage and handling. Also, foreign customers, please send money orders in U.S. DOLLARS ATTACHED to your order.

BASIC EXCHANGE
Summer 1981 Vol. 2 No. 2

Information about new hardware and software, new policies, programming and operating suggestions, further reading, and feature articles. Published four times a year for owners of Hewlett-Packard personal computers.
Reader comments and contributions are welcomed and should be addressed to the editor.
Hewlett-Packard Company
1000 N.E. Circle Blvd.
Corvallis, OR 97330 U.S.A.

Hewlett-Packard S.A.
7 Rue du Bois-du-Lan
P.O. Box, CH-1217 Meyrin 2
Geneva-Switzerland

Hewlett-Packard Intercontinental
3495 Deer Creek Road
Palo Alto, CA 94304 U.S.A.

HEWLETT-PACKARD COMPANY
1000 N.E. Circle Blvd.
Corvallis, OR 97330

BULK RATE
U.S. POSTAGE
PAID
PERMIT NO. 814
PORTLAND, OR

Address Correction Requested
Postage Guaranteed

Printed in U.S.A.