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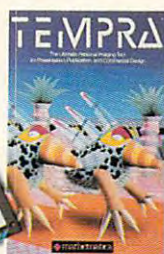
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Clifton Karnes

If Windows is in your future, it pays to know something about the future of Windows.

The Windows Developers Conference, held this past October in Santa Clara, California, showed the shape of Windows to come. As you may already know, Windows is fast becoming a family of products that share a common core of features and functions, and that idea was one of the focuses of the conference.

In Microsoft's recent ads, you see what looks like three interconnected cough drops, each representing a member of the Windows family. The first family member is Windows 3.1, the next is Windows for Workgroups, and the last is Windows NT. And you've probably heard about other flavors of Windows, too—like Modular Windows, Win32s, and OLE 2.0—and wondered where these fit in the family tree.

First, Windows 3.1 is the most recent version of the operating system that's gaining popularity now. It was released last spring and is becoming the interface of choice for the majority of PC users—including COMPUTE's readers.

Windows for Workgroups is a superset of Windows 3.1 that was released last October. In addition to all of 3.1's features, WFW adds extensions for working with other Windows users over a network. It also adds improved versions of 3.1's File Manager and Clipboard plus new programs that offer scheduling, mail, and file sharing.

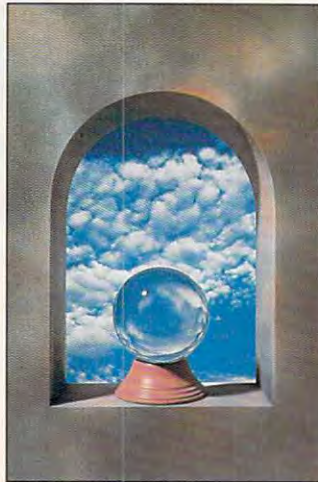
Both Windows 3.1 and WFW are 16-bit versions of Windows. With the exception of one 32-bit magic trick, both operating systems move data 16 bits at a time even on the latest 486 screamer.

Windows NT, however, is a full 32-bit operating system with tons of features to make it lightning fast and network-

ready. With networking built in, Windows NT has something in common with WFW.

As I mentioned earlier, both Windows 3.1 and WFW are 16-bit operating systems, but a special trick lets these environments run some 32-bit code in the form of virtual device drivers, or VxDs.

Microsoft has taken advantage of this feature to create Win32s. Win32s is a subset of Windows NT that will run on Windows 3.1 or WFW using 32-bit VxDs. This gives developers and users a chance to take advantage of a measure of NT-style 32-bit computing



but in Windows 3.1 or WFW.

Modular Windows is simply a subset of Windows 3.1 that's burned in ROM so that it can be used with home video systems or personal digital assistants. Modular Windows is the foundation of Tandy's new VIS home entertainment system.

This Windows family has a common interface and downward compatibility, and soon, all members (except perhaps Modular Windows) will have something else in common: OLE 2.0.

One of the most exciting things at the Developers Conference was Microsoft's an-

nouncement of OLE 2.0, a way of creating compound documents that will be a part of the common interface of Windows 3.1, WFW, Win32s, and Windows NT.

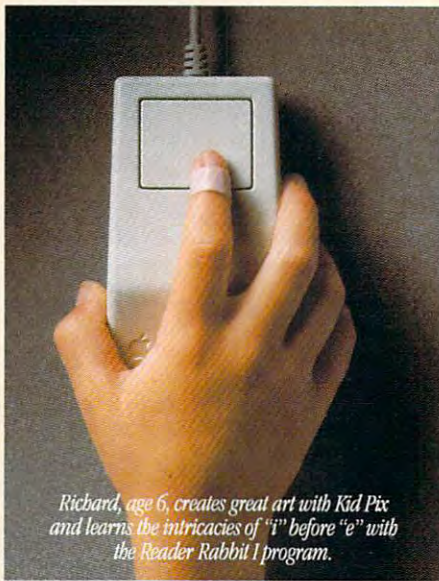
Windows 3.1 supports OLE 1.0, so you may already have an idea of what OLE's about. OLE makes it possible to create documents that contain parts of other documents. For example, a word processor file might contain a section of a spreadsheet, an illustration from a draw program (for the company's logo, for example), and a photograph in the form of a bitmap. With OLE 1.0, you can combine these elements into a compound document and, by double-clicking on an OLE element, call the object's creator with the object loaded and ready to edit.

OLE 2.0, however, takes this one major step further. When you double-click on an OLE object, your host application *becomes* the creator.

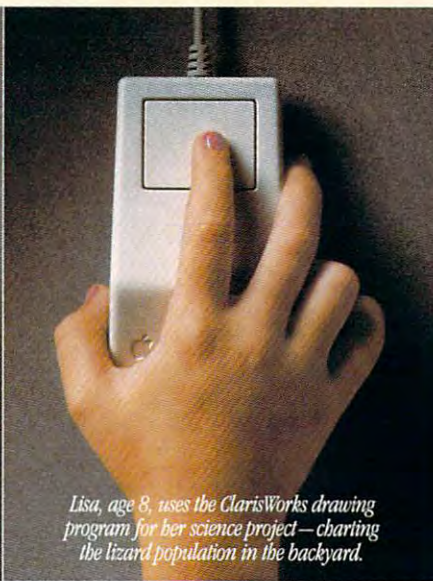
Let's assume you have a graphic created with CorelDRAW! that's embedded inside a Word for Windows word processor document. If you double-click on the Corel graphic, Word for Windows *becomes* CorelDRAW!. The menu bar changes to Corel's menu bar, and Corel's tool palette pops onto your screen. You can edit the Corel graphic without thinking twice about it.

The second major new benefit of OLE 2.0 is that you can create compound documents by dragging objects from one application to another.

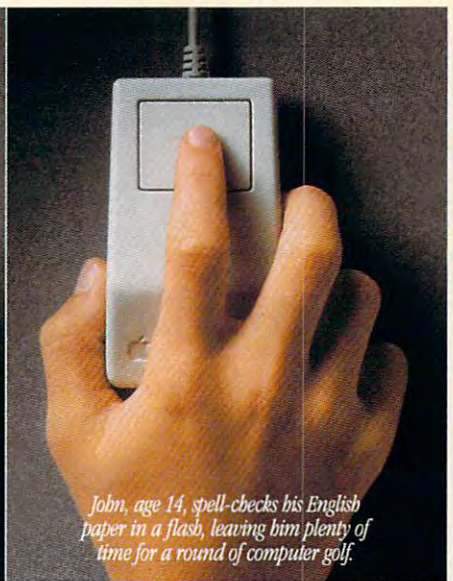
That's the rundown on the Windows family and one of the most interesting aspects of its common interface—OLE 2.0. Stay tuned to COMPUTE in 1993 for more details on these exciting Windows developments and for how-to help in making them useful and productive for you. □



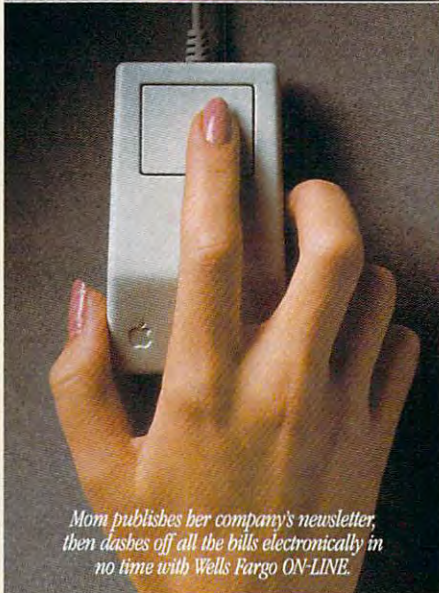
Richard, age 6, creates great art with Kid Pix and learns the intricacies of "i" before "e" with the Reader Rabbit I program.



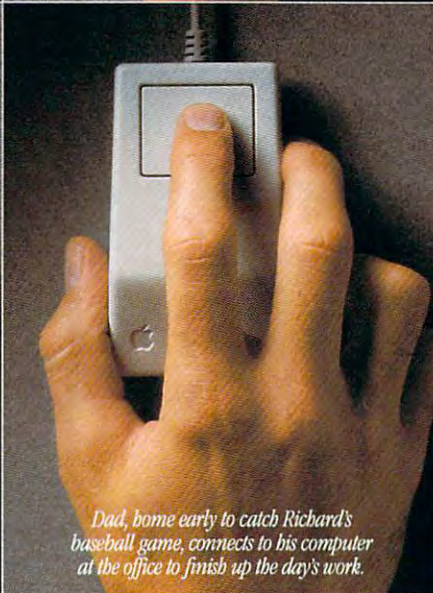
Lisa, age 8, uses the ClarisWorks drawing program for her science project—charting the lizard population in the backyard.



John, age 14, spell-checks his English paper in a flash, leaving him plenty of time for a round of computer golf.



Mom publishes her company's newsletter, then dashes off all the bills electronically in no time with Wells Fargo ON-LINE.



Dad, home early to catch Richard's baseball game, connects to his computer at the office to finish up the day's work.




Rex, tired of being ignored while everyone uses the Macintosh, discovers a new way to grab Dad's attention.

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TEST LAB

Edited by Mike Hudnall

With a remarkable array of input options and powerful tools, today's paint programs make it easier than ever to harness your creative energies, transforming your artistic vision into an attractive finished product, perhaps even a work of art.

This month's Test Lab focuses on five DOS packages and five Windows packages that range in price from \$129 to \$795.

Some of these packages clearly target beginners and casual dabblers, while others offer the power and features demanded by professionals. Some of these paint programs have been around for a while, and if you're pleased with the features in the latest version of one of them, you may decide to stick with it because it's familiar. On the other hand, if you feel you've outgrown your present paint program, there's plenty of information here to help you choose an abler one.

Input options will figure high on many people's lists, and seven of these programs offer scanner support. Image-In Scan & Paint 3.1 works with Kodak PhotoCD images and printers, and six of the programs offer screen capture capabilities. Because a mouse doesn't offer the precision many artists look for, you'll find support for styluses and tablets with some of the packages.

Support for various file formats—images you can import from or export to the applications you use on a regular basis—may also affect your choice. Take a look at the grid of paint program features to see just which formats a particular package supports.

The tools you'll use to modify images or create your works of art may well be your primary consideration in choosing a paint program. Some of them are pretty amazing. One offers a custom brush tool, another helps you paint in the style of Van Gogh, and still another includes sophis-

ticated photo-retouching tools. Here, too, the features grid assists by presenting information about paint tools, special effects, filter functions, image control, and more.

Keep in mind, however, that these programs sometimes differ in their terminology and approach so much that it's difficult to draw comparisons. For a more detailed look at how each program works and what the particular strengths of a program are, look to the reviews. Here you'll also find valuable information about documentation, ease of use, add-ins, and other matters that can't be covered adequately in a list of features.

Pay careful attention to the hardware requirements for these paint packages. As hardware has become more powerful and sophisticated, system requirements have also increased. Memory requirements in our lineup vary from 512K all the way to a whopping 6MB, and the manufacturers recommend even more. The minimum of disk space required varies from 2.5MB to 10MB, and you'll need a 24-bit video adapter and high-resolution monitor if you want to display the 16.7 million colors that six of these paint packages let you use. Make sure that your video adapter is supported by the package you want. Also, many of these programs rec-

ommend at least a 386 microprocessor, and there's no doubt that a 486 system will speed the performance of Windows apps. In fact, these sophisticated paint packages may offer you just the excuse you've been looking for to upgrade to a more powerful system.

Finally, while both paint programs and draw programs come under the larger rubric of illustration software, there are some important differences to consider before you buy. As managing editor David English pointed out in his introduction to the Test Lab on draw software (September 1992), "Paint programs are your best choice if you work with scanners and photorealistic images. Draw programs are best if the form of the image is more complex than its color or if you plan to print at high resolutions."

Whatever your artistic aspirations and requirements, Test Lab can help you understand this software category and make a more informed buying decision.

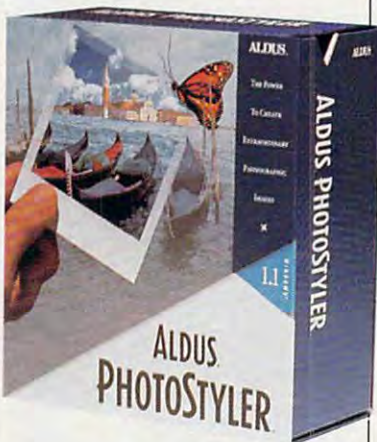
MIKE HUDNALL

ALDUS PHOTOSTYLER 1.1

Remember the excitement of opening a birthday or holiday package containing an art set? Few gifts brighten a child's face so much. Aldus PhotoStyler 1.1 is

Aldus PhotoStyler 1.1
IBM PC or compatible (80386 compatible), 2MB RAM (4MB recommended), any Windows-compatible adapter (high-resolution 256-color or 24-bit adapter recommended), hard drive with 4MB free (80MB hard drive recommended), Windows 3.0 or higher, mouse—\$795

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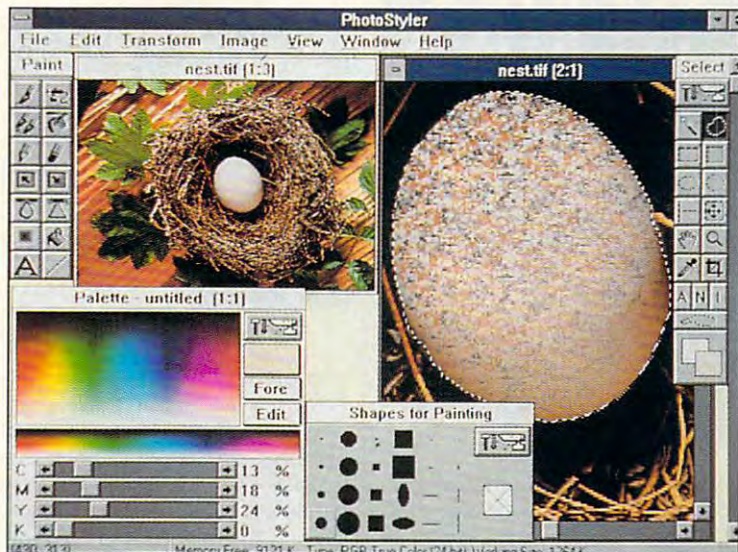
a powerful art set for your computer; paints, pencils, and tools of all kinds give you incredible control over any kind of artwork. You can create images from scratch, or you can start with scanned images and modify as you please.

The programming artists who assembled this package have left no milieu unexplored. As a tool for creating artwork, PhotoStyler works well, and it's superbly suited for modifying and enhancing existing electronic images such as scanned photographs.

Back to the drawing board: PhotoStyler's array of paint tools may seem unremarkable on the surface, but when you explore the customization possibilities for each tool, you realize what splendid tools they are. For example, in addition to choosing the shape of your paintbrush, you can select the rate of the flow of the paint and the transparency of the paint. Also, when painting over previously painted areas, you can choose to have the paint applied only to areas that are lighter or darker than the paint color. Options also permit you to isolate and change only the hue, color, or brightness components of the underlying pixels.

One of PhotoStyler's finest features is the Magic Wand color selection tool. When you click on a pixel with the Magic Wand, that pixel and all adjoining pixels of a similar color are selected. This is a speedy way to select large areas—such as the background—of a picture for recoloring. Besides its ability to repaint images, PhotoStyler has a full set of color correction and enhancement tools that provide control over either the whole image or selected regions.

PhotoStyler offers an array of filters designed to help you enhance your artwork in various ways. With these filters, you can sharpen, soften, blur, or emboss your image. You can add a ripple effect or a whirlpool effect. And with the filters, as with most options in PhotoStyler, the tools are available for



you to define your own effect.

PhotoStyler has sophisticated options for combining and merging images, making the program one of the most complete image manipulation tools around. The program can read almost any standard graphics file format and includes driver software for a handful of scanners, but the popular hand-held models are not included. Nevertheless, PhotoStyler will have no trouble reading and modifying images once they're captured through the scanner maker's proprietary software.

With so many options and possibilities, PhotoStyler can seem overwhelming. The documentation, however, will put you at ease. In typical Aldus fashion, a fine tutorial in the Getting Started book helps you clear the initial hurdles. The reference manual includes detailed explanations of the hows and whys of image manipulation. Keep the book at hand, however, because the online reference falls a little flat compared to the help services provided in other Aldus software.

Despite its down-to-earth documentation, PhotoStyler has too much horsepower for anyone who just wants to do a little computer-aided painting. PhotoStyler

is designed to handle the problems of a sophisticated user, and it won't disappoint even the most demanding professional.

TONY ROBERTS

Circle Reader Service Number 371

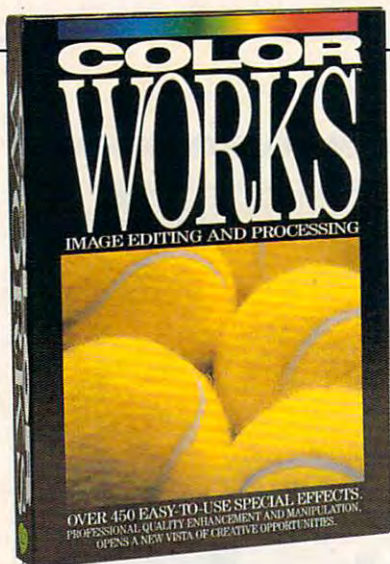
COLORWORKS 1.0

If you want real power in DOS image processing with the ability to professionally create, edit, merge, and process black-and-white and color images with over 450 separate tools for drawing, image editing, and applying special effects, then ColorWorks 1.0 from SPG could very well be for you.

Instead of an expensive Windows-compatible program costing hundreds of dollars, SPG offers a DOS package for only \$149 retail that still provides all the power of many high-end programs. This is a power program meant for serious image manipulation. While it lacks some of the polish and glitter of Windows applications, it compensates by supplying you with greater flexibility.

Giving up the Windows interface means that you have added power and speed. For example, all of the drawing tools in ColorWorks are completely configura-

TEST LAB



ble on the fly. This means you have the option of configuring and reconfiguring the tools while you edit images, selecting the brush stroke, color, pattern, special effect, or combination of effects you want a tool to use as many times as you like while working on a drawing.

And there are plenty of tools available for reconfiguring. The 13 basic drawing tools include line, free draw, rectangle, triangle, parallelogram, ellipse, curve, fill, font, circle, polygon, a zoom/edit pixel editor, and a cut-and-paste tool. The ColorWorks cut-and-paste tool allows you to rotate, paint/drag, scale, stretch/shrink, flip, cut, copy, image-merge, and superimpose an area of your screen image (called the canvas).

Want more flexibility? Whenever you load a file in ColorWorks, the cut-and-paste tool is active. Thus, you can apply the effects described above before positioning and pasting your loaded images where you want them on the canvas. And the program allows an unlimited number of images onscreen at the same time for editing and creating unique pieces of work.

Several of the major graphics file formats find support in this program: BMP, TIF, PCX, Targa, and ColorWorks' own SPG image file formats. I like the SPG format because it allows you to save images with various irregular shapes

ColorWorks 1.0
IBM PC or compatible, 640K RAM
(3MB recommended for some
modes), VGA, hard drive, mouse—
\$149

SPG
6170 NW 173rd St., Ste. 405
Miami, FL 33015
(305) 362-6602

and areas defined as transparent. When you reload these images onto your canvas, the transparent areas are see-through. Using ColorWorks, you could, in effect, create a library of clip art containing only the images and no backgrounds—just like having a supply of electronic decals to slap on whatever images you wished.

ColorWorks also lets you create black-and-white and color EPS files. The 23 special-effect functions include undo, reflection, grid, blend, graduation, dupe, cycle draw, antialiasing (gives smooth edges to lines, curves, circles, and fonts), shade, tint, color strip, tile, sharpen, shear, negative, filter (over 30 filters included), redo, RGB guard, and RGB swap. ColorWorks also

includes powerful shape- and color-masking functions.

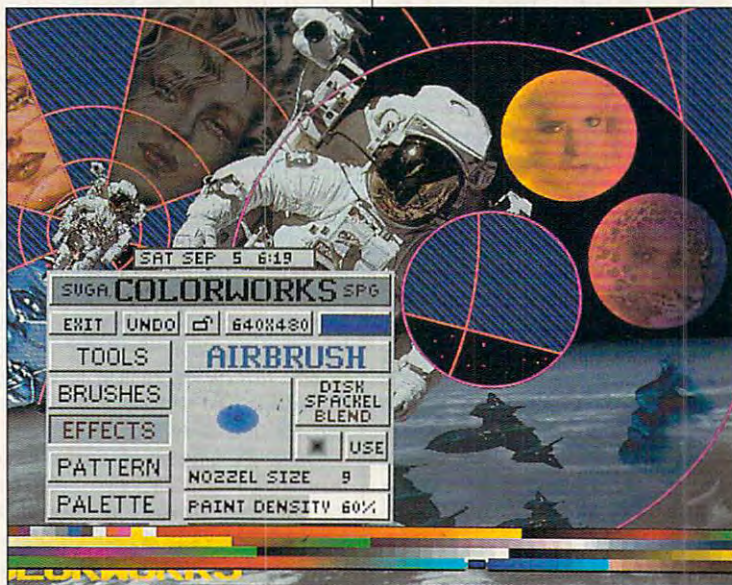
All special effects include precise controls for their application to your canvas. You get printer support through several black-and-white and color print drivers, including PostScript.

An exceptionally powerful paint and image-editing program, ColorWorks worked well except on my 486 with the 8514 video adapter, since that display is not yet supported. I recommend ColorWorks to those who need flexible and powerful image manipulation beyond what the Windows applications offer. If you find yourself in that group and you're willing to put forth the extra effort to learn a program with a number of options and plenty of flexibility, then ColorWorks is an excellent choice.

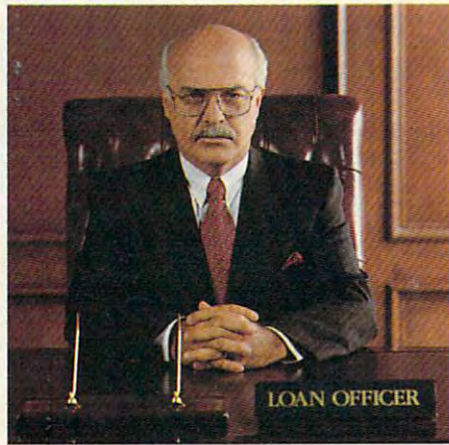
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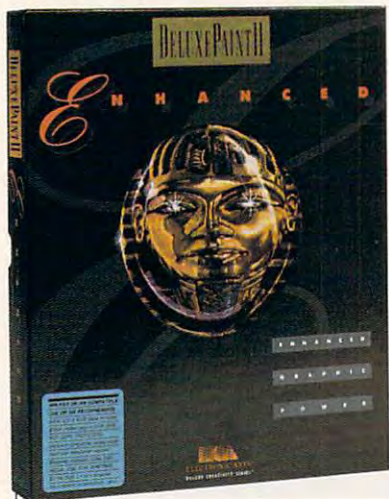
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TEST LAB



DELUXEPAINT II ENHANCED

I still feel nostalgic for my first car, a beige and black 1966 Plymouth Fury V8 convertible that was showing its age in 1972 but could pass those upstart little imports like they were standing still. I feel the same affection for Dan Silva's original DeluxePaint, the first piece of software I ever bought. The Plymouth has long since gone to auto heaven, but DeluxePaint, now in its seventh year and called DeluxePaint II Enhanced, is still around and still faster than most of the competition. Though I've tried just about every paint program in the world, I still turn to DeluxePaint when I want to get a job done quickly.

Like most paint programs today (many of which have copied DeluxePaint's tool set), this program offers a wide variety of icon-based painting tools in a bar down the side of the screen. These tools include a color palette and the usual line and shape makers. You'll also find area fill; a versatile, resizable airbrush; a magnifying glass; a text tool; a grid for exact alignment; and a mirroring feature.

Pull-down menus along the top of the screen offer file-handling and screen mode controls (you can switch screen modes on the fly); brush options such as flip,

DeluxePaint II Enhanced
IBM PC or compatible (80286
compatible recommended); 640K
RAM; Hercules, CGA, EGA, VGA, or
EVGA (EVGA requires 512K EMS);
hard drive; mouse—\$129.95

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rotate, distort, and bend; and such painterly effects as smear, blend, and smooth. The program's comprehensive palette controls allow you to mix all of VGA's 256 colors; there's also a spare screen for thumbnail sketches and the ability to create pictures larger than the screen. Everything about DeluxePaint's interface is well designed and easy to understand.

The secret to DeluxePaint's speed and power is its custom brush tool. Using the custom brush tool, all that you have to do is draw a box around any part of your work, and it becomes a brush. You can draw with it, erase it, resize it, stretch it, rotate it, warp it, skew it, change its colors, make it partially transparent, outline it, and more.

Custom brushes can be used

in conjunction with most of the other tools, too, so you can create effects that no other paint program can achieve. For example, you can actually use a face to draw a circle. You can't really understand how much time the custom brush feature will save you until you try it for yourself.

The other DeluxePaint feature that I find truly unique is perspective (one of the program's image-control tools). This is a complex but powerful system that allows you to tilt any brush or screen to create the illusion of spatial depth. Once you master the intricacies of manipulating a brush's x-, y-, and z-coordinates with the numeric keypad, you can do tricks like designing rooms that extend back into infinity or wrapping labels around boxes.

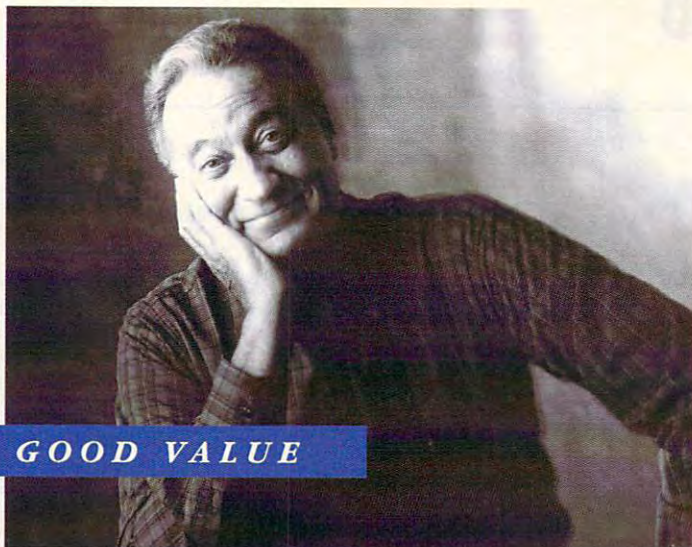
There are plenty of features that artists want but DeluxePaint doesn't have, and probably never will. These include the ability to edit 16- and 24-bit images; the inclusion of photo-retouching tools like contrast and gamma correction; and support for Super VGA, expanded memory, and Windows. What DeluxePaint II Enhanced does offer is a fast, elegant, time-tested, and powerful system for painting images onscreen.

STEVEN ANZOVIN

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TEST LAB

DR. HALO IV PAINT AND IMAGING PAK

Dr. Halo is without a doubt one of the best-known names in PC painting. Around since 1984, this program boasts nearly 3 million users. It's a workhorse for many users who own no other graphics software, and now Dr. Halo has been released in a new version, Dr. Halo IV Paint and Imaging Pak.

There's plenty that's useful about Dr. Halo IV Paint and Imaging Pak. The package now includes five programs: the paint program Dr. Halo itself, which looks very much like the previous versions; the Viewer, a display and file conversion utility that gives Dr. Halo access to more image file formats than before; the Font Editor, which allows you to redesign bitmapped fonts to your specifications; the Grab utility, a screen-grabbing program; and Presents, a slide-show program for Dr. Halo images.

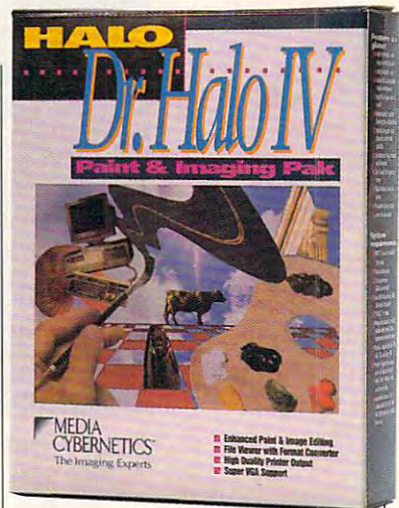
With its own conventions, icons, and ways of working, Dr. Halo, the core of the package, differs from other paint programs. For example, you choose tools and options entirely from dozens of icons—there are no drop-down menus—

Dr. Halo IV Paint and Imaging Pak IBM PC or compatible (80386 compatible recommended); 640K RAM (2MB extended or expanded memory for the Viewer); CGA, EGA, VGA, or SVGA; hard drive with 1MB free (3MB to install all programs); mouse recommended—\$140

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but the meaning of some of the icons isn't always obvious. Even such a simple function as color selection didn't work quite as I expected it to. To change the painting color, you first have to select the pencil tool. Luckily, the manual is clear and includes some basic tutorials, but you'll still need to experiment until you're sure what each tool does.

Dr. Halo performs most of the usual paint program operations, such as drawing lines and circles, filling with colors, and selecting areas for block operations like flip and rotate—and it does them fast. You won't find some of the program's unusual options in



other paint programs, such as the ability to automatically draw a representation of a 3-D box.

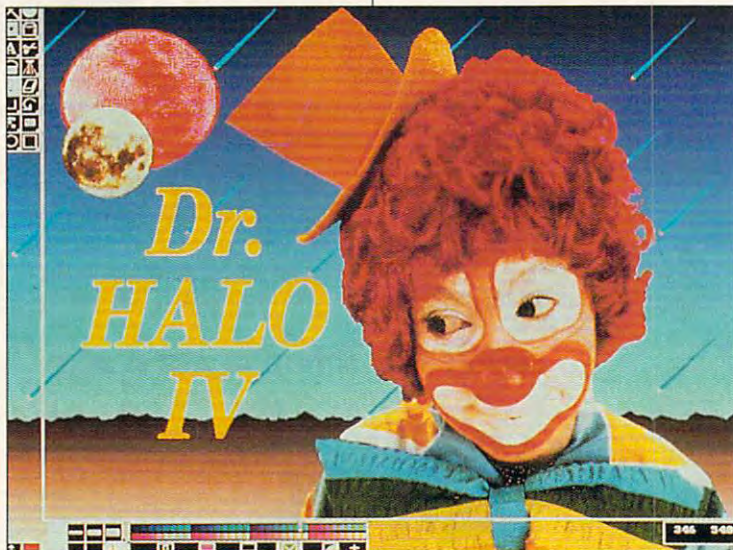
However, Dr. Halo also has some odd omissions, at least by today's standards for paint programs. For example, there are no brushes in different shapes, and you have access to only four line thicknesses.

The other program in the Dr. Halo package that you'll use often is the Viewer. The Viewer not only converts file formats to and from Dr. Halo's own CUT format but also performs some basic image processing. You can crop, merge, and adjust the colors of TIF, BMP, and PCX images. Unfortunately, you can't jump directly from Dr. Halo to the Viewer or to any of the three other programs (except for Grab, which is a TSR).

Should Dr. Halo IV be your first paint program? Probably not. The program's cryptic, quirky interface and lack of integration between modules make it unnecessarily hard for paint novices to master. But if you're one of those 3 million Dr. Halo users who feel comfortable with the program's idiosyncrasies and occasional oversights, then Dr. Halo IV Paint and Imaging Pak is a real bargain. It greatly extends the original capabilities of Dr. Halo while retaining this classic's speed and power.

STEVEN ANZOVIN

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FRactal Design PAINTER 1.2 FOR WINDOWS

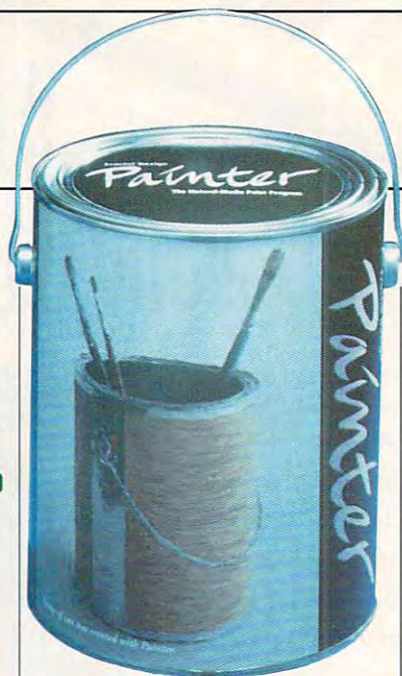
The woods are full of paint and draw programs, but if you have artistic talent and seek an exceptional program, Fractal Design Painter 1.2 for Windows may be just what you're looking for. The scope and options are extraordinary.

Never mind the usual toolbox—rotate and grab and fill and the usual. Painter has those, but they're trivial in the face of the program's other features. When you create an image, the brush palette offers the options of an airbrush, a brush, pencils, chalk, charcoal, felt pens, crayons, and special brushes. You even have the option of painting in the style of Van Gogh or Seurat. Each of these options has variants; for example, the brush can be a hairy brush, graduated brush, water brush, watercolor brush, or Japanese brush. With each of these, you can adjust the size and angle of the brush tip and make the edges of the stroke flat or soft or intermediate.

Fractal Design Painter 1.2 for Windows
IBM PC or compatible (80386 compatible), 6MB RAM (8MB recommended), SVGA, hard drive, Windows 3.0 or higher; supports math coprocessor, mouse, and Wacom and Calcomp tablets—\$399

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Not content with that variety, the developers created an array of application methods potentially bewildering to the novice. You can choose among such options as grainy edge flat buildup, grainy hard, wet, soft buildup, and more. Further, you can select the depth of penetration into the paper of your palette and the concentration of the color. In the watercolor variants, if you don't like what you've produced, you can wet the brush and soften it. For other effects, you can create a frisket, which is a mask to shield certain areas during painting or retouching.



The color palette offers 15 color families, which differ according to the selected brush, just as the colors available for pastel differ from those for oils. You can alter these default colors in their hue, saturation, and value.

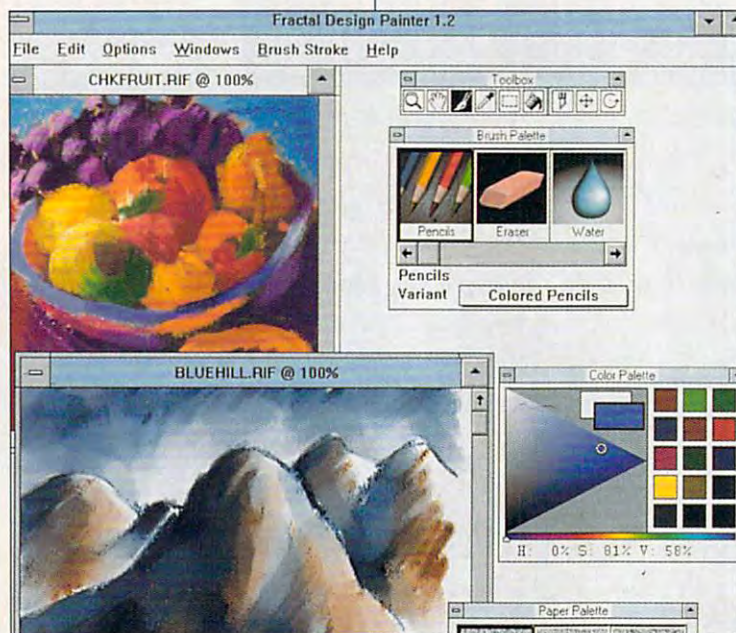
And there's more. You have the option of viewing your finished artistry in a different mode. If you've painted in watercolor, you can clone it in oil, or you can see it à la Van Gogh or Seurat. Artists might well find the mouse a poor substitute for a paintbrush. Painter recognizes this and provides support for such equipment as the Wacom pressure-sensitive stylus.

The program is rather slow on a 16-MHz 386SX with 8MB of RAM. And Painter consumes plenty of RAM and disk space. While it requires only 2.5MB of free disk space for installation, Fractal Design recommends 20MB for creating images. I wish the program included more extensive documentation. The user's guide includes no sample images, and no true tutorials are provided.

Though I'm not a fine artist and though I lack access to a color printer, I was nonetheless most impressed with Painter as an exceptional program, striking in the depth and breadth of its potential for creative artistry. If you are a fine artist or have aspirations in that direction, Painter deserves your attention.

CHARLES IDOL

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IMAGE-IN SCAN & PAINT 3.1

Given the remarkable progress in personal computer graphics over the last couple of years and the impressive crop of draw and paint programs to choose from, you should carefully consider just what you want to do with such a program. Image-In Scan & Paint 3.1 has much to offer, including the ability to import Kodak PhotoCD images.

The program takes good advantage of Windows 3.1's features, and it's perceptibly faster than other image-editing software running under Windows. When you create an image, you can choose color, gray-scale, or bilevel (black-and-white); if you change your mind later, it's possible to convert from one type to another. The program's toolbox offers a wide range of tools. Shape and thickness options are available whether you're using a pen, a brush, or an airbrush. You can create lines, open or closed Bézier curves, rectangles, circles, or ellipses. There's also a text capability, with more than 20 fonts provided. For convenience, the right mouse button provides fast access to the options for each tool.

When you're ready to edit, a pointer tool lets you select an area of the image in the shape of

Image-In Scan & Paint 3.1
IBM PC or compatible (80386 compatible), 2MB RAM (4MB recommended), any Windows-compatible adapter (VGA or SVGA recommended), hard drive with 6MB free, Windows 3.0 or higher; pressure-sensitive tablet recommended—\$149

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Minneapolis, MN 55420
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(612) 888-3633

a rectangle, a circle, an ellipse, a polygon, or a free form. Once you've defined an area, you may choose to have your modifications apply to that area or to the rest of the image. Fill and eyedropper tools help you make color modifications. For effects, you can filter the image to sharpen it or blur it. Images can be manipulated with the flip, rotate, and stretch/shrink commands; and adjustments can be made for brightness, contrast, and color balance.

You have your choice of 11 formats, including the popular TIF, PCX, and EPS, for saving your work and for exporting to other ap-

plications. For conservation of disk space, the TIF format offers a compressed mode. Those same formats are also supported in importing images. With very little difficulty, I imported a gray-scale image produced by a hand scanner, converted it to RGB, and tinted areas to produce an acceptable color image.

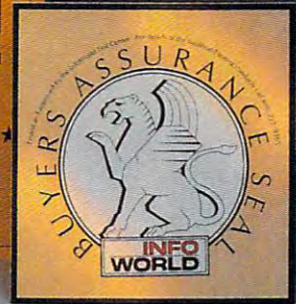
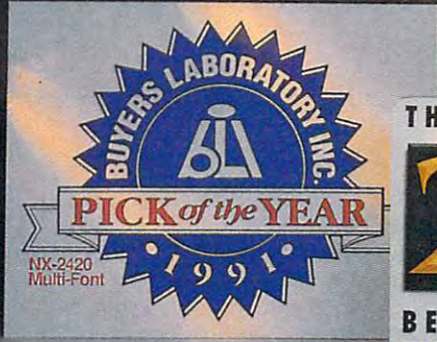
Scan & Paint provides direct support for a large number of scanners. When you set up the program, you can install the driver for your scanner and later call the scanner from the toolbox. The scanned image is brought directly into the program, where you may modify and edit it as you choose. The program also provides support for loading Kodak PhotoCD images and for fast printing to the Kodak XLT7720 series printers.

Regrettably, the documentation is in the form of a reference guide rather than a user's guide, with no tutorials provided. It requires a fair amount of digging on the part of the new user to discover just what the program offers. Still, power and a modest price make Scan & Paint a program that many consumers will want to consider.

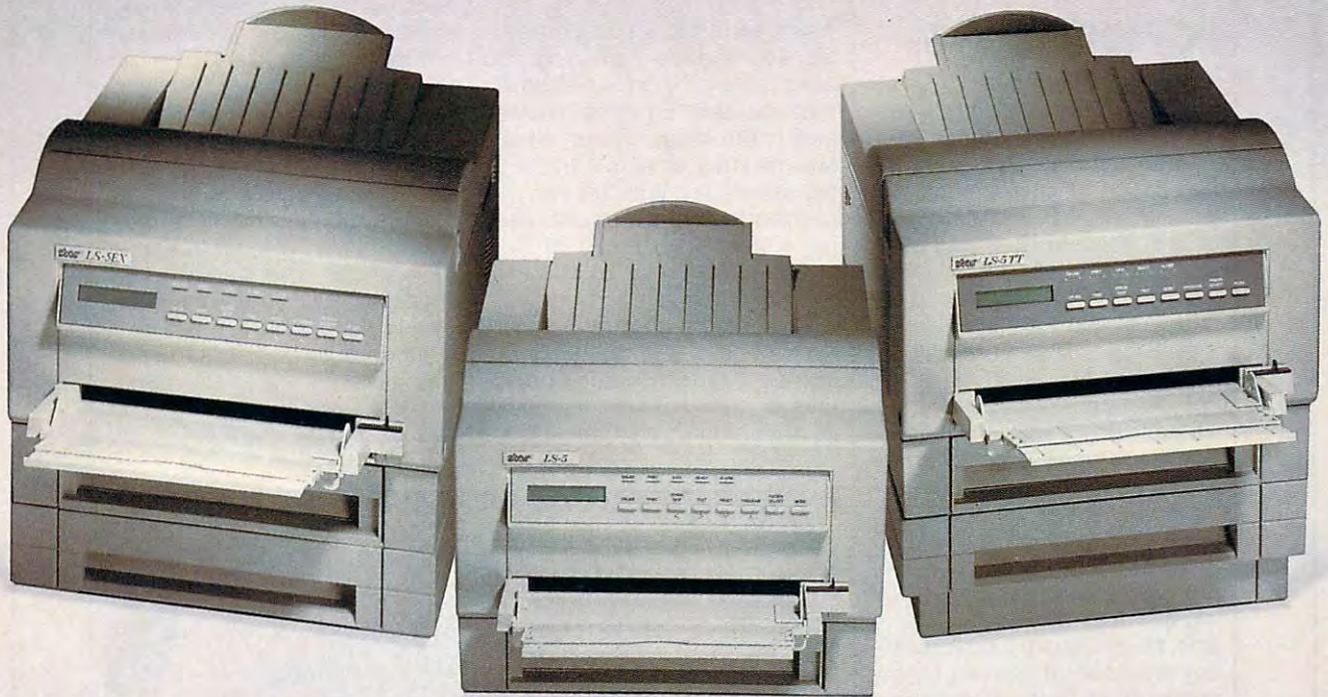
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PC PAINTBRUSH 5+

At its modest price, PC Paintbrush 5+ can be a good value, depending on your needs.

When compared to some similarly priced Windows products (or even Windows Paintbrush, which is free), this old DOS performer seems a little long in the tooth. It lacks 24-bit color support and supports a limited number of file formats (PCX, compressed and uncompressed TIF, and GIF), so it's not really conducive to full-color image editing. If you don't run Windows and need a good monochrome and gray-scale image editor, however, this is a good start.

Where Paintbrush really excels is in its extensive scanner support. Since ZSoft has been building scanner drivers for a long time, the program is a strong scanner interface. Scanning black-and-white and gray-scale images with my ScanJet IIc, I got excellent results. Paintbrush didn't handle the scanner's 24-bit color capabilities well, however. There is also strong printer and graphics adapter support, which is not found in many other products in this price range. Literally hundreds of VGA and SVGA boards are supported by Paintbrush.

Paintbrush comes with an extensive array of image-editing tools, including some found in ZSoft's higher-end image-editing packages, such as PhotoFinish. In fact, if you're familiar with PhotoFinish or Publisher's Paint-

PC Paintbrush 5+
IBM PC or compatible; 640K RAM
(an additional 246K disk cache
recommended); Hercules, CGA, EGA,
VGA, EVGA, SVGA; hard drive with
3MB free; drawing device—\$149

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brush, you'll notice some similarities. Tool and filter names are the same, as are the color and brush width palettes. Especially impressive is the Magic Wand, which automatically selects objects of the same color. With this tool you can recolor multiple objects easily. I used it to make all the clouds in a sky scene grayer and more foreboding.

In all, the program comes with over 20 paint and retouch tools and some sophisticated special effects, such as emboss, mosaic, and motion blur. Automatic fil-

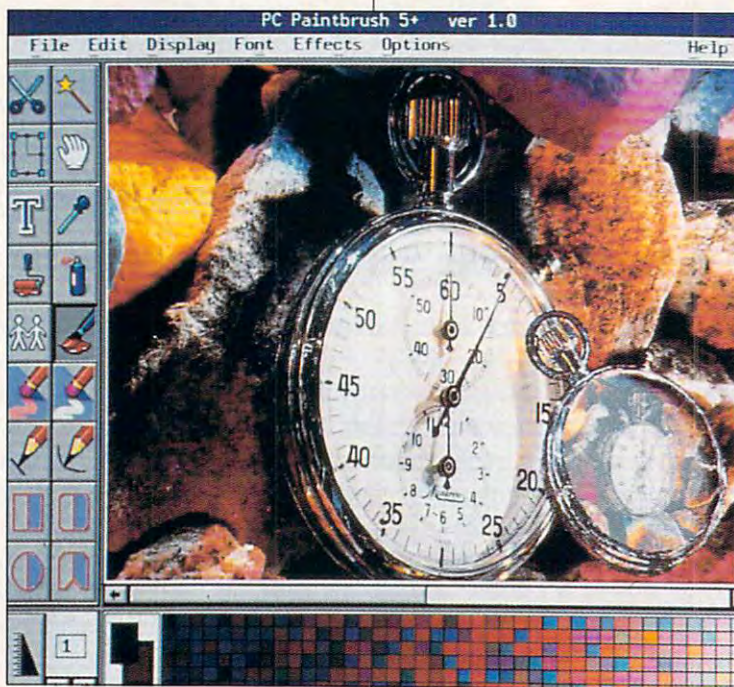
ters—sharpen, smear, smudge, spot removal, and others—allow you to work on selected portions or the entire image at once.

Paintbrush runs on systems with 640K RAM; it uses empty disk space as virtual memory to hold large images. However, until I did some reconfiguring, eliminating several device drivers, I got a lot of out-of-memory errors. The worst part is that as often as not the system locked up, forcing me to reboot. This program is certainly not for power users with numerous TSRs. And it's certainly not for Windows users, who can find more power and a prettier interface somewhere else.

When I started working with computer graphics several years ago, Paintbrush was my first bitmap editor and scanning software. And it served me well for quite a while. This is an excellent program for beginners. You should not consider it, however, if you plan to do a lot of photograph editing, especially color.

WILLIAM D. HARREL

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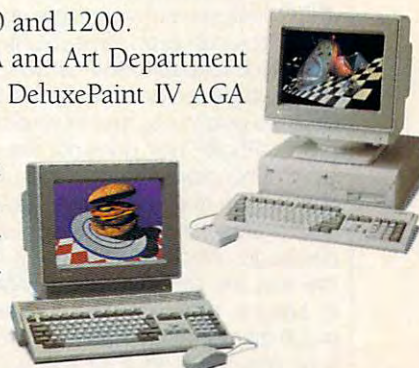
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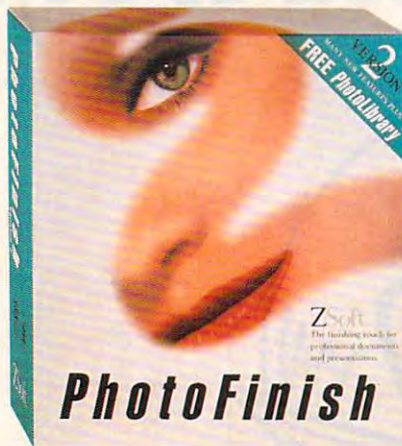
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PHOTOFINISH 2.0

For \$500 less than most high-end electronic darkrooms, PhotoFinish 2.0 gives you about 90 percent of the features and 200 percent of the ease of use.

PhotoFinish supports an impressive list of scanners. However, you must load the driver in config.sys, which eats up RAM and could conflict with other TSRs. Most of today's Windows scanning software uses a dll or drv driver that loads when the scanner is activated and moves out of the way when it's not needed.

The program's automatic filters—sharpen, blend, smudge, and so on—work great, as do the 20+ paint and special-effect tools. Most major bitmap file formats are supported, and there is even a filter that automatically decompresses industry-standard JPEG images before displaying them. You can even save your images to Encapsulated PostScript format to get color separations in desktop publishing and draw programs. PhotoFinish does not, however, print color separations on its own, which makes it less suitable as a professional photo touch-up package. Another drawback is the way the program uses RAM. It seems that no matter how much memory is available (this review was done on a system with 20MB), there is entirely too much disk accessing going on, which

PhotoFinish 2.0
IBM PC or compatible, 2MB RAM (2MB-18MB for higher modes), any Windows-compatible adapter (support includes XGA, 16-bit high color, and 24-bit true color), hard drive with 5MB free, Windows 3.0 or higher, drawing device—\$199

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significantly slows down screen redraws when you're working on big images.

Version 2.0 comes with a nifty image viewer that loads thumbnails of all the images in a subdirectory for easy selection. And there is an extensive library of prescanned 24-bit images you can use in your layouts and presentations, virtually free of copyright restrictions, which is great if you don't have a scanner (or even if you do). Another plus for version 2.0 is the addition of monitor, scanner, and printer calibration. This feature, originally part of ZSoft's full-featured Publisher's Paintbrush, allows you to optimize your input and output devices

to get even closer to true WYSIWYG. (This isn't easy when dealing with color. You need all the help you can get.)

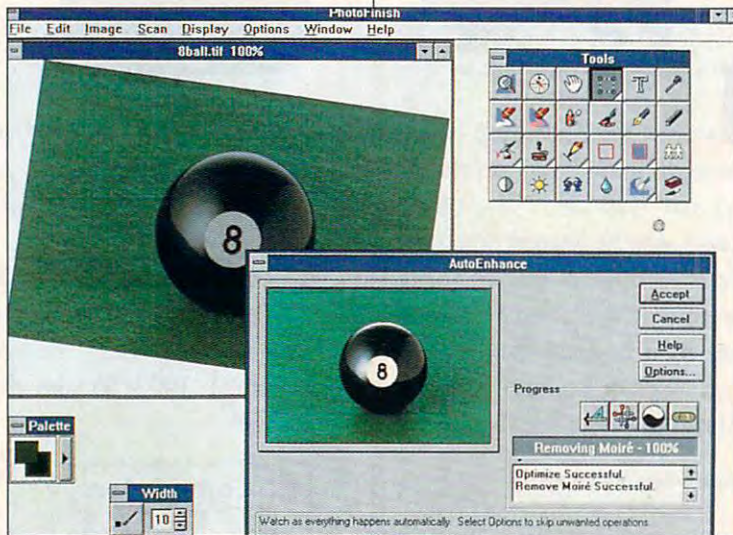
Even the full-featured products don't have some of this program's features, such as automatic deskewing and image stitching (automatically stitching multiple scans together). One feature that few programs of any type have is ZSoft's Local Undo. It allows you to undo changes to selected areas of a drawing, rather than having to reverse all of your work—a lifesaver if you're making extensive edits.

I found the documentation for PhotoFinish to be thorough and easy to use. The tutorial walks you through touching up both a gray-scale and a full-color photograph. The program is straightforward and easy to learn, but if you should ever need technical support, it's easy to get through, and the technicians are well trained. My calls were answered promptly, and my questions were answered quite satisfactorily.

Unlike PC Paintbrush, which is definitely a beginner's package, PhotoFinish may be the only paint and image-editing program you'll ever need.

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PICTURE PUBLISHER 3.1

Picture Publisher 3.1 (now dropped to \$495 from the \$795 that 3.0 cost) is an image editor rather than strictly a paint program. While it has many of the standard paint tools for drawing, filling, and color control, it's primarily oriented toward enhancing an already existing image instead of creating one. For example, you could take a flat but colorful drawing generated in another program and—through blends, gradients, textures, and other special effects—give it a three-dimensional, more photorealistic look.

Picture Publisher gives you complete control over images—either scanned in or imported via such standard file formats as BMP, GIF, PCX, Photo CD, Targa, and TIF. The program supports EPS and DCS formats only as exports.

Looking for a clean, uncluttered, easy-to-use interface? Picture Publisher has it. On the bottom line of the window, helpful hints appear about the currently selected tool or option.

Editing several images at once is easy with Picture Publisher. Each has its own resizable window. You may cut and paste between these images or between them and other Windows applications, or you can have several views of the same picture! A linking option causes changes made in one window to be reflected in all other open copies of the image.

Picture Publisher supports everything from 1-bit black-and-white line drawings to 256 levels of gray scale to 24-bit true color images. You'll find features for sharpening, smoothing, and so forth.

For picking a specific color from an image, Picture Publisher furnishes an eyedropper tool. Called a color probe, it lets you choose just one point for an exact color match or draw a rectangle and get an average of all the colors within the bounded area.

Picture Publisher 3.1
IBM PC or compatible (80386 compatible recommended), 4MB RAM (8MB recommended), VGA (256-color SVGA or 24-bit color recommended), hard drive with 10MB free, Windows 3.0 or higher, drawing device—\$495

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(800) 733-3729

The use of text is as powerful as whatever fonts are installed in Windows. You place text as a mask, allowing you easily to resize, fill, and rotate it for stunning effects.

Speaking of masks, Picture Publisher has strong mask features. You can isolate areas of an image for retouching and other special effects, or select areas for copying or cutting—all with masks.

Color control is also excellent. You can adjust local areas or the entire image for color contrast, hue, brightness, and saturation. Picture Publisher supports the three basic color systems: RGB, HLS, and CMYK.

Various special effects let you get as weird as you like in twirling,



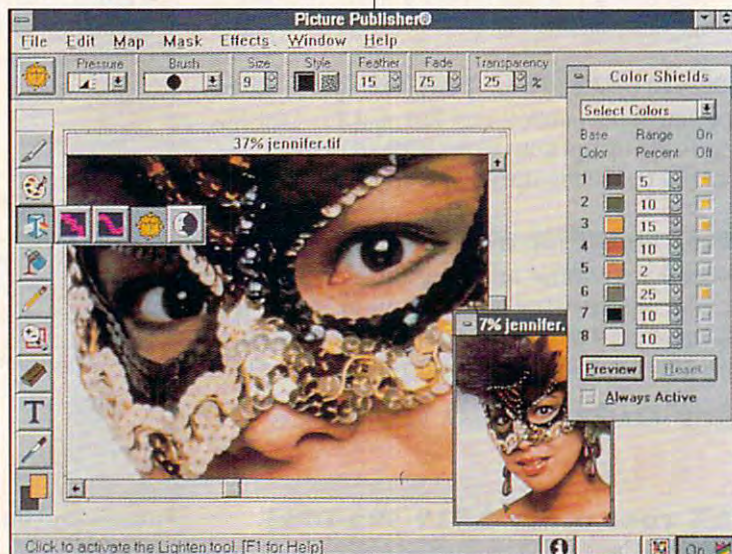
crystallizing, waving, or running Hurricane Andrew through your picture (try the Wind special effect for that one; it works nicely).

Service and support by Micrografx are good. The documentation, while extensive and well written, still does not cover everything possible about this very complex program. However, 24-hour technical support is available.

Other reviewers have said Picture Publisher is the best image-editing program available. I'll just say, "I switched." If you need the powerful features found in Picture Publisher, you may switch, too. That's my recommendation.

RALPH ROBERTS

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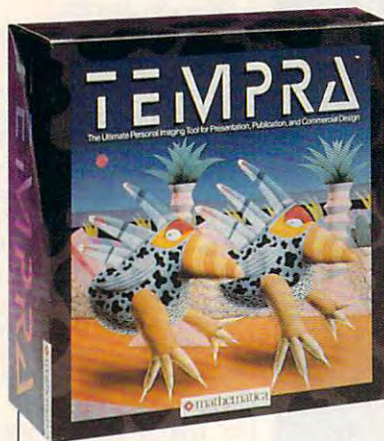
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TEMPRA PRO 3.0

TEMPRA PRO 3.0 is a powerful paint and imaging program that provides a remarkable degree of color control. And since this program runs under DOS, even computer artists who "don't do Windows" have access to its abundant set of tools that can create not only drawings but multimedia presentations as well.

While TEMPRA PRO directly accepts input from a handful of scanners as well as video-digitizing boards, the program provides ample ways to apply paint by hand. And if your hand isn't that steady, TEMPRA PRO includes the tools to help you out.

For example, you can create masks to isolate sections of your artwork and either paint those sections or protect them from change. And if the shapes are the way you like them but the colors are not, TEMPRA PRO provides an outstanding set of color protection controls.

From the Color Protect Palette, you can isolate individual colors or ranges of color and protect them from change. The swap feature allows you to select a single color and protect all others, making it possible for you to recolor an image one shade at a time. In addition, your color protection selections can be turned into a mask that you can save to disk and reuse.

Although TEMPRA PRO works on any AT-class computer with any VGA monitor, your creative

TEMPRA PRO 3.0
IBM PC or compatible (80286 compatible), 640K RAM, VGA or SVGA (supports 16- and 24-bit adapters), hard drive with 6MB free, mouse—\$695 (includes TEMPRA SHOW)

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sessions will benefit from a faster processor and more sophisticated display system up to and including 24-bit systems. Even with a 486 processor, you'll find yourself waiting for some drawing functions. If you have at least a 386SX processor, though, you can boost performance through Mathematica's add-on Turbo Charge feature (available separately for \$295), which allows TEMPRA PRO to run two to five times its normal speed.

TEMPRA PRO supports a long list of color and black-and-white printers and comes with its own print program that allows you to adjust images as they're going to the printer. From TEMPRA PRINT PRO you can crop images, adjust the dot size and brightness, and

scale the image. Printing can be activated from within TEMPRA PRO itself or from the command line.

Another Mathematica utility of some note is TEMPRA SHOW, a multimedia authoring system. TEMPRA SHOW is a presentation program in which the user describes the events that constitute the presentation. Events can include audio, full-motion video, animation, text, and special effects. Although TEMPRA SHOW is a separate product that lists for \$199, Mathematica has bundled it with TEMPRA PRO.

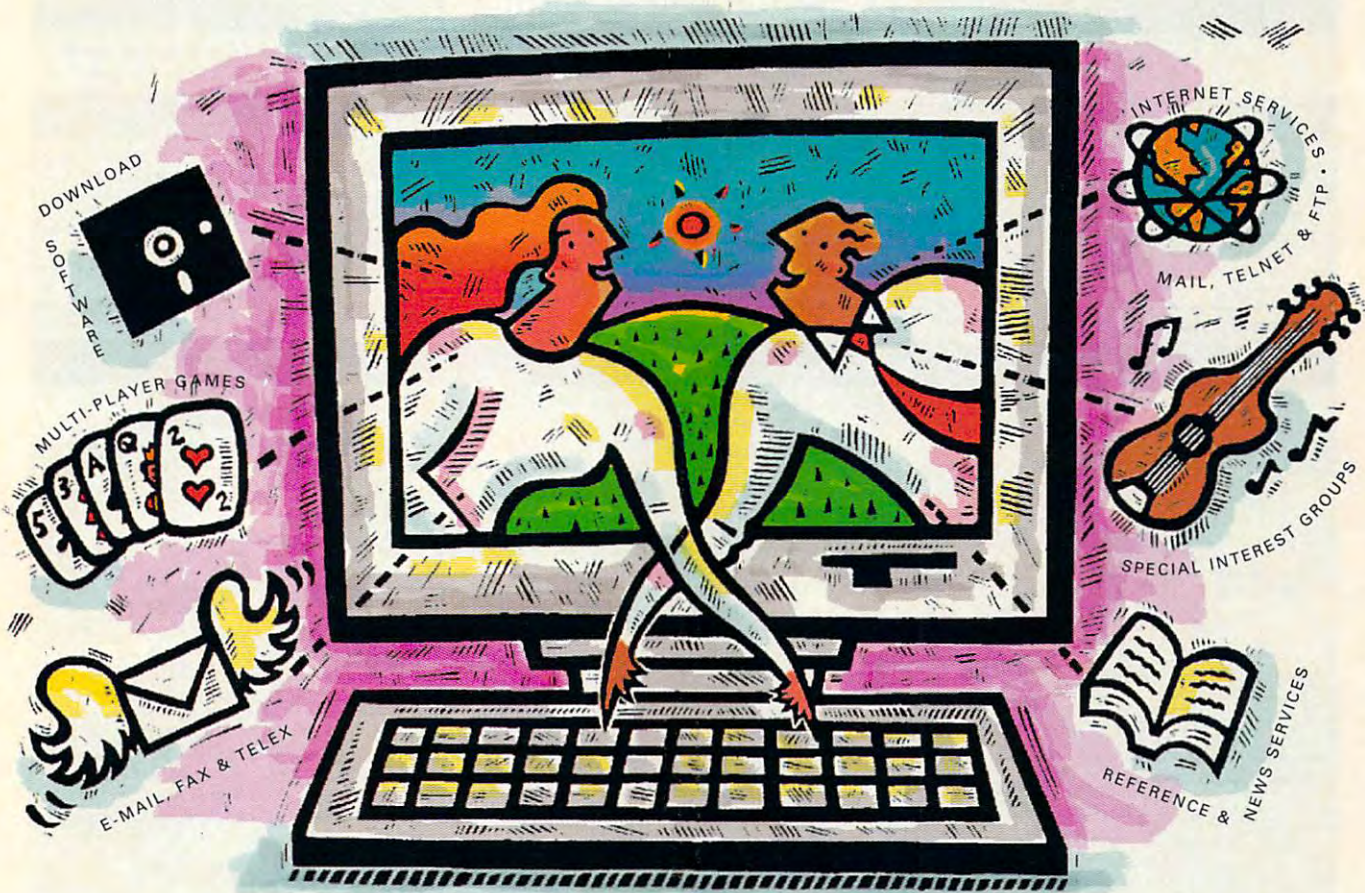
Thanks to the step-by-step instructions for each of the commands provided in the manual, I found TEMPRA PRO fairly easy to use. Despite its thoroughness, however, the manual is a visual disappointment. The camera-ready copy for the manual, including screen representations and illustrations, was produced on a 300-dpi laser printer. By using low-resolution black-and-white illustrations, Mathematica missed a chance to showcase the program's vibrancy and fully illustrate some of its outstanding color capabilities.

TONY ROBERTS

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PAINT SOFTWARE FEATURES

	Aldus PhotoStyler 1.1	ColorWorks 1.0	DeluxePaint II Enhanced	Dr. Halo IV Paint and Imaging Pak	Fractal Design Painter 1.2 for Windows
GENERAL					
Maximum image size	32,000 × 32,000 pixels	limited by disk and memory	1024 × 768 pixels	limited by memory	limited to available disk space
Maximum number of colors	16.7 million ¹	16.7 million ¹	256	256	16.7 million ¹
Color models	CMYK, HLS, HSB, RGB	CMYK, RGB	RGB, HSV	RGB	HSV, RGB
Online help	yes	no	no	no	yes
Disk space required	4MB	4MB	3MB	3MB	2.5MB
EDITING TOOLS					
Paint tools	airbrush, blur, brush, bucket fill, clone, darken, eraser, gradient fill, lighten, line, pencil, sharpen, smudge, text	Bezier curve, boundary fill, circle, ellipse, flood fill, free draw pen, line, parabola curve, smart fill, spline curve (up to 100 points), parallelogram, pixel level zoom editor, polygon, text, triangle	airbrush, circle, clear curve, custom brush, ellipse, fill, freehand brush, line, polygon, rectangle, text, undo	airbrush, circle, clear, fill, line, pencil, rectangle, rubber stamp, selection, text	airbrush, artist, brush, chalk, charcoal, crayon, eraser, felt pen, pen, pencil, water, watercolor
Special effects	custom, cylinder, pinch, punch, ripple, sphere, whirlpool	airbrush, antialias, blend, color strip, cycle draw, dupe, gradients, negative, RGB swap, redo, shade, sharpen, shear, tile, tint	color cycling, color pickup, gradients, grid, magnify, outline, patterns	color pickup, gradients, dashed lines	apply surface texture, apply screen, autoclone, grainy edge flat buildup, grainy hard, wet, soft buildup, oil and watercolor modes, Van Gogh style, Seurat style, and many more
Filter functions	add noise, average, blur, despeckle, edge enhancement, emboss, find edge, find edge and invert, Gaussian blur, maximum, median, minimum, mosaic, motion blur, sharpen, trace contour, user-defined	blast, burlap, demon, double edge, eclipse, edge, edge detect, emboss, haze, motion blur, mutate, nuclear, parchment, pastel, rough, sandblast, shake, slate, solar, stone, sundown, texturize, unfocus	shade, smear, smooth, antialias, colorize, translucent (tint)	contrast, gamma, RGB adjustment	brightness, contrast (See special effects; supports PhotoStyler and Gallery Effects plug-ins.)
Image control	brightness and contrast, convert format, distort, equalization, flip horizontal, flip vertical, gray/color correction, negative, perspective, posterization, resample, resize, rotate, skew	color mask, copy, cut, flip left/right, flip up/down, hardware zoom emulator, image merge (five types), move, paint/drag, RGB mask, rotate, scale, shape mask, stretch/shrink, superimpose	flip, merge, perspective, remap colors, resize, rotate, stencil (masking), warp	flip, mask, merge, rotate, Boolean operators	clip, clone (many variations), grab, mask, rotate, zoom
INPUT/OUTPUT					
File formats supported	BMP, EPS, GIF, PCX, TGA, TIF	BMP, EPS, PCX, SPG, TGA, TIF	LBM, MAC, MSP, PCX, TIF, VMG	BMP, BUT, CUT, IMG, MSP, PCX, TGA, TIF	BMP, PCT, PCX, RIF, TIF, TGA
Scanner support	yes	no	no	yes	no
Screen capture capabilities	no	no	yes	yes	no
Color separation capabilities	yes	no	no	no	no
TEXT TOOLS					
Number of fonts supplied	none	28	20	54	none
Type of fonts	any Windows screen font	bitmapped	Digi-Font typefaces ²	bitmapped	NA
Special text effects	NA	blend, shadow, fill	bold, italic, underline	resize, rotate	NA

¹Requires 24-bit video adapter to view this number of colors.

²The Hewlett-Packard downloadable LaserJet font format is now also supported.

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PAINT SOFTWARE FEATURES

	Image-In Scan & Paint 3.1 ¹	PC Paintbrush 5+	PhotoFinish 2.0	Picture Publisher 3.1	TEMPRA PRO 3.0
GENERAL					
Maximum image size	NA	limited by memory	limited by memory	limited by caching space on hard drive	8192 × 8192 pixels
Maximum number of colors	16.7 million ²	256	16.7 million ²	16.7 million ²	16.7 million ²
Color models	CMYK, HSV, RGB	HLS, RGB	HLS, RGB	CMYK, HLS, Pantone, RGB	CMYK, HLS, HSV, RGB
Online help	yes	yes	yes	yes	no
Disk space required	6MB	3MB	5MB	10MB	6MB
EDITING TOOLS					
Paint tools	airbrush, brush, drawing, eraser, eyedropper, hand (paste control), magnifier, pen, pointer (rectangle, point-to-point, ellipse, free form), scroll	airbrush, color replacer, clone, curve, eraser, eyedropper, line, magic wand, paint roller, paintbrush, spray can	airbrush, charcoal, color replacer, clone, curve, eraser, eyedropper, fountain pen, line, magic wand, paint roller, paintbrush, spray can	airbrush, clone, color probe, color tint fill, elliptical, eraser, freehand draw, gradient fill, paint, pencil, rectangular draw, smart fill, smear, texture, texture fill	airbrush, arc, curve, ellipse/circle, line, pen, polygon, rectangle/square, spline, TEMPRA WAND
Special effects	none ³	emboss, gradient, mosaic, motion blur	apply texture, black hole, crystallize, edge, detect, emboss, facet, fisheye lens, mosaic, motion blur, outline, pixelate, twist	crystallize, emboss, engrave, facet, graphic pen, highlight, mosaic, motion blur, noise reduction, pixelize, polar to rectangular, rectangular to polar, smooth edges, splatter, stucco, three-dimensional, twirl, wave wind	color cycle animation, color protect, color spread, perspective, pattern, clone, color compress (8-bit only)
Filter functions	blur, brighten, gallery effects, negative, color balance, sharpen	blend, brighten, contrast, sharpen, smudge, tile, tint	add noise, blend, blur, diffuse, maximum, minimum, posterize, remove spots, remove moiré, sharpen	darken, edge detection, lighten, sharpen, smooth, stitch	antialias, brighten, emboss, pixelate, sharpen, soften, stain, tint, wash
Image control	convert, flip, resample, rescale, resize, rotate, stretch, shrink, slant	resize, rotate, perspective	clip, mask, resize, perspective crop, rotate	automask, color shield, copy, copy to, cut, delete, elliptical mask, freehand mask, invert, mask transform, mask point editing, mirror, paste, paste from, rectangular mask, rotate, size smart mask	clip polygon, clip regular, fill, mask, mirror, pen editor, quick load, quick save, rotate left 90 degrees, rotate right 90 degrees, text, turnover, zoom
INPUT OUTPUT					
File formats supported	BMP, EPS, GIF, IMG, JPG, MSP, PCX, PNT, RAW, TIF, TGA	GIF, PCX, TIF	BMP, GIF, JPG, MSP, PCX, TGA, TIF	BMP, DCS, EPS, GIF, JPG, PCX, Photo CD, TGA, TIF	BMP, EPS, GIF, HRS, PCC, PCX, PXL, IMG, TGA, TIF, VST, WIN, -IM, !IM
Scanner support	yes	yes	yes	yes	yes
Screen capture capabilities	no	yes	yes	yes (with board)	yes (with board)
Color separation capabilities	no ³	no	no	yes	no
TEXT TOOLS					
Number of fonts supplied	22	24	none ⁴	none ⁴	3
Type of fonts	NA	bitmap and outline	Type 1 and TrueType	ATM and Type 1	Bitstream
Special text effects	bold, italic, normal, strike through, underline	gradient, shadow	none	resize, fill, rotate	drop shadow, blended drop shadow
¹ Information on Image-In Color and Image-In Color Professional available from the manufacturer.			³ These are available with Image-In Color Professional.		
² Requires 24-bit adapter to view this number of colors.			⁴ Uses fonts on system.		



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Software Carousel, Version 4.0



Software Carousel \$89⁹⁵

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NEWS & NOTES

Jill Champion

The BMW of Notebooks

New from Texas Instruments comes the fastest color traveler around: the new 486-based TravelMate 4000 WinDX2/40 Color notebook—"the ultimate portable speed machine," with a 40-MHz processor. It's the fastest, lightest, and most powerful 486-based color notebook computer available in a 5.6-pound package. This ultimate speed machine features 8MB of memory and a 200MB hard drive. It also includes the new Microsoft BallPoint with the QuickPort easy snap-on and snap-off connection that eliminates the need for a cable. The TravelMate's 9.4-inch-diagonal full-color screen displays 256 colors simultaneously at full VGA 640 x 480 resolution.

Preinstalled Windows 3.1 software powers up in less than 30 seconds. Also preinstalled is MS-DOS 5.0. To help get the most out of Windows, standard configurations include a portable pointing device, an oversized cursor, Windows power-conservation software, and custom utilities for quick entry to and exit from Windows.

Another advantage to the TravelMate: You can fly coast to coast with this machine's

486 power and have battery life to spare. The TI BatteryPro power-management system provides long battery life, and for added convenience and preparation time, BatteryPro shows you your remaining battery life at a glance.

Expansion options include lightweight, snap-on modules for Ethernet or Token Ring LANs as well as SCSI-compatible devices. TI also offers an optional 14,400-bps V.32bis modem with 9600-bps send/receive fax capability, which plugs into an internal slot in the TravelMate.

Scheduled to be on the market in January 1993, suggested retail price for the TravelMate 4000 WinDX2/40 is \$4,499. If you would like to get more information, contact Texas Instruments Peripheral Products, P.O. Box 202230, Austin, Texas 78720-2230; (800) 527-3500.

Classics for a Song

Five LucasArts original adventure games are now available as a collection set titled LucasArts' Classic Adventures—and at a very attractive price of \$59.95 for the set. The collection includes Maniac Mansion, the game that pioneered the point-and-click type of interface now adopted by most major publishers of graphic adventure games; Zak McKracken and the Alien Mindbenders, which centers around a journalist who writes for a supermarket tabloid; Indiana Jones and the Last Crusade, based on the 1989 blockbuster film; Loom, a mystery set in mythical times; and The Secret of Monkey Island, the humorous tale of a pirate wannabe.

Hint books for each game are also included in the package.

Why is LucasArts offering such a steal on five of its biggest moneymakers? "So new gamers can discover some original, classic favorites," according to Kelly Flock, head of LucasArts Games. "We want to introduce first-time PC owners to the world of entertainment software by making our classic graphic adventures easily accessible to new enthusiasts."

For more information, contact LucasArts Games, P.O. Box 10307, San Rafael, California 94912; (415) 721-3300.

A New Chapter in Books

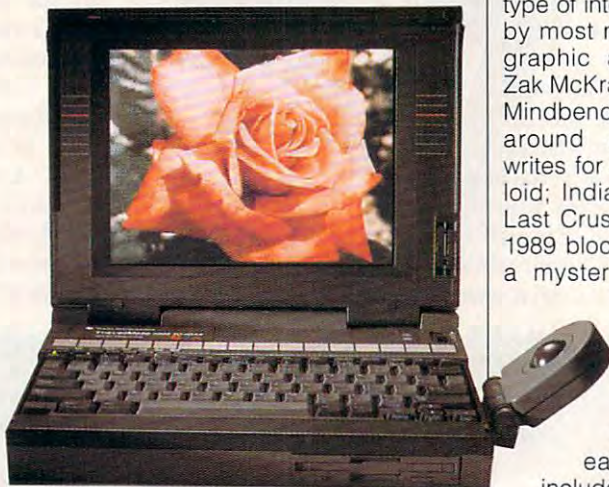
Books aren't what they used to be. With the introduction of its new Digital Book System, Franklin Electronics takes book publishing into the twenty-first century. Touted as one of the most powerful handheld reference devices ever made, the Digital Book could ultimately change the way reference materials are "printed" and accessed in the future.

Franklin's Digital Book, tiny enough to fit in a shirt pocket, is based on a ROM chip that's capable of storing 45 million pieces of data—the equivalent of every word in a stack of ten Bibles. The entire system, with lithium batteries and memory cards installed, weighs a mere 4.6 ounces.

Up to two ROM "books," each the size of a matchbook, can snap into the back of the hand-held system at the same time for instant access and cross-referencing between the two.

According to the Association of American Publishers, 90 percent of all printed material is already in digital form—manuscripts originate on PCs, where they're also stored and edited and then printed onto paper. Says Carol Risher, Director of New Technology for the Association, "Because those pages are in digital form, all are candidates for

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386DX Personal Computer

- high-speed 32-bit/25MHz central processing unit
- 40 megabyte IDE hard drive
- full expansion capabilities
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Companies or public relations firms with items of interest suitable for "News & Notes" should send information along with a color slide or color transparency to News & Notes, Attn: Jill Champion, COMPUTE, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408.

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Disreputable Characters

I'm 11 years old and have enjoyed programming for several months on my IBM PC. One of the games that I programmed in BASICA has user-defined characters. The game works perfectly in BASICA, but after the program is compiled in QuickBASIC, the computer locks up and the screen goes black. Is there a way of preventing that from happening?

MALCOM MCCAFFERY
SACKVILLE, NS

Sounds like you've created a machine language subroutine using a CALL statement that interferes with QuickBASIC's memory management, but it's hard to tell without seeing the program itself. You probably BLOADED the routine into an absolute address. If you're loading that subroutine into an area that QuickBASIC uses, you're asking for trouble.

A better solution is to write the routine in machine language and load it in as a separate module, using LINK to resolve the address for you. Also, if you're using an EGA, VGA, or higher-resolution graphics card, make sure you use the approved video interrupt INT 10h, function 11h character generator routines.

C-ing is Believing

I'm an avid reader of your magazine and like to create programs for DOS 8086-based machines. I'm currently learning C in college and, once the class is over, would like to continue developing my own programs, possibly some shareware. Which C should I purchase? I want the flexibility to write programs for both the DOS and Windows environments.

What's the difference between the Borland C++ & Application Frameworks and Tur-

bo C++ for Windows besides price? Do I need to purchase both? I'm confused as to why Borland doesn't just sell one C++ product that provides everything you need. If I purchase Turbo C++ for Windows, will I be able to do the things that Borland C++ & Application Frameworks does? I've noticed that Microsoft C 6.0 with Windows SDK and QuickC for Windows are set up in a similar fashion.

GLEN R. WHEELock
UTICA, NY

What's the difference between a Geo Metro and a Cadillac? Why does GM sell both? Because people have different needs and different amounts of money to spend. The Turbo and Quick lines of products were introduced to provide low-cost ways for beginners and light programmers to write in their favorite languages. The other products cost more and do more, so they're favored by professional developers. Pros use either Borland C++ & Application Frameworks or Microsoft C/C++, not the lower-end packages.

On the question of whether Microsoft or Borland languages are superior, COMPUTE staffers and contributing editors agree that you can't go wrong with either package. Borland C++ & Application Frameworks comes with a Windows-hosted development environment and may be available at your college at a sharp discount for students. Turbo C++ for Windows doesn't generate DOS programs, so it's out of the running for your purposes. Likewise, only the high-end Microsoft offering, C/C++ (now at version 7.0 for C but only 1.0 for C++), creates both Windows and DOS applications. On the other hand, Turbo C++ actually runs as a Windows program. Microsoft's program-

ming language doesn't. In Microsoft's favor is the home court advantage and 30 pounds or so of superlative documentation.

Spaced Out

Clark Harper ("Feedback," July 1992) has another option for entering filenames and directory names with spaces in them: character 255. Where a space appears in a filename or directory name, hold down the Alt key and type 255 on the numeric keypad. When you release the Alt key, a space will appear, but DOS will recognize it as a character and not the end of the name.

JOHN WILLIAM FORSYTH
FISH HOEK, RSA

Thanks to you and all the others who wrote in with the Alt+255 solution.

All the Rage

The letter from Mr. Horowitz in your September 1992 issue provides me with an excellent opportunity to vent some frustrations. You may recall that he had a 40MB drive but only had access to 32MB. I had the identical problem, and I couldn't wait to read the reply. Unfortunately, I couldn't understand it. Let me ask some questions about your answer.

1. You wrote, "Begin by completely backing up everything on your hard disk, using DOS's Backup program . . ." Which DOS?

2. "Make sure a copy of your backup program and command.com are on the floppy." Do you mean command.com from my current DOS?

3. "Next, boot from your floppy disk and run Fdisk." Do I boot from my DOS 3.3 floppy or my DOS 5.0 floppy?

And finally, at what point do I install DOS 5.0?

THOMAS FOCONE
PLAINVIEW, NY

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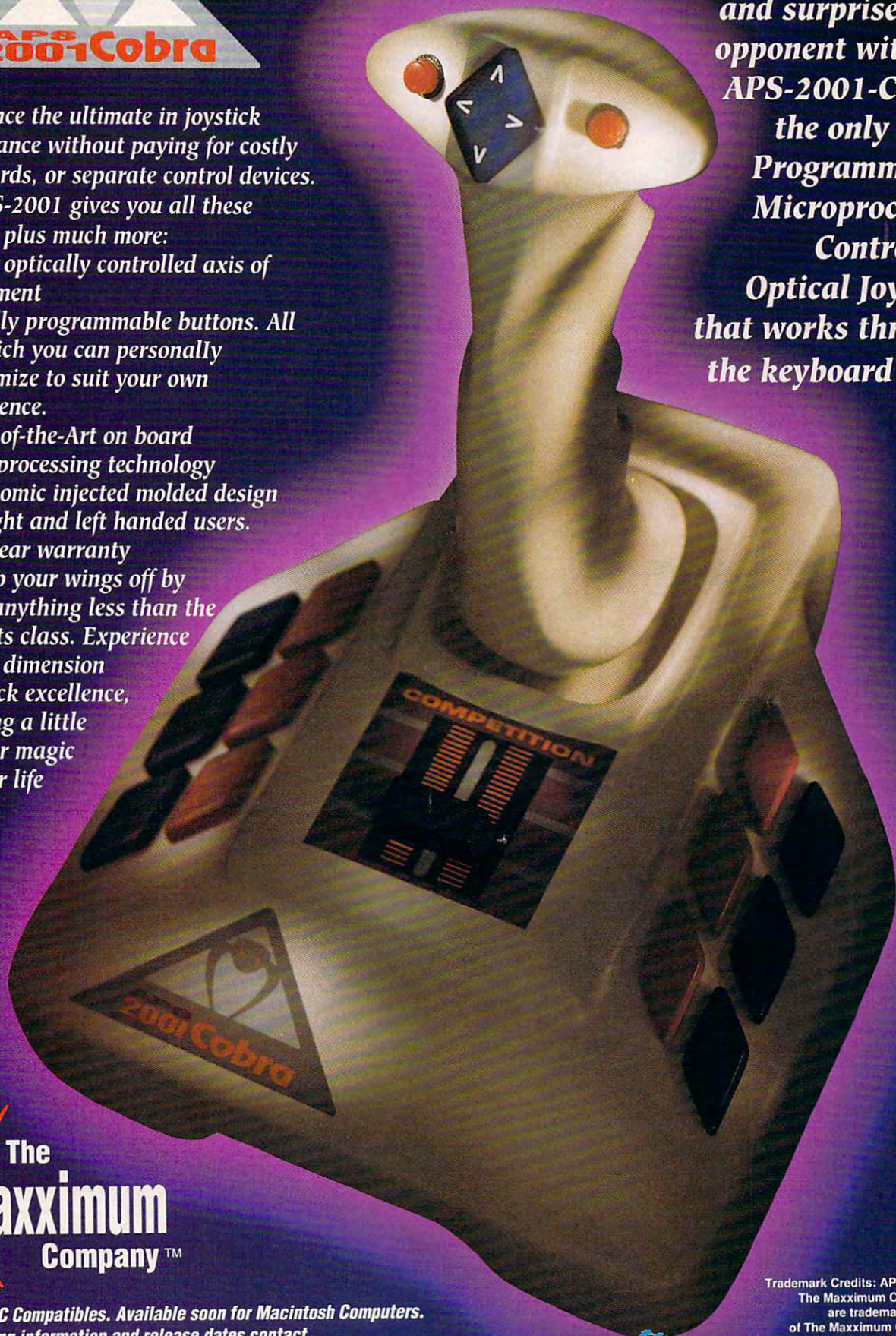
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FEEDBACK

We apologize if our reply was less than clear. First, from our reading of Mr. Horowitz's letter, we understood that he had already installed DOS 5.0, so the version of DOS wasn't a question on our minds. You would be best served if you installed DOS 5.0 before performing any of the steps in our reply. If you performed the steps using DOS 3.3, you would still be limited to 32MB of disk space per partition. You could (as another reader pointed out) use Fdisk to partition the other 8MB as drive D and thereby have access to the whole disk under DOS 3.3, but it has been our experience that 40MB of hard disk space in a single partition is more useful and flexible than 32MB and 8MB in two partitions. We recommend that you upgrade your DOS, back up your disk, and repartition to get access to the unused 8MB.

Forked Tree

My hard disk is almost full: it's stocked with many different programs and games. When I execute the DOS Dir command, it shows 10MB free. When I use Chkdisk, it tells me I have around 93MB of user files. When I use Dtree, it says I have around 80MB in files. Where are the missing megabytes?

Also, I have been considering buying one of those systems that double your disk capacity. Which do you recommend?

HORMAZD ROMER
WOODBIDGE, ON

We suspect that you've been led astray by the difference between the size of a file and the amount of space it takes up on your disk. Hard disks store files in sectors. If a file takes up less than a sector, it still uses up the whole sector. If you have a hard disk that uses 2048 bytes per sector (a fairly common size), then a file will take up a minimum of 2K on the disk, no matter how small it is in reality. A worst-case scenario would be if you had a 32MB disk and you placed 16,000 1-byte files on it—you would use up the entire hard disk to store only 16K of files. Most files are larger than a single byte, of course, but if a file is 11K, it will still take up 12K of disk space. Batch files are the worst offenders, since they're often shorter than 100 bytes, and our "Tips & Tools" column often features ways to gather many useful batch files into a single large batch file so disk space is used more efficiently.

In answer to your second question, we would unhesitatingly recommend *Stacker*. We've had the opportunity to

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Neither Micro nor Soft

This is to complain about an attitude you people seem to have that has surfaced again. Does Microsoft own a controlling interest in your magazine? I feel like I'm paying for an advertising brochure for Windows and Microsoft. The latest example is the "Programming Power" column in the September 1992 issue. Mr. Campbell lists Microsoft versions of BASIC, but what about PowerBASIC2 and its predecessor, Turbo Basic? I have both PowerBASIC and QuickBASIC 4.5, and PowerBASIC is superior in every way.

JAY KETHLEY
HOUSTON, TX

Thank you for the opportunity to reply to the many letters we receive that hint at ties between COMPUTE and IBM or between COMPUTE and Microsoft. COMPUTE is owned by General Media International, a privately held company that publishes many other magazines, including Omni and Penthouse. Neither IBM nor Microsoft has any connection with COMPUTE. We've had the opportunity to mention PowerBASIC and True BASIC many times in this column and will continue to mention them. They each have many fans, and they're both fine languages. You'll note that Mr. Campbell gave a balanced look at the BASICs offered by Microsoft and wasn't enthusiastic about many of them.

Patter Familias

I have become tired of all the advertisements you include in COMPUTE that are for "adults-only" services. By carrying these advertisements, you contradict family values.

KOBY SMITH
ROLLA, MISSOURI

Thanks for sharing your concerns. We strive to make our magazine of value and interest to all age groups.

Readers whose letters appear in "Feedback" will receive a free COMPUTE's PC clock radio while supplies last. Do you have a question about hardware or software? Or have you discovered something that could help other PC users? If so, we want to hear from you. Write to COMPUTE's Feedback, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408. We regret that we cannot provide personal replies to technical questions. □



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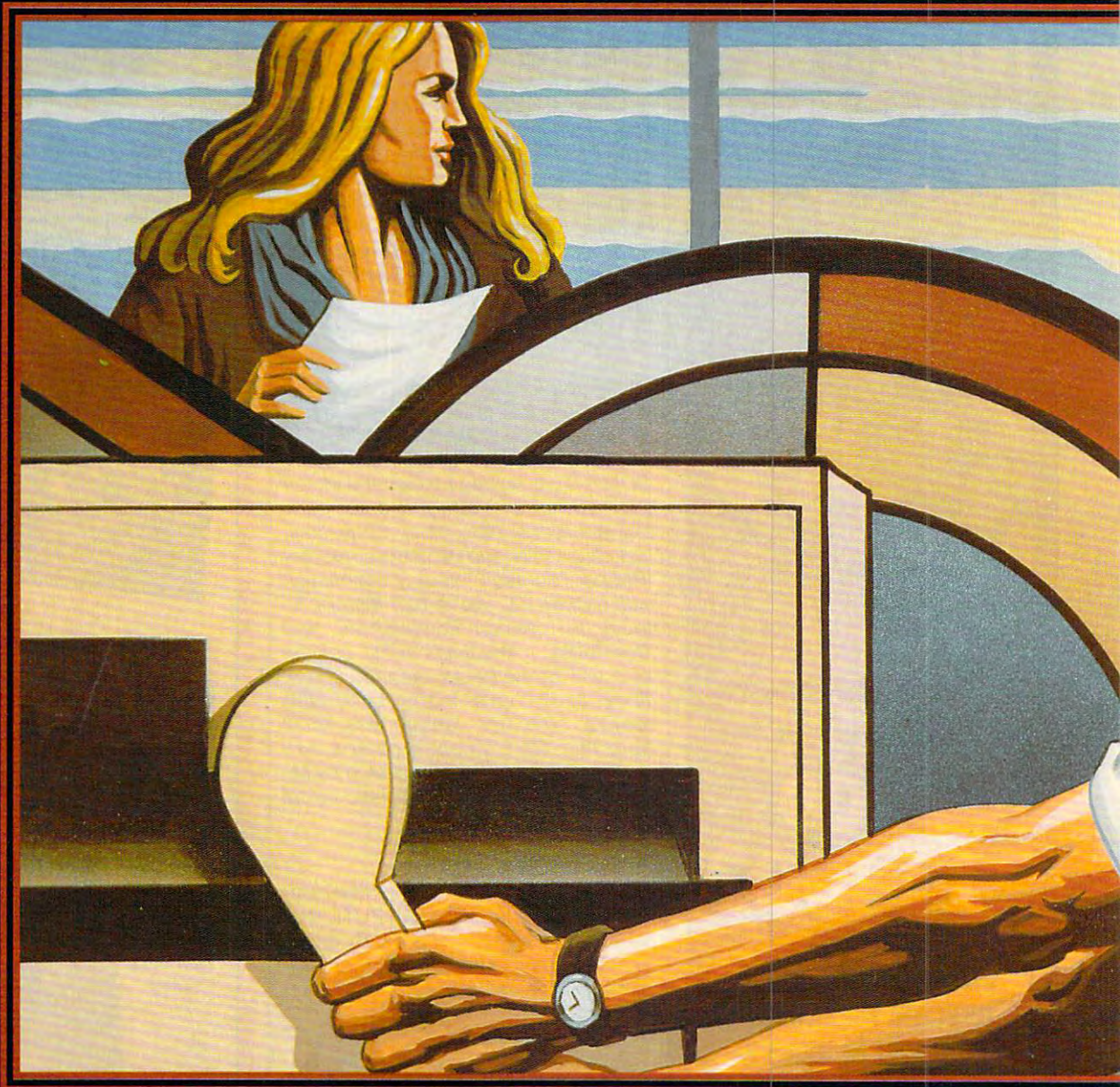


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To make Windows really smoke, you need top-flight



THE ULTIMATE WI

It goes without saying that you need a bold, powerful computer to run Windows at its best. The folks at Microsoft have endeavored to make Windows hospitable to nearly all PC hardware, and there are tricks and techniques to make it run better on any machine, but the only way to make Windows really shine is with the latest CPU, a quick hard drive with lots of free space, megabytes of RAM, and a speedy yet colorful video system. This leaves

BY DAN GOOKIN

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ht hardware. Here's our guide to choosing the best.



WINDOWS MACHINE

you not only wanting more but also faced with dozens of options and choices for upgrading your current PC, as well as any future PC you plan to purchase.

Configuring an ideal PC for Windows wouldn't be such a great problem if it weren't for two things. First, newer and better hardware appears daily. Subtle improvements are made in microprocessor and video technology, most of which are directly beneficial to Windows.

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This means you have more and more choices every day, and some of yesterday's best picks are rapidly becoming obsolete.

The second problem is money. Fancy new hardware is expensive. In a few years it will come down in price, but by then newer and better hardware will be available—and even more expensive. So while you can make the choice quite easily, the options you prefer may not be in your budget. And even if they are, is it wise to spend that much money on something when the price will eventually drop and other better and more expensive items will eventually appear?

Welcome to the buyer's dilemma. If money were no object, then creating the ultimate Windows machine would be a snap: Jog down to your local computer store and purchase the most expensive model. It's a no-sweat, no-brainer purchase. Yet, while this will get you a hot Windows PC, it's not a very smart way to spend your money. For example, you may be spending too much money on a fancy video system when that money would be better spent on a larger hard drive or more RAM. As with all computer purchases, how you spend your money depends on how you're going to use your Windows computer.

Four Basic Parts

Windows eats hardware for breakfast, and its four major food groups must be supplied in proportion to its appetite. Up front, there's the microprocessor, or CPU (which also includes the math coprocessor). Windows' basic lust for speed is satiated only by a fast CPU. Second, there's RAM, or memory. Windows devours RAM, gulping it down in megabyte-sized chunks. Third is the hard drive, which must be fast and contain plenty of room for Windows and its massive programs. Finally, there's the video system, where Windows shows its stuff. Since Windows is a visual environment, a PC's video system can make or break Windows, no matter how good the other three items are.

Together, the CPU, RAM, hard drive, and video system are the four pillars upon which you can build the supreme Windows computer. (Actually, these are the four major elements of any computer, so you could say that the ultimate Windows PC is also the ultimate PC. However, soup-ing up a computer in this manner to run only WordPerfect, 1-2-3, or an order-entry system would be an extreme waste of money.) Other items

are important, such as a mouse, sound card, modem, and so forth, but they aren't as crucial as the basic four.

CPU and Math Coprocessor

The heart of any computer is the CPU, or microprocessor. Windows requires an 80386-family CPU in order to run in the enhanced mode, Windows' top operating mode. Windows can run on an 80286-equipped PC, but then it's restricted to operating in the limited standard mode, where fancy features such as multitasking DOS programs isn't an available option. Fortunately, the 80386 family of CPUs is extensive and contains many brothers, sisters, and cousins bound to fill the role of Windows CPU.

The accompanying chart, "CPUs Capable of Handling Windows," lists CPUs capable of meeting Windows' demands. Topping the list is the current generation of PC microprocessors, the 80486 family. That's followed by the 80386 family and then the 80286. Quite frankly, you don't want an 80286 to run Windows. The 80486, at the top of the scale, is your ideal Windows microprocessor.

CPUs are judged by two factors: computing power and chip speed. These attributes apply to all the CPUs in the chart. Computing power is measured by a microprocessor's bit width.

That indicates the size of the numbers and the amount of memory the CPU can play with. The larger the bit width, the better the CPU. Early CPUs had a bit width of 8. Today's 80486 desk burners churn out numbers 32-bits wide. When Windows sees 32 bits, it gets very happy. Anything less, and you're making Windows tighten its belt, cramping its style.

One important aspect about a CPU's bit width is that there are both internal and external values. The internal value refers to the way the microprocessor handles values inside—the way it thinks in its "head." For example, just about any 80386 or 80486 CPU can juggle 32-bit numbers internally with one hand tied behind its back. The SX-suffixed CPUs, on the other hand, have a 16-bit width externally. This means that although they can handle the 32-bit numbers internally, they must slice them in half to slide them out the door. This slows the chip's performance, but it gives us the advantage of a less expensive chip.

The second factor used in judging a CPU is its chip speed. This is raw horsepower. Microprocessors calculate many thousands of times per second—sometimes millions of times per second. That speed is measured in millions of cycles per second, a value scientists have described as mega-

CPUs Capable of Handling Windows

Be aware that dealers will always advertise the higher speed.

80486DX A "pure" 80486 chip. This CPU computes using 32 bits internally and externally. The chip's speed (measured in MHz) is the actual speed of the chip.

80486DX2 This CPU computes at 32 bits internally and externally, just like the DX. The difference is the 2, which means this chip uses special tricks to run at twice its normal speed. For example, a 33-/66-MHz 80486DX2 runs at 66 MHz internally and 33 MHz externally. This chip is more economical than an 80486DX running at 66 MHz (which is a faster chip).

80486SX This CPU computes internally at 32 bits but at only 16 bits externally. This means its performance will be somewhat less than the full 80486DX or DX2 chip. Also, the 80486SX lacks an internal math coprocessor, which must be purchased at an extra cost. While the 80486SX is initially a less expensive CPU, the added cost of the 80487 math coprocessor chip to make it

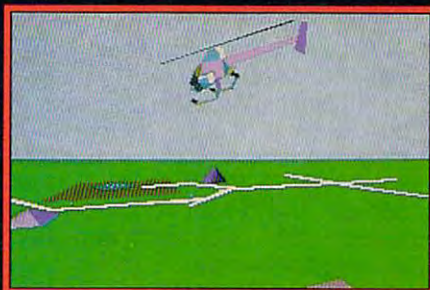
compatible with the full 80486DX makes this chip a poor choice.

80386DX This is the fastest 80386-family chip available. Like the 80486, it runs at 32 bits internally and externally. This chip is also a bit slower than an 80486 chip running at the same speed, and it requires a math coprocessor (80387) chip to be fully software compatible with the 80486DX.

80386SX This CPU runs at 32 bits internally but at only 16 bits externally. This makes it the least powerful CPU recommended for running Windows in the enhanced mode. On the upside, this is also the least expensive chip of the lot and the only CPU you're likely to find in most laptops (thanks to this chip's low power consumption).

80286 The 80286 CPU sits on the bottom rung of Windows power requirements. Windows runs on computers with this microprocessor, but not very well. In fact, with an 80286 chip installed, you're limited to running Windows in the standard mode.

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hertz (MHz). This value is straightforward: The more MHz, the faster the CPU. The typical speed of a PC's microprocessor is about 33 MHz. Older computers may sport slower speeds, sometimes 20 or 25 MHz, which was as far as the technology could push things a few years back. Today's CPUs can run at 33, 40, 50, 66 MHz—and faster. Obviously, the faster speed is better, but there are two warnings attached to this. The first concerns comparisons between the MHz values of 80386 and 80486 microprocessors. The 80486 is a later-generation chip and runs faster than a comparable 80386 chip. For example, an 80486 running at 33 MHz runs much faster than an 80386 also running at 33 MHz. In fact, an 80486 running at 25 MHz may be faster than an 80386 running at 33 MHz. While the 80386 may be less expensive, the 80486's advances in technology make it a faster chip.

The second warning concerns the 80486 clock-doubling chips. These chips will end with the number 2 or sometimes /2. By using special technology, the doubling chip sometimes—and only internally—can achieve speeds double its rating. For example, an 80486DX2 may claim a speed of 66 MHz—which would make it one screaming chip! However, the 2 indicates that this is a clock-doubling chip; the actual speed of the chip is really just 33 MHz. The advantage here, of course, is that an 80486DX2 that can sometimes run at 66 MHz would be much less expensive than a 66-MHz 80486DX. However, the 80486DX would be much faster, since it would always run at full speed.

Finally, there is a technical issue of the CPU's internal cache. This differs from a disk cache, which is a special area of your computer's memory set aside to improve disk operations. A microprocessor's cache is a special area on the chip that improves the speed of the microprocessor. (It works like a disk cache, but it does not require any of your PC's memory. The cache is stored on the chip or on a special companion chip.) Some CPUs will have no internal cache. Others may have a 1K, 8K, 64K, or larger cache. The larger the cache, the more performance you'll see from the chip. In some cases you may be able to upgrade the cache yourself; other times, the cache is an internal part of the microprocessor and cannot be changed. (Internal is better, by the way.)

This aspect of the CPU is something you may have little control over. Usually, only the big boys offer the

Buying a Windows Laptop

Windows on a laptop is no longer such a curious thing. On my last visit to the computer store (hunting for a laptop, incidentally), I was greeted with two dozen laptop computers, each of which was running Windows—some of them in color. Flash aside, the four basic hardware groups are also important when considering the ultimate Windows laptop, but to a lesser degree. For example, you may only get a 25-MHz 80386SX or SL in your laptop. The reason is power consumption. Higher-power CPUs draw a lot more battery power than the low-power 80386 models.

If possible, look for Intel's SL chips or similar microprocessors from other manufacturers, which are designed to have a special power-down mode that conserves juice when the laptop is inactive. If possible, make sure the laptop conforms to the Advanced Power Management (APM) specification.

RAM and hard drive capacity are limited on a laptop to available storage space. Most laptops can be upgraded to 4MB of RAM. Laptop hard drives are typically puny, though you may find the occasional 80MB or larger model. (And with programs like Stacker, you can convert that 80MB into a potential 160MB of storage.)

Finally, for video, most laptops come with built-in VGA or Super

VGA, though they display the image on a less-than-perfect LCD screen. If you want to bite the bullet and go into debt, then you can opt for a color LCD screen. Some of them do show color comparable to many desktop systems, but they are still very, very expensive. If you decide to go monochrome, take a good look at the laptop's rendition of Windows. Are there smears on the screen? Do colors bleed up and down or left and right? Do some colors cause flicker?

Another laptop item you need is a mouse. Some of the newer laptops have built-in thumbball mice. If the laptop lacks a companion mouse, then you can purchase one of the special clip-on trackball mice, such as Logitech's Trackman Portable or the Microsoft BallPoint mouse. These add width to the laptop, but not as much as a full-size mouse and mouse pad would.

Finally, don't neglect Windows' special options for laptop computers, such as color schemes or the mouse tails, which let you find the mouse more quickly. If you have plenty of money, then you can purchase the ultimate Windows laptop and really make fellow plane passengers jealous. But if I were you, I'd spend the cash on making my desktop model Windows happy and keep the Windows laptop just one notch above tolerable.

high-speed microprocessors with beefy caches, and they do so for a premium price. Overall, the best CPU to get for Windows is the fastest available 80486DX chip. As this issue goes to press, that's the 80486DX running at 50 MHz. (A 66-MHz model is rumored to be in the works, and the next-generation CPU, the Pentium, is also just around the corner.) The second-best CPU would be the clock-doubling 80486DX2 running at 66 MHz. It's a better choice than the 33-MHz 80486DX, which doesn't have the higher speed as an option.

On the economical front, the best chip worth having is the 80386DX. I recommend this above the 80486SX, which is essentially a slow 80486 without a math coprocessor. While the 80386DX also lacks a math coprocessor, its optional coprocessor chip (the 80387) is less expensive than the comparable chip for the 80486SX (the 80487). (Refer to "The Math Coprocessor Equation," elsewhere in this article.)

Laptop owners may be stuck with the 80386SX, primarily because of its low power consumption. For a desktop computer, however, I don't recommend the 80386SX at all; consider the 80386DX or save up some cash and go for the fastest 80486 chip you can afford.

The CPU Tally

Best Windows CPU: 80486DX at 50 MHz or 80486DX2 at 66 MHz
Very good: 80486DX at 33 MHz or 80486DX2 at 50 MHz
Economical: 80386DX at 33, 25, or 20 MHz
Unsatisfactory: 80486SX, 80286

Memory

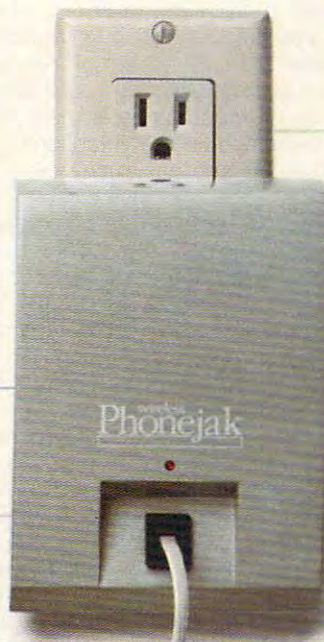
An 80386 or 80486 CPU can rule over four gigabytes of memory. That's 4096 megabytes, which is about 4092MB more than the typical PC contains. Even so, most PCs only have room for 8MB of RAM on the motherboard, sometimes 16MB or 32MB, given various expansion options. With all that

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memory, Windows claims it only needs 2MB to start in the enhanced mode. Of course, if you believe that, then there are some real deals on swampland in Florida if you're interested . . .

No matter how fast your microprocessor or how much hard drive space you have, Windows needs acres and acres of free memory to frolic and dance. Without it, the program is as cramped as an airline passenger in the middle seat in coach trying to slice up and eat a steak while maintaining a civil composure.

Realistically speaking, you need at least 4MB of memory to properly run Windows. However, Windows runs even better with 8MB. And 16MB? If your computer has room for that much RAM and you can afford to put it in, then why not? In fact, I'll make a blunt, flat rule about Windows memory consumption needs and how to fill them: Buy as much memory as you can afford for your PC or as much as will fully populate the motherboard. For example, the typical 80486 desktop-model PC may have room for 8MB of RAM. Buy it. Install it. Use it. If you have room for more RAM, buy it. Overall, memory is the least expensive thing you can add to your PC, and Windows will love it.

Another important point to consider is the type of memory you add. Specifically, Windows needs extended memory. This is the native memory you add to your 80386 or 80486 PC. Do not run any software drivers or special programs that convert the extended memory into expanded memory—no, no, no! Windows needs only extended memory; expanded memory is wasted when you run Windows.

As far as technical specifics go, make sure you buy memory of the proper speed and type for your PC. For example, if the manufacturer suggests buying 80-ns RAM chips, buy 80-ns chips. Don't save money by getting less expensive chips. The reason is that one slow chip in your PC will cause every other RAM chip to slow down to that speed. This isn't how you make Windows run fast on your PC. Other technical information about the chips is of a more specific nature; make sure you always have what the manufacturer suggests and nothing less.

Economically speaking, 2MB is the least amount of memory you need to run Windows in the enhanced mode. But why suffer? At present prices, another 2MB of memory is cheap (especially if you buy it by mail order from a memory chip specialty house). However, I recommend at least 8MB

of memory for Windows. With 16MB, you'll be going first class.

The Memory Tally

Best memory for Windows: 16MB or more—as much as your motherboard will hold/you can afford.

Very good: 8MB

Economical: 4MB

Unsatisfactory: Anything less

Hard Drive Size, Speed, and Type

Windows and its applications have a rapacious appetite for hard drive storage. By itself, Windows occupies some 10 or 12 megabytes of disk space. Add a single Windows application, and you lose another 10 or 12 megabytes. This all but rules out running Windows on a hard drive with only a 20MB capacity. Even a 40MB or 60MB hard drive gets cramped quickly with Windows.

The obvious solution to the hard drive storage dilemma is to buy the largest hard drive you can afford. I recommend anything over 200MB. If you need a formula, figure on a basic 40MB, plus 15MB for each of your applications (either Windows or DOS based). Double that figure and buy a hard drive of that capacity—or larger. Suppose you use Windows, Excel, WordPerfect for Windows, ProComm, plus a few utilities. That's 40MB + (4 × 15MB), which equals 100MB. Double that, and you get 200MB. Better still, since most people have more than four applications, consider a 320MB drive as the bare minimum for the ultimate Windows PC.

Capacity shouldn't be the only factor in selecting the ultimate Windows machine's hard drive. There are two other gauges you can use to measure a hard drive's willingness to behave with Windows: speed and interface. A hard drive's speed is judged by its average access time, measured in milliseconds (ms). This is the average time it takes the hard drive mechanism to reach out and fetch some data on the disk. The smaller the value, the faster the hard drive. Values of 20 ms or less indicate a fast, zippy, perfectly-suited-for-Windows hard drive. Anything less than 40 ms is OK, but avoid greater values.

The final factor used in selecting a hard drive is its interface, or the mechanism that controls the hard drive, sometimes called the hard drive controller. The best controller to get for Windows is the SCSI (pronounced "scuzzy," Small Computer System Interface) controller—but only if you select a top-quality SCSI interface

card, preferably one with an on-board microprocessor or large cache. And if you get the 32-bit EISA SCSI, then you're going just about as fast as you can go (refer to "Expansion Slots," elsewhere in this article).

Some may disagree with my selection of SCSI as part of the ultimate Windows machine's hard drive interface. However, any quick look at the top-of-the-line hard drives will prove my point: The hottest, fastest, and largest-capacity drives are all SCSI. Another advantage to SCSI is that you can connect up to seven hard drives to a single controller. Other controllers limit you to one or two drives. And if you don't need seven hard drives, then consider connecting a CD-ROM, a scanner, or another device to the flexible SCSI interface.

After SCSI, the two next-best options are the IDE and ESDI interfaces. Both of these types of hard drives are smart, having the electronics that control the hard disk on the drive unit itself. Some older workhorse PCs probably use the ESDI interface; modern PCs and nearly all laptops sport IDE drives. The problem with both of these is a lack of availability of drives at the higher capacities. But if SCSI is too eccentric for you, IDE drives in particular are a good second choice.

At the bottom of the heap are the older PC drives, identified as RLL, MFM, or some other interesting acronym. These drives have been supplanted by the newer standards mentioned above, and you should avoid using them. If your goal is to upgrade your PC to the ultimate Windows machine, then a new SCSI or IDE hard drive and controller is a good place to start spending your upgrade cash.

If you're trying to save money—and you're a cost-conscious buyer—then note that though large capacity drives are more expensive, the cost per megabyte is much less than with lower-capacity drives. And if there's one thing you can never overestimate, it's the amount of disk storage you'll need, especially under Windows.

The Hard Drive Tally

Best hard drive size for Windows: 320MB

Very good: 200MB

Economical: 80MB

Unsatisfactory: 40MB or less

Best hard drive speed: 20 ms or faster

Very good: Anything faster than 40 ms

Unsatisfactory: 40 ms or slower

Values of 20 ms or less indicate a fast, zippy, perfectly-suited-for-Windows

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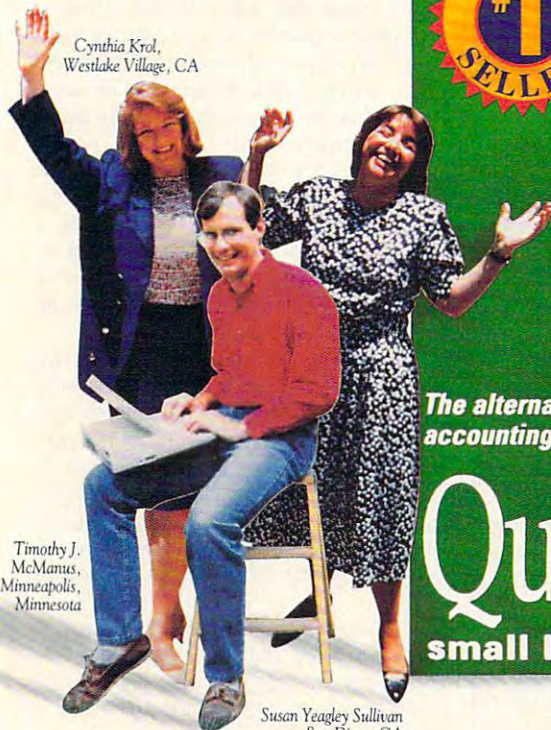
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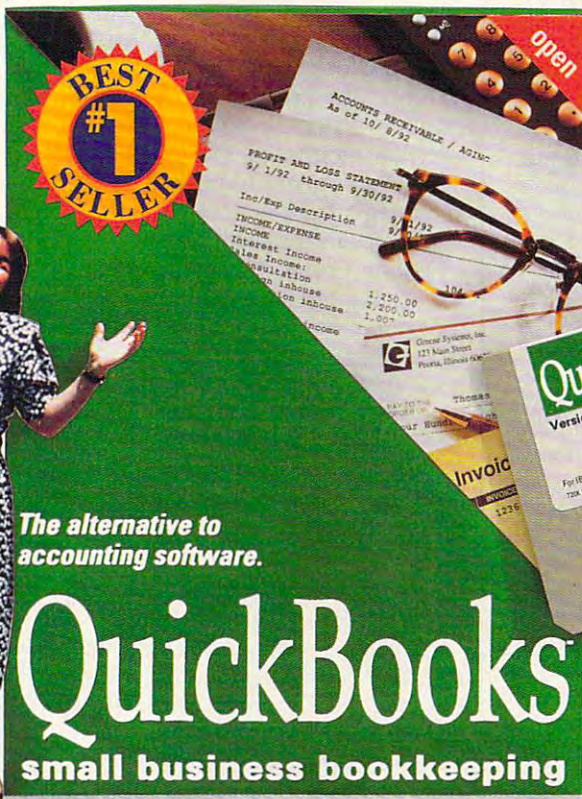
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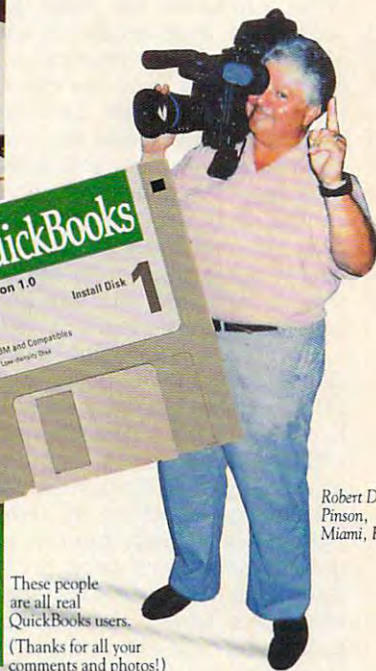
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hard drive. Anything less than 40 ms is OK, but avoid greater values.

Best type of hard drive: EISA SCSI
Very good: IDE, ESDI
Unsatisfactory: Anything else

Video Card and Monitor

One area of tremendous improvement over the past several years is in PC graphics. Gone are the days of ugly fuzzy text and primitive two-color graphics screens. Today's Super VGA offers colors, resolution, and splash to dazzle the most discerning graphics artist's eye. Not only that, but a technology called local bus (or direct bus) is enabling PC makers to directly connect the PC's eye (the video system) to the PC's brain (the microprocessor) for the absolutely fastest and best video system possible.

A PC's video system really consists of two elements: the video adapter card, which is an expansion card that plugs into one of your computer's expansion slots, and the monitor. Of the two, the adapter card is more important, since it sets the resolution and number of colors and determines what type of monitor you connect to the PC. Once you select the adapter card, you can find a suitable monitor, though some people will erroneously pick out specialty monitors and then hunt for video adapters to drive them.

There are many high-end video standards for the PC, so it's quite possible to spend a great deal of money to get the highest possible resolution with the most colors. Though they sound like part of the ultimate solution, adapter cards such as the XGA or the old PGA are really best suited for graphic artists with deep pockets (a rare combination) or CAD engineers who use a specific application that pushes the high-end video card to its limits. For everyone else, the Super VGA standard will suffice.

Super VGA is an extension of IBM's VGA video standard included with most PS/2 computers. It's called super because of its extra colors, resolutions, and graphics modes that the standard VGA graphics adapter lacks. Better SVGA cards offer 1MB or more of video memory. A resolution of at least 1024 x 768 pixels with 256 colors is considered good; 1280 x 1024 resolution is tops (anything higher, and you're starting to wander into graphic-artist land).

The best SVGA standard is the local bus or VESA standard. This is a video system that's integrated with your computer's microprocessor. The local bus is actually a direct line of

Cost-Effective Upgrades

Where do you start if your goal is to upgrade to the ultimate Windows machine? Right away, I can tell you that upgrading a PC a piece at a time is much more expensive than buying a new model—just like buying a car a piece at a time would cost two times the sticker price (which is the theory behind which chop shops operate). And chase away those thoughts of selling your PC used; there's no value in it! Consider donating the old clunker to a school or nonprofit organization instead. However, if you want to upgrade, here are the items I suggest purchasing, in the order they'd be most effective.

More memory. This always helps, even on an 80286 system. Pack that motherboard full of RAM!

A larger, faster hard drive and controller. If that's out of your reach, consider adding a second drive.

A video system upgrade. I list this third because the improvements more memory and a better hard drive have to offer will be immediately noticeable, whereas newer graphics hardware just makes poky old Windows look better.

A CPU upgrade. This isn't an option for most of us. Newer computers have CPU upgrade paths; older systems are stuck in the mud. Some 80286-to-80386SX options exist, such as the SotaPop or Cumulus 80386SX upgrade kit. A better solution might be a motherboard swap, which also updates the support circuitry the microprocessor relies upon.

Other items, peripherals, sound cards, CD-ROM, and so on. Save these upgrades for last; spend your money on the items above, in order, before you consider the fun stuff.

As far as spending money is concerned, consider what it is you do under Windows. If you notice your software going out to disk a lot and you subsequently wait for the disk drive to catch up, put more money into a faster disk drive and less into RAM. If the disk drive is fine, then shift more funds into RAM or a fancy video system. In the end, you may not have the ultimate Windows machine, but you'll definitely end up closer to it than when you started.

communications to the computer's brain, allowing for the fastest possible video. (Other local bus items, such as hard drives, will probably be available in the near future.) Keep in mind that a VESA, local, or direct bus video system should still be SVGA compatible.

Selecting the ultimate Windows machine's video monitor isn't that hard once you've chosen a graphics adapter card. The typical monitor has a tube that measures 14 inches diagonally, with 15-inch and larger monitors available. The advantage of the larger monitor is that you can see more information on the screen—especially with the higher graphics resolutions possible on SVGA systems.

Monitors have several technical descriptions attached to them. The most important of these for shopping purposes is whether the monitor is interlaced or noninterlaced. Many users claim that noninterlaced monitors offer a clearer image without flicker. If you have a choice, noninterlaced is the better option; however, I've seen many interlaced monitors that don't seem to flicker much.

Most of the other descriptions of a monitor are technical and serve only to boggle the mind. I prefer to see a monitor in person before buying it, since the dot pitch, refresh rate, and other technical descriptions don't really describe the image you see.

Specialty monitors for Windows include larger 19-inch and portrait and landscape models. The huge monitors are usually selected for in presentations. While it would be impressive to view Windows on a 19-inch screen, you'd probably have to wear lead-shielded eye shades and sunblock with an SPF of 15 if you sat too close to it!

The portrait monitors are nice because they display approximately one page of information, typically 9 inches wide by 15 inches tall. This is ideal for desktop publishing where viewing a page's "real size" is especially important.

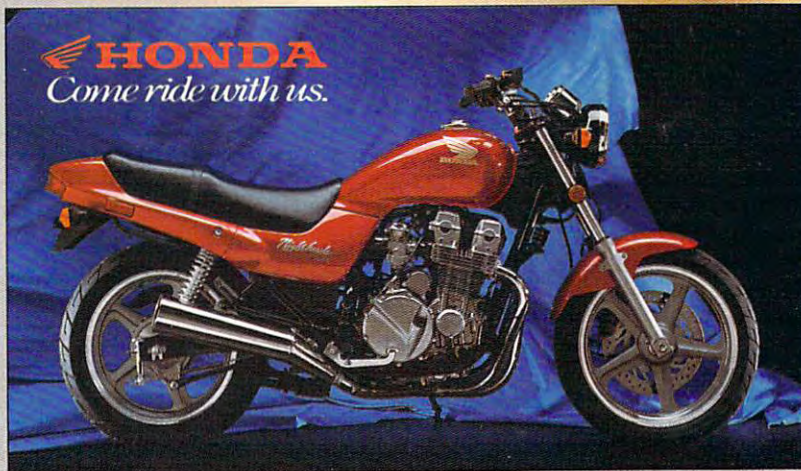
The landscape monitor is a portrait monitor lying on its side (some even rotate between landscape and portrait positions). Landscape monitors are best for showing horizontal information, such as long spreadsheets or some types of graphics.

Picking a specialty monitor for Windows may involve buying a custom interface card; it definitely will require a special type of video driver. In fact, Windows is extremely flexible when it comes to weird monitors and video drivers. Some setups, such as the Colorgraphic Super Dual VGA

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Be sure to see the March issue of COMPUTE for a look at the rest of this year's lineup of prizes, and a full view of the 1993 Chevrolet Camaro Z28. Don't miss it! No purchase necessary. Void where prohibited.

*Always wear safety belts, even with air bags.

card, allow you to run several SVGA adapters and several monitors on a single Windows machine. While this may qualify as the ultimate Windows machine, sticking with SVGA and a good 15-inch monitor will suffice for most of us.

The Video Tally

Best video for Windows: Local bus SVGA, 1MB or more video memory
Very good: SVGA, 1MB or more video memory
Economical: SVGA or VGA
Unsatisfactory: EGA, CGA, Hercules,

oddball standards

Luxury Items Worthy of Consideration

Why limit yourself only to a fast CPU, a large hard drive, mountains of memory, and vivacious video when creating

Mail-Order Machines to Fit the Bill

The ultimate Windows machine is . . . just about anyone's guess. Truthfully, just about any manufacture can configure the ultimate Windows machine. You need to know the contents of the box and the phone number of your favorite dealer (the cash comes later). All told, the following system or one very similar qualifies as the ultimate Windows machine.

CPU: 50-MHz 80486DX
Memory: 16MB
Hard drive: 320MB, 20 ms, EISA SCSI
Video: Local bus SVGA, 1MB video memory, 15-inch monitor
Other stuff: Both 3 $\frac{1}{2}$ - and 5 $\frac{1}{4}$ -inch drives, mouse, DOS 5.0, Windows 3.1

This is the base system. Anything extra—CD-ROM, sound card, printer, scanner, and software—must be added as an extra; the idea here is to buy the basic powerhouse. To meet these requirements, I called several top mail-order vendors to see what they had available and for how much. Please note that the prices listed here are as of October 1992; current prices and configurations will doubtless be different.

Dell Computers

(800-426-5150)

Dell's ultimate Windows graphics workhorse is the 450DE-2, DGX. It's powered by a 486DX chip running at 50 MHz, and it contains Dell's own DGX direct video. The 450DE-2 is an EISA machine, complete with the required 16MB of RAM and a 330MB SCSI card. The monitor is a 15-inch flat screen, noninterlaced model. Dell also tosses in a Microsoft mouse, DOS, Windows, and one year of on-site service. The price for the complete package: \$5,489 plus local tax and shipping.

The Dell salesperson suggested that we might want to go with the ATI Ultra card in place of the direct

video. He explained that the DGX system is really designed for high-end CAD operations, though it will certainly smoke on any Windows application. If we elected to use the ATI Ultra card, the unit's price would drop to \$4,689.

Gateway 2000

(800-523-2000)

The Gateway 2000 66-MHz 80486DX2 EISA machine easily qualifies as an ultimate Windows machine. The system to fit our bill comes with a 66-MHz 486DX2, EISA bus, local bus VESA video (the Ultra Store 24X), local bus SCSI hard drive at 500MB, and 16MB of RAM. A 15-inch CrystalScan 1572FS flat screen monitor, mouse, DOS, Windows, and your selection of Windows or DOS application software finishes the picture. All of that lists for \$4,240, plus a shipping and handling charge of \$95.

CompuAdd

(800-925-7811)

CompuAdd doesn't have an EISA machine, nor does it offer SCSI hard drives. But the rest of the system does stack up rather nicely: an 80486DX2 running at 50 MHz, 16MB of RAM, two 200MB IDE hard drives for a total of 400MB disk space, local bus video, and a 15-inch monitor for \$2,925. There is no tax charge, and shipping is UPS ground rate.

Extra goodies offered by CompuAdd are abundant. The salesperson suggested a tape backup unit, surge protection or uninterruptible power supply, plus an optional fax/modem card. The fax/modem deal was particularly sweet: only \$109 for the Intel SatisFAXtion card, which includes preinstalled software.

IBM Direct

(800-426-2968)

IBM Direct doesn't sell all of IBM's machines. Specifically, the high-end 80486 and MCA systems aren't avail-

able, which somewhat limits your selection of an ultimate Windows machine.

The beefiest system IBM Direct has available is the PS/2 model 35. That's an ISA PS/2 with a 20-MHz 80386 microprocessor, 2MB of RAM, and a 40MB hard drive. VGA is built into the PS/2 system. The entire price is \$1,495, which also includes DOS. A mouse is \$80 extra.

Needless to say, this system barely qualifies as anyone's ultimate machine, but it's what IBM Direct offers. Upgrade options are available, including CPU upgrades. The salesperson also reminded me that IBM offers a one-year warranty with 24-hour support and on-site service. If it's your dream to have the letters IBM on your desktop, this is your mail-order Windows system. However, for only a few hundred dollars more, much more capable machines are available. (And you can always check out the local IBM dealership for its 80486 line.)

Swan

(800-446-2498)

Swan offers both EISA and ISA machines, but when I requested EISA, the salesperson recommended I get the ISA machine instead. The ISA machine is the only model equipped with local bus video, which Swan calls direct bus. The EISA model would have to be equipped with a 1MB video card, which Swan admits would be much slower—and less desirable for Windows—than the local bus option on the ISA machine.

The ultimate Swan Windows machine is the model 66DB. That's a 66-MHz 80486DX2 with 16MB of RAM, a 310MB SCSI hard drive, a 15-inch noninterlaced monitor, a mouse, and Windows. The system comes in at \$5,625, which includes shipping (add tax only if you live in Pennsylvania). Swan also offers a gracious two-year warranty and on-site service.

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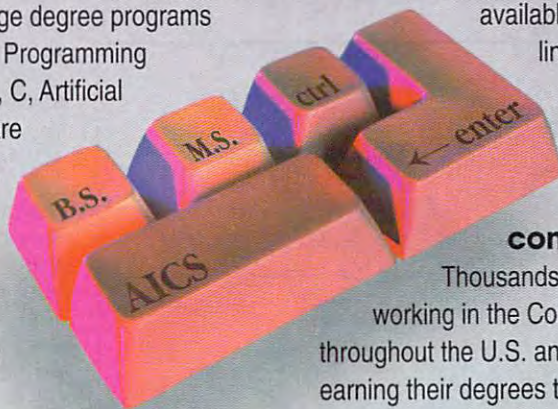
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the ultimate Windows machine? Many would argue that the ultimate Windows machine must also be a multimedia computer. They may even stretch it to include some type of desktop TV or video editing. Others may claim you need a fax/modem or a tape backup system to round out the ultimate PC. While all of these items contribute to an ultimate Windows machine, they're not as central as the basic four. In fact, few of the high-end systems from the national mail-order vendors (see "Mail-Order Machines to Fit the Bill," elsewhere in this article) include or even offer such options, so they remain luxury extras.

The first and most obvious addition to any Windows PC is multimedia. That's a buzzword for expanding a computer by use of sound, music, a CD-ROM drive, and sometimes desktop video. While the concept may remain fuzzy, Windows is capable of supporting sound and MIDI, the Musical Instrument Digital Interface, right out of the box. So the software is there. Additional multimedia software usually comes with the multimedia PC or a multimedia upgrade kit, which can be purchased separately.

The typical multimedia upgrade kit includes a sound card, speakers, a

CD-ROM drive and its interface (usually SCSI), and software. (The MIDI kit, plus any MIDI-compatible electronic musical instruments, are usually extra.) The price of these kits varies from about \$400 to over \$1,000 for sophisticated 16-bit setups. If you buy all of the parts separately, the cost will be more.

A modem or fax/modem card is another option worth considering for the ultimate Windows machine. Modems allow you to hook up your PC to the phone line and access online services, national databases, or remote computers such as the office computer, your home computer, a laptop, and so on. The topflight modems run at the blazing speed of 14,400 bits per second (bps), with lesser models flying by at 9600 bps. Entry-level models buzz by relatively slowly at speeds of 2400 bps and 1200 bps. Modems come in both internal and external models.

Better than stand-alone modems are fax/modem cards. These plug into your computer and give you both computer communications as well as standard level III fax capabilities. Using your computer and a phone line, you can both send and receive faxes while in Windows. Higher-end

models come with on-board micro-processors that allow you to send and receive faxes without impeding the PC's overall performance. Special software that runs under Windows allows you to send a fax in the same way you send a document to your printer.

A tape backup system is a boon to any PC. Rather than mess with a stack of floppy disks, you can use the tape backup to archive your entire hard drive onto a single inexpensive data cartridge. Special software that runs under Windows makes this painless and much more convenient than backing up with floppies alone.

Finally, you should consider some type of surge protection—especially in areas of unreliable power or where lightning strikes are common. Varying degrees of power protection can help insulate the valuable components inside your PC against electronic havoc. On the high end of the scale, adding an uninterruptible power supply is considered a must for any PC whose contents you value.

Ultimate Standards

Other items in the ultimate Windows machine are more or less accepted features on any PC: a floppy drive, either 3½- or 5¼-inch or both; a serial and a parallel (printer) port, or maybe two of each; a mouse and a mouse port—which are required for Windows even though the box says they're only recommended.

Creating the supreme machine for Windows can be challenging and fun. Paying for it is more challenging but less fun. Leading-edge technology—what Windows requires to run at its best—is something you can never really have; as technology advances, the power of your machine begins to slip through your fingers. So while planning and building are fun, the ultimate Windows machine you create winds up being for today and not quite for tomorrow.

In the end, the real question is how to spend your money. Do you really need the latest screamer with tons of power to run Windows? Not really. While the fastest CPU, gobs of memory, a large and speedy hard drive, and decent video are important, you don't need everything and the kitchen sink to create a worthy, powerful Windows PC. By spending your money wisely and applying it in the proper amounts toward the proper areas of your PC, you can create a robust, muscle-laden Windows machine without going bankrupt or losing any sleep over creeping technology. □



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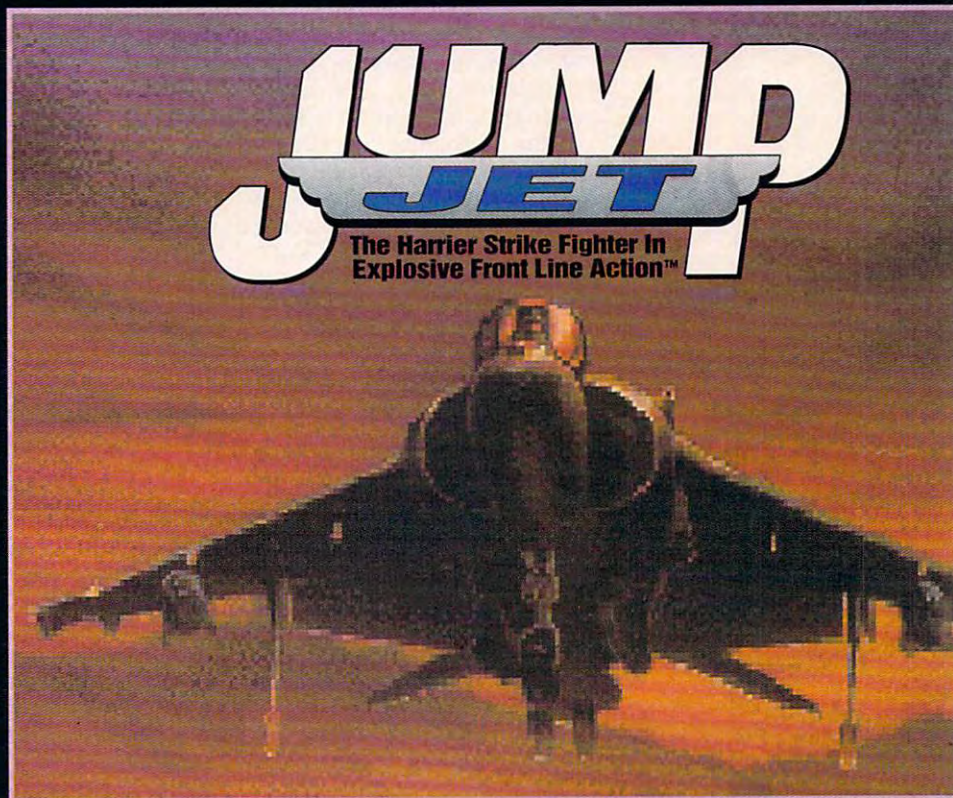
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WINDOWS WORKSHOP

Clifton Karnes

TAPE BACKUP FOR WINDOWS

Windows has really upped the hardware ante. Most of us would agree that Windows helps us get more work done more quickly and with less effort, but all this high-powered productivity demands some pretty hot hardware. Let's face it—to really run Windows right, you need at least a 386DX with 4MB of RAM, Super VGA graphics, and a 200MB hard disk (or a 100MB Stacked hard disk).

Make no mistake about it: If you run Windows, you need a tape backup.



It's this last point that I'm going to talk more about—hard disk space. Windows programs demand megabytes and megabytes of hard disk real estate. It's not at all unusual for a Windows app to require 7MB–10MB. Before you know it, you have a hard disk full of applications and data files—a hard disk you should back up. But how? If you're lucky enough to have a 400MB hard drive, you'll soon discover that you'll need nearly 300 high-density floppies to back up that sucker. With large hard disks, floppies are just not an option. So what do you use? In a word, tape.

Windows makes tape backup an essential. But choosing the best backup system can be tricky. First, you'll need one that provides high capacity—at least 200MB per tape. Second, you'll want a system that's fast. Third, you'll want a system that has a Windows

backup program—so you can work while you back up. And the last consideration, of course, is price. This system should be under \$500.

Is all this too much to ask? I would have thought so before I tried Irwin's AccuTrak Plus (Maynard Electronics, 36 Skyline Drive, Lake Mary, Florida 32746; 407-263-3500; \$349; high-speed controller, \$179). This superb tape system comes in internal and external versions and can be used with your current floppy controller or with a special high-speed controller. The system stores as much as 250MB on a tape (with compression), and it comes with the easiest-to-use backup program I've ever seen—EzTape for Windows.

I opted to test the internal model with the high-speed controller. To install the unit, I simply put the controller card in an open slot, inserted the tape drive in an open drive bay, and installed the EzTape for Windows software.

To get going, I pushed a tape in the drive and cranked up EzTape. The EzTape screen looks a lot like the Windows File Manager, displaying a directory tree on the left and a file listing on the right. Above the tree and file windows is a toolbar with buttons for Disk, Library, Tape, Mark, Unmark, Backup, Restore, and Scan.

Disk, Library, and Tape are the three sources you can choose. The default is Disk, showing the files on your hard disk. To back up, you simply mark anything from a single file to your entire hard disk.

After selecting the files, you click on Backup, and you're presented with a dialog box that includes the name of the backup set, any password you'd like to assign to the backup set, and options to reset the archive bit (the default), ver-

ify after backup, add to library, encrypt the backup file, and choose the level of compression (none, level 1, or level 2).

The only default I changed was the compression level. The default is none, which would only store about 120MB on my 200MB hard disk. I knew I'd need level 2 to push the tape's storage to 200MB.

After changing the compression, I clicked on OK and listened to the tape whir. It took about 50 minutes to back up about 170MB of data. The backup really did multitask. I worked in Microsoft Word for most of this period and didn't have any problems.

After making the backup, I labeled the tape and decided that I'd restore some files to test the system the next day. Little did I know that a malevolent program would trash some essential data on my hard disk and make my first attempt at restoring more than just an exercise.

The next day, I was running a beta copy of a program I was testing, and after a crash I noticed that Ascend, the personal information manager I use, wasn't working. As it turned out, half a dozen files in my Ascend directory had been mangled by the beta program. Yikes!

I cranked up EzTape and inserted the backup I'd made the day before. I still hadn't read the manual, but it seemed logical to click on the tape button, which I did. After a few moments of whirring and flashing lights, EzTape showed me a tree and file listing of the backup files on the tape. I moved to my Ascend directory and marked it. Next, I clicked on Restore, and in less than a minute, my entire Ascend directory had been restored. Everything worked perfectly. EzTape and the AccuTrak had saved the day—and my bacon. □

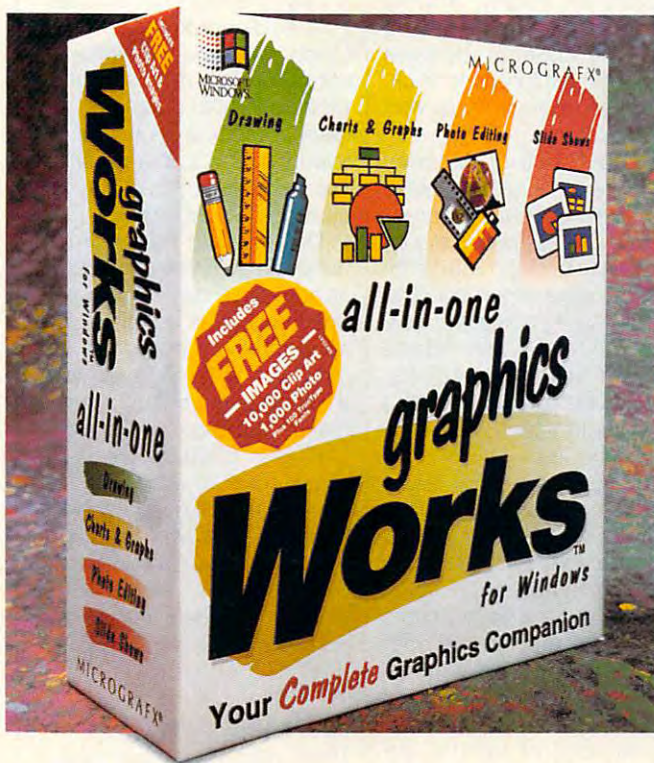
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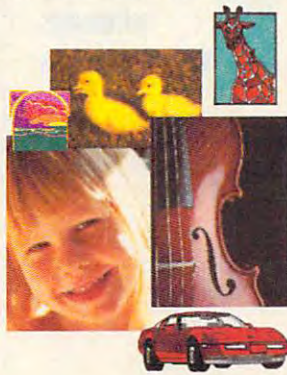
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TIPS & TOOLS

Edited by Richard C. Leinecker

Surviving disaster with your data intact, entering Debug scripts the easy way, wildcards and directories

Protect Your Backups

My staff of 12 programmers dutifully handed in their backup disks on Friday, August 21, 1992, before leaving work. I put them in my desk drawer and left for home thinking the company's data was safe and sound.

At about 5:00 on Monday morning, we caught the north eye wall of Hurricane Andrew. Before the wind-measuring instruments broke, winds of 192 mph were recorded. The concrete utility poles that carry electricity to South Florida snapped like toothpicks. When dawn arrived, I didn't see a single intact roof in my neighborhood.

After assessing our damage, I decided to walk the two miles to the office. Planes from the nearby municipal airport littered the fields as if they were a young boy's toys thrown during a temper tantrum. Our building came into view, and my worst fears were realized—it was destroyed. Out of habit I unlocked the door and walked to the pile of rubble that was my desk. So much for my backup disks.

The good news is that all of the equipment had been removed on Saturday afternoon in preparation for Hurricane Andrew. Thankfully, our computers survived, and we didn't lose any data. But I've learned some lessons that will stay with me as long as the memories of the flattened houses in my neighborhood.

Backup disks that are near the equipment are only useful if a file is accidentally deleted or corrupted or if the hard drive crashes. In the event of a serious catastrophe, you're done for. Even another room in the same building isn't necessarily safe.

Here's what I've implemented at work: I keep a set of backups in my new desk in

case files are deleted or hard drive problems arise. I bring a duplicate set home with me, in case there's a fire or (heaven forbid) another hurricane. I then send another duplicate set home with the company's president, who puts them in a fireproof safe at his house. I'm even thinking about getting a safe-deposit box at a bank for storage of backups.

Don't let luck be the crucial factor in whether your business or other computing enterprise succeeds or fails. A little bit of foresight and effort can make the difference between a minor inconvenience and a major catastrophe.

If your business requires any kind of crucial data that cannot be lost, heed my warnings. Make multiple backups and keep them in multiple locations. You never know when you'll need them.

RICHARD C. LEINECKER
MIAMI, FL

Easier Debugging

Three different people submitted similar tips for making entry of the Debug programs found in the "Tips & Tools" column much easier. Their letters have been combined into a single tip.

Instead of typing the hex codes directly into Debug, create a file using a text editor or word processor. If you use a word processor, make sure that you save the data as an ASCII file.

Type the Debug codes beginning right after the line that says File not found. Note that the hyphen prompt is produced by the computer and should not be in your text file. Each line of data will look like this in your text file.

e 100 BE 82 00 BF 41 01 31 ED

After all of the lines of data are typed in, check to make sure you've entered every-

thing accurately. The next lines in your file should look like this.

**RCX
56
W
Q**

Be sure to press Enter after typing the Q at the end. The number 56 in the second line will vary from program to program. It's a hex value representing the number of bytes in the program. Once you have your script file saved to disk, type *debug filename < textfile* (where *filename* stands for the name of the program you are compiling and *textfile* stands for the name of the file you typed with your text editor). If your prepared file is named test.txt and the com file that you're creating is called test.com, you'd type the line *debug test.com < test.txt*. The next tip spends a little extra time showing you how to use this technique.

Another trick you might want to try is to type *n filename.com* on a line by itself at the beginning of the text file (*filename* stands for the name of the program you are about to create). Then send it to Debug by typing *debug < textfile*. The first line tells Debug that you're creating a new program and gives its name. Debug does the rest.

EDWIN LEE
WILLOWDALE, ON
THOMAS S. FREEMAN
PACIFIC PALISADES, CA
KENNETH B. DAVIES
BELLINGHAM, WA

Wild Directories

I often find myself wanting to change directories with wildcards. It's usually shorter to type *t** than *thisdir*, and it's sometimes convenient when you forget the exact name of a directory. Here's a short program that lets you change directories with wildcards. Just

type *cdw directory* (where *directory* is the name of a directory including wild-cards), and it'll change to any valid directory on your current drive.

You can type in Cdw using the DOS Debug command. Make sure the DOS program called Debug is in your path or the current directory. In these examples, the italic text is what the computer prints; the roman text is what you should type. One way to be sure you get these programs exactly right is to have someone read the numbers to you as you type them in. Another way suggested by one of our readers is to read the numbers into a tape recorder and then play them back as you enter the program code.

debug cdw.com

File not found

-e 100 be 80 00 ac 0a c0 74 3c

-e 108 ac 3c 0d 74 37 3c 20 74

-e 110 f7 8b d6 4a ac 3c 0d 74

-e 118 04 3c 20 75 f7 c6 44 ff

-e 120 00 b4 4e b9 10 00 cd 21

-e 128 72 1a b4 2f cd 21 83 c3

-e 130 15 f6 07 10 74 12 83 c3

-e 138 09 80 3f 2e 74 0a 8b d3

-e 140 b4 3b cd 21 b4 4c cd 21

-e 148 b4 4f cd 21 72 f6 eb da

-RCX

CX 0000

:50

-W

Writing 0050 bytes

-Q

If you'd like to try the method mentioned in the previous tip, create a text file called *cdw.txt* that looks like this.

e 100 be 80 00 ac 0a c0 74 3c

e 108 ac 3c 0d 74 37 3c 20 74

e 110 f7 8b d6 4a ac 3c 0d 74

e 118 04 3c 20 75 f7 c6 44 ff

e 120 00 b4 4e b9 10 00 cd 21

e 128 72 1a b4 2f cd 21 83 c3

e 130 15 f6 07 10 74 12 83 c3

e 138 09 80 3f 2e 74 0a 8b d3

e 140 b4 3b cd 21 b4 4c cd 21

e 148 b4 4f cd 21 72 f6 eb da

RCX

50

W

Q

Then, from the command line, type *debug cdw.com < cdw.txt*. The com file



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TIPS & TOOLS

will be automatically created. If you run Checksum on this com file, the result should be 062.

RICHARD C. LEINECKER
MIAMI, FL

Long Lost WordPerfect File

If you're like me, you've got a million files in your WordPerfect directory. When your boss asks you to find a memo you wrote a year ago, it's hard to remember what you named it. It can be like finding a needle in a haystack. Fortunately, there's a solution with WordPerfect.

Log to the directory where the document is most likely stored. List the files by pressing F5. When prompted for the directory, type in the path of the directory you wish to search (for example, c:\wp51\docs). Once the files are listed, look at the bottom of the screen for the available options. Select 9 (Find) and then 4 (Entire Doc). When prompted for Word Pattern, type in a word (in all lowercase characters) which would be unique enough to identify the document once a match has been made.

You might type something like *overtime* if you're looking for the memo that covered working overtime hours. WordPerfect will scan all of the files for the pattern you gave it. When it's done, it'll show you a list of files that contain the specified string. You can print the list on your printer by pressing Shift+F7.

SUSAN KELLEY
MOBILE, AL

Better Zipping

As I read Gordon Newstrom's tip in the August issue of COMPUTE about PKZIP and PKUNZIP, several improvements came to mind.

Rather than delete all of the files in the directory after zipping them, use the -m option. This verifies the files in the archive and then deletes them from the directory automatically. If an error exists in the archive file, PKZIP won't delete the files.

Another very useful option is -u. This updates the archive file with only the files that have changed. You can even combine it with the -m option by adding the command line switch -mu.

An option that'll speed up the actual compression is -ea. This will use the method called imploding. It's much faster and doesn't use much more disk space than the shrinking method.

One last suggestion is the -rp option, which recurses subdirectories. By using this option, you can include all

embedded subdirectories in one archive. You'll need to couple this with the -d for PKUNZIP. The -d option with PKUNZIP creates recursed subdirectories upon extraction.

With a little planning and ingenuity, you can customize PKZIP and PKUNZIP to do almost anything. All of the switches can be easily added to Mr. Newstrom's batch file.

CLARK WAGGONER
SAPULPA, OK

Personnel Space

I have a number of computers, all of which must share peripherals like printers. I often have to use LapLink to transfer files from one computer to another, as hard disk availability varies across machines (it's also the simplest way to back up document and graphics files). For years I had to remove my computers from the desk to change the connections in the back, but I finally got smart. I left about 18 inches of space behind my computer desk so I can stand behind the computers and alter connections as needed. The hard part is not using this inviting space for storing old magazines and surplus office supplies.

Instead of backing up my whole hard disk, I tend to back up only the files I have been working on. I'm much more likely to lose a single file or directory because of carelessness than to lose the entire hard disk. Therefore, this kind of backup makes more sense, as long as I am diligent.

Another simple change speeds up printing from Windows. I have a laser printer that can print in PCL or PostScript mode. Generally, I've found that printing in PCL mode is much faster than printing in PostScript, and with Windows 3.1 drivers and TrueType, there's virtually no reason to use PostScript anymore. The only times PostScript is useful are when I want to vary the screen frequency of a gray-scale printout and when I want to print PostScript patterns from CorelDRAW! These uses of PostScript are so rare that I leave Windows and my printer set for PCL printing by default.

WAYNE PALMER
NEW YORK, NY

If you have an interesting tip that you think would help other PC users, send it along with your name, address, and Social Security number to COMPUTE's Tips & Tools, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408. For each tip we publish, we'll pay you \$25-\$50. All tips submitted become the property of General Media International. □

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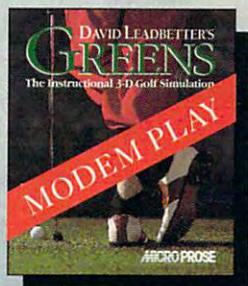
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Circle Reader Service Number 254

HARDWARE CLINIC

Mark Minasi

INTERRUPTS MADE EASY

I've noticed that the subject of interrupts has come up a lot in the PC literature lately. If you're messing with Windows, networks, or printing (or any combination of the three), you've perhaps heard people talk about interrupt conflicts, IRQs, and the like. This month, I'll explain in plain English what interrupts are and what kinds of trouble they can cause.

There are actually two very different kinds of interrupts, software and hardware. In this article, I'll deal with hardware interrupts.

Interrupts solve a basic problem faced by any computer peripheral: how to get the CPU's attention. Let's take the example of a basic peripheral—the keyboard. The keyboard connects to the PC via a chip on the PC's motherboard, a keyboard controller. Whenever you press a key, the keyboard sends the keyboard controller a scan code, which the keyboard controller then offers to the CPU.

When I say, "offers," that's just what I mean. The keyboard controller has only enough storage space to hold a single keystroke. Therefore, the keyboard controller must get rid of each received keystroke quickly before the next one arrives. It gets rid of each keystroke by giving it to the CPU, which puts it in the system's keyboard buffer.

That's where the trouble appears. You see, the CPU is normally busy doing things; it's not simply at the beck and call of the keyboard controller. How, then, does the keyboard controller (a) get the CPU's attention and (b) do it quickly?

Interrupts Versus Polling

Peripherals have needed to get the attention of the CPU

since the first computer. There are two approaches to making sure that the CPU gives that attention—interrupts and polling. In a polled system, the CPU periodically drops whatever it's doing and asks the keyboard controller, "Do you have a keystroke for me?" (Remember that drops-whatever-it's-doing part; it'll be important later.) The keyboard controller either says yes and hands over the keystroke or says no. In either case, the CPU then returns to what it was doing. After some time has passed, it again checks the keyboard controller.

Think of a CPU polling a keyboard as being somewhat similar to the situation you'd have if you had a phone without a bell. With such a phone, you'd have to periodically put the receiver to your ear and ask, "Is anyone trying to call me?" It would be a pain, but it would simplify the requirements of the telephone hardware; the phone company wouldn't have to design a ringer into the system.

With an interrupt-based system, on the other hand, the CPU must be designed to accept interrupts. That means that one or more of the wires extending from the CPU chip itself will accept an input signal from another circuit on the motherboard, a signal that says, "Come pay attention to me." The keyboard controller then is connected to one of those interrupt wires, and it places a signal on that wire when it has a keystroke the CPU must handle. The CPU senses the interrupt and puts its current work aside, signaling the keyboard controller that it's ready to accept that chip's keystroke. Let me continue my telephone analogy at this point. As you've no doubt surmised, the interrupt signal is like the telephone's bell in my phone analogy. You can work continuously at your

desk without having to worry about whether anyone's trying to reach you or not.

Let's summarize what we know so far. A CPU communicates with a peripheral either through polling or interrupts. Polling requires less support hardware, but it requires that the CPU spend a lot of time checking with the polled peripherals to see if they have need of the CPU's attention.

Which Is Better?

It seems obvious. Interrupt-based input/output handling is more than polling, in terms of the CPU's time. And aren't we always looking for faster performance from our PCs?

That's true, but polling has a place in the microcomputer world. For example, the Apple II polled its keyboard. And despite the fact that the parallel port has an interrupt line assigned to it, your PC polls the parallel port, in all probability.

Why? The story starts in 1981, with the first PCs. They were sold with optional serial and parallel ports, and the first parallel ports were made, of course, by IBM. The PC architecture that IBM settled on made heavy use of interrupts, and the parallel port was assigned its own interrupt line, interrupt line number 7 (IRQ7). Unfortunately, some of the parallel ports in the first batch had nonfunctional interrupts, the legend goes, and so IBM rewrote the original PC BIOS so that the PC sent data to the parallel port via polling, not interrupts. Once the initial PCs shipped with a BIOS that supported polling of the parallel ports, all software that followed it—until OS/2 and Windows, as you'll learn in a bit—polled the parallel port, ignoring the IRQ7 that was assigned to the parallel port.

Under a polled system, the PC sends a character to the

What are interrupts, and what kind of trouble can they cause?

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printer and then says to the printer, "Did you print that character yet? How about now? How about now?" and so on until the printer finally says, "Yes, I printed that character." The PC then sends the printer the next character, starts polling to find out if the parallel port is finished with that character, and so on.

Under an interrupt-driven system, the PC would just send the printer a character and then go back to work on whatever it was doing. When the printer is ready for the next character, it taps the PC on the shoulder and says, "I'm ready for the next character."

The interrupt-driven system sounds more efficient—but is it really? Think about how DOS works—it's a single-tasking operating system. If the PC is in the process of printing, then that's all it's doing. In the last paragraph when I referred to its going back to work on whatever it was doing, I omitted the fact that there's nothing else to do, as most DOS programs are unable to multitask and DOS offers very little in the way of background printing support. So in the final analysis, it really doesn't matter much whether your printer port uses polling or interrupts.

I also neglected to mention a benefit of polling. A PC-to-printer cable doesn't need to have as many wires in it if the interface uses polling rather than interrupts. Some of the 25 wires that go into the standard PC-to-printer cable are only there to support interrupts, so they're unnecessary for most DOS-based systems. That's how some vendors have managed to cut prices on printer cables; they just leave out the superfluous wires.

The fact that the printer interrupt IRQ7 is largely unused is useful for another reason. Interrupts are scarce commodities, and if the parallel port

won't use IRQ7, there are plenty of boards that can use it! Many companies have installed local area networks in the past four years, and many LAN interface boards require an interrupt. IRQ7 has served well in this function.

Windows and OS/2 Printing

So you've seen that many printer cable manufacturers save money by leaving a few unnecessary wires out and that stealing the parallel port's IRQ is the most forgivable of sins, as the computer isn't using it anyway, and it makes adding some nifty board like a LAN or a Sound Blaster possible. That was fine under single-tasking DOS. But what about OS/2 and Windows, which are multitasking operating systems? Well, um, there's a problem there.

It should be obvious that an interrupt-driven printer interface would be a real asset to any multitasking system. If one program was printing and another was doing calculations, then the operating system could dump a few bytes to the printer from the first program and then do a few calculations for the second program. When the printer signaled that it was ready, the CPU could give the printer a few more bytes, return to its calculations, and so on. It's like getting the benefits of a mainframe from your desktop PC.

You can probably see the problem by now. There are many PCs out there whose owners have given their IRQ7s away, so when Windows tries to print, nothing happens. Worse yet, when Windows tries to print, the network locks up (if the LAN board was on IRQ7), or the Sound Blaster starts emitting static. In the worst case, the system crashes.

Most PCs have two basic kinds of bus slots—8-bit bus

slots and 16-bit bus slots. Let's consider the 8-bit slots, as they're the ones that have the tightest crunch for interrupts. The 8-bit slots support six interrupts numbered 2 through 7. Interrupts 0 and 1 aren't available in bus slots because they're already taken up by the system's timer, which gets interrupt 0, and the keyboard controller, which gets interrupt 1. Interrupt 2 is free on XT-type systems, but it's required on 286 and higher systems to serve as a gateway to the extra interrupts provided by a 16-bit slot. Interrupt 3 is the interrupt for either COM2 or COM4. Since both serial ports are assigned to the same interrupt, they'll only work reliably if you have one or the other. Interrupt 4 is for either COM1 or COM3. Interrupt 5 is usually free on 286 and higher systems, as it's reserved for LPT2 and most of us don't have a second parallel port. Interrupt 6 is used by the floppy drive, and interrupt 7 by LPT1, the first parallel port, as I've mentioned earlier. Use those assignments as a guideline when assigning interrupts to new circuit boards.

What if you have one of those printer cables that don't contain the wires for interrupt support? You'll see trouble there, as well. That inexpensive printer cable that has served you for years may be the root cause of any Windows printing problems that you may be experiencing.

So if your printer prints under DOS but not under Windows, then one thing you should investigate is whether or not your parallel port has a free and clear title to IRQ7. Another thing to try is another printer cable; borrow one from a Windows workstation that's printing OK and put it on your system. If you can print with this cable, then you're OK on the interrupts, and you just need a better cable. □

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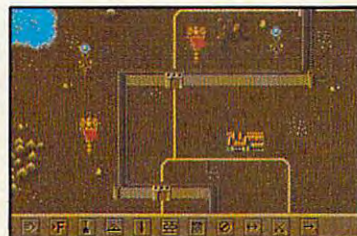
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INTRODOS

Tony Roberts

FORMATTING MADE EASY

Formatting disks is one of computing's most annoying tasks, but with the help of a couple of undocumented commands, the process can be made more tolerable.

I find disk formatting vexing because the makers of formatting software are so determined to protect us from our own foolishness that they make us answer several questions confirming that we really want to perform the format.

OK, I'll concede that it's wise to have some safeguards against accidentally formatting your hard disk, but there ought to be a less painful way to format a box of floppies. Well, there is—they just didn't tell us about it.

MS-DOS 4.01 and MS-DOS 5.0 include some undocumented switches that can eliminate the prompts that instruct you to place a new disk in the drive and ask if you want to format another disk.

(Warning: These commands also eliminate the prompts that remind you that you're about to wipe out your hard disk. Be sure you know what you're doing before you try these commands. Read on for some safeguards.)

The switches are `/autotest` and `/backup`. Type `format a: /autotest`, for example, to jump right in and format whatever disk is in drive A. You won't see the disk statistics, and you won't be asked if you want to format another disk.

The `/backup` switch is similar to, but slightly more verbose than, the `/autotest` switch. Type `format a: /backup` to begin formatting immediately. When the format is complete, the program will prompt you for a label and will display the disk statistics before returning you to the DOS prompt.

These undocumented switches can speed up your disk formatting by cutting down on the prompts displayed, but can you take advantage of this without risking the accidental erasure of important data? With a little care, yes.

First, if you're using DOS 5.0, you'll find that even with these switches, the Format command will collect the information that's needed by the Unformat command. This can help you recover if you accidentally format the wrong disk.

Second, you should reserve these commands for mass formatting projects. When you format a new box of disks, for example, you know that there's no valuable data on the disks, so it makes sense to proceed as quickly as possible.

Finally, you should limit these fast-format switches to batch files so you can test to make sure the Format command won't be used on a hard disk.

Take a look at the batch file below, called `multifmt.bat`. This program is designed to format several disks in the same drive with a minimum of operator intervention. After things get rolling, you need to press a key only when you swap disks.

To protect your hard disk, the program verifies that you've specified either the A or B drive as your target. If the drive designation checks out, the format proceeds immediately. Otherwise you get a message reminding you to specify a valid disk drive.

At the end of the process, you're summoned with a beep. At that point, insert a new disk and press a key to continue formatting, or press `Ctrl+Break` to get out of the program.

By default, the `/autotest` and `/backup` switches format

the target disk at its maximum capacity. If you want to format double density disks in a high density drive, be sure to add the appropriate size specification switches. For example, type `multifmt b: /f:720` to format 720KB disks in a 1.44MB drive.

To really speed things along, you can use the documented `/u` switch to tell the Format command not to worry about saving Unformat information. This switch is appropriate with brand new disks, but it may not be suitable for disks you're reusing.

I like to keep several formatted floppies on hand so I don't have to interrupt my work for formatting chores. I find it convenient to run `multifmt.bat` whenever I take time to straighten up the office. When the program beeps, I insert a new disk, press a key, and return to my cleanup. By the time my desk is clear, I have a fresh stack of formatted disks to carry me through the next week.

```
rem multifmt.bat
@echo off
for %%f in (a:
A: b: B:) do if (%%f)==(%%1) goto
continue
goto help
:continue
format %1 /autotest %2 %3 %4
echo Change disks to continue
formatting or press Ctrl-Break to
quit.
rem The following echo command
produces three beeps. To create
it, use
rem a text editor that allows you to
enter a Ctrl-G character (ASCII 7)
rem to create the beep. (This line
can be omitted if you prefer.)
echo <Ctrl-G><Ctrl-G><Ctrl-G>
pause
goto continue
:help
echo Usage: MULTIFMT drive:
[optional parameters]
echo You must specify a
drive name. Only drives A or B
are valid. □
```

Format floppies
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undocumented
commands.

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What programmers in C, BASIC, or Pascal will appreciate most is that the structure of a database can be changed with impunity and that adding data entry routines is trivial. In traditional languages, adding or subtracting fields to a random-access file structure requires vast recoding and must be avoided.

You can create a complete database browser with a mousing, menuing interface in well under 100 lines—including a custom data entry screen with error checking. Let's look at code from a program I wrote in under 15 minutes.

This code makes a box at the bottom of the screen that's 36 columns wide; has a shadowed, double border; and can be dragged anywhere onscreen with a mouse: `DEFINE WINDOW Buttons FROM; 20, 12 TO 22, 56 FLOAT; SHADOW DOUBLE.`

Later commands such as `ACTIVATE` will use the box's name (Buttons in this case). The semicolon continues lines.

Later, this code displays the box and makes it active: `ACTIVATE WINDOW Buttons.` Now you can drag the box, and all of its contents will remain neatly inside.

This code creates a row of

buttons within the box.

```
@ 0, 2 GET ButtonCmd PICTURE;  
'@*HN  
\<Next;\<Previous;?\<Quit';  
DEFAULT 0 VALID ValidButton()
```

The row of buttons is located at row 0, column 2 in the Buttons box. `PICTURE` is a terse but logical and easy-to-use minilanguage. The `@*` means buttons will be created. `H` means it's a horizontal row; use `V` for a vertical row. `N` means pushing a button won't halt data entry.

Identifiers such as `Next` will appear in the buttons; semicolons separate buttons. Preceding any letter in the button text with the two-character `\<` sequence makes that an accelerator—meaning you can press that key to activate the button. The `?\` sequence means that the button is activated when you press the `Esc` key. In our example, `Quit` can be activated with `Q` or `Esc`. `ButtonCmd` is the name of the variable in which the value of the button you click on will be placed; its default value is 0, `\<Next` in this case.

`ValidButton()` is a user-written routine that's evaluated when a button is clicked on. Because the row was defined in a floating window, you can drag the window, and all the buttons will stay in it.

A custom data entry screen with a row of push buttons requires fewer than 24 lines.

```
DEFINE WINDOW Customer  
FROM;
```

```
3, 8 TO 13, 60;  
FLOAT SHADOW DOUBLE
```

```
USE Test
```

```
ACTIVATE WINDOW Customer;  
NOSHOW
```

```
@ 1, 3 SAY 'Name'
```

```
@ 1, 14 GET TEST.Name
```

```
@ 3, 3 SAY 'Address'
```

```
@ 3, 14 GET TEST.Address
```

```
@ 5, 3 SAY 'Price'
```

```
@ 5, 14 GET TEST.Price
```

```
@ 7, 3 SAY 'Phone'
```

```
@ 7, 14 GET TEST.Phone
```

```
ACTIVATE WINDOW Buttons
```

```
@ 0, 2 GET act PICTURE;
```

```
'@*HN \<Previ-
```

```
ous;\<Next;?\<Quit';
```

```
DEFAULT 0 VALID ValidButton()
```

```
READ
```

`USE Test` opens up the database called `test.dbf`. The `@ . . . SAY` lines display labels in the window at the specified positions. Data is entered at the `@ . . . GET` lines, and data entry is triggered by `READ`. Move between fields using the keyboard or the mouse.

`ValidButton()` is called to handle the push-button actions. Each button is treated as if it were an index into a numeric array, so `Next` returns 1, `Previous` returns 2, and `Quit` returns 3. All `ValidButton()` needs is about 20 lines worth of `CASE` statements that call built-in xBASE routines such as `TOP` to move to the beginning of the file or `BOF()` to sense if the end of the file has been reached. `ValidButton()` is called continuously until `Quit` is clicked on. The `Quit` case executes a command such as `CANCEL`, which returns control to the calling program or to DOS if it's an exe.

That's it: the beginning of a program that with two more pages of code can become a self-contained database management system with a modern user interface and error-checking logic for data entry.

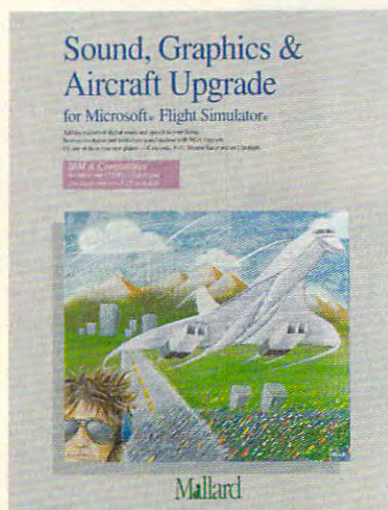
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Steve Draper

FAMILY VALUES

This month, COMPUTE's SharePak brings you three programs for the entire family. We've included Commander Keen, the big winner at the shareware industry awards; Magic Crayon, an outstanding educational program for the kids; and BENny, a slick batch file enhancer. If you're looking for programs that are guaranteed to be values, give the SharePak a try. If you're not completely satisfied, just return it for a full refund.

February's SharePak features something for everyone in the family.



Check out the award-winning Commander Keen.



Magic Crayon teaches colors and shapes.

Commander Keen

Commander Keen was the first real commercial-quality game to be released in the shareware market, and it has proven itself to be one of the highest-quality releases of all time. In fact, at the first annual shareware industry awards last fall, Commander Keen took the award as the best shareware product of the past ten years. It's hard to ignore credentials like that.

Commander Keen features ultrahigh-speed EGA graph-

ics and superb sound effects. The animation and scrolling are updated at nearly 40 frames per second—even faster than motion picture-quality cartoons, which are filmed at only 24 frames per second.

You play the role of Billy Blaze, an eight-year-old genius who builds an interstellar ship from various household objects. At the first sign of trouble, Billy dons his brother's football helmet and becomes Commander Keen.

Armed with only a pogo stick and ray gun, Keen travels to Mars to face the Vorticons, who are planning an invasion of Earth. Shortly after he arrives, the Vorticons steal vital parts off Keen's ship and hide them in their cities. Keen must explore the Vorticon cities and find the missing parts. Along the way, you must help Keen overcome many diabolical traps and the weird, deadly creatures that roam the cities.

Commander Keen requires an IBM PC or compatible with 520K RAM available. You'll also need EGA or VGA graphics and a hard drive. A joystick is optional. The registration price is \$15.

Magic Crayon

Magic Crayon is a collection of three colorful and musical games for children 3 to 12 years old. Children will have hours of fun with these challenging games and learn about the basic principles of color and shape at the same time.

The first game is Coloring Book. Its object is simple—color the sections of the picture, using any colors you want. This game teaches kids about colors and lets them explore their artistic capabilities. The second game is Color Shading. Here, you can use any colors you want to color various objects

in order to find the hidden shape. This game teaches visual perception and visual discrimination, skills that are important in geometry and geography. The final game is Color Memory, an excellent game for building memory and concentration skills. First, you'll see a colored picture for 30 seconds. Try to memorize the exact colors of this picture. Then, when the colors disappear, your goal is to color in all the sections of the picture, using the exact colors of the original.

Other features of Magic Crayon include two levels of difficulty, easy menu operation, online help, mouse support, scorekeeping, and dot-matrix printer support.

Magic Crayon requires an IBM PC or compatible with 256K RAM, an EGA or VGA display, and a Microsoft or compatible mouse. The registration price is \$18.

BENny

BENny is a batch file enhancer or stand-alone tool that's easy to use and adds both color and utility to your batch files. It contains several straightforward commands that can be used from the command line or from a text file.

Batch files are, as a rule, pretty dull to look at—just some white text on a black background. BENny breaks all the rules. Now, your batch files will explode with color, action, and sound. It takes just a few simple commands. BENny includes commands for windows, selectors, text, and more. For example, one simple command can give you windows with single- or double-line borders, shadows, or an exploding feature.

BENny runs on any IBM PC or compatible with a color monitor. The registration price is \$5. □

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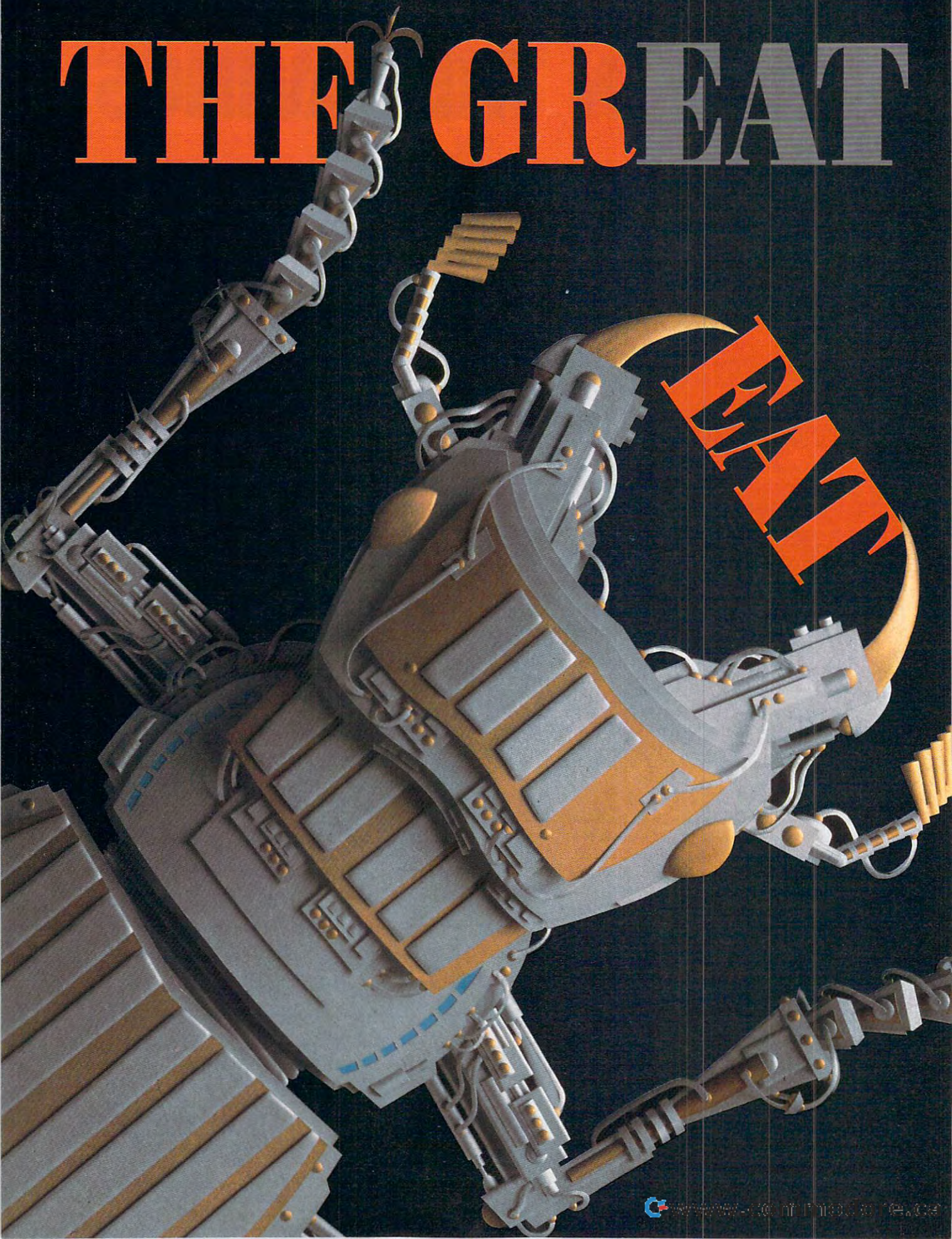
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VIRUS SCARE

BY PHILIP CHIEN

Fearsome creatures lurk within the code of benign software. But what are viruses, and how dangerous are they, really?

Virus. The mere mention of the word throws computer users into a panic. But most people don't feel there is anything they can do besides panic and hope that a virus never comes their way.

Viruses can damage software or destroy important files. Any computer user who shares information with other computers should be aware of what viruses are and how to avoid becoming infected. Knowledge—not paranoia—is the most important too, in fighting viruses.

A HAIRY ANIMAL

What is a computer virus? A virus is a program that attaches itself to another program. The virus replicates itself and spreads to other programs. As

programs are shared, the virus spreads geometrically, infecting more and more computers. At some point, the virus activates and performs its damage. This damage can range from a simple prank to erasure of all of the files on the computer's hard drive. In all cases, viruses are programs that were written by an outlaw—a hacker who specifically sets out to damage other people's computers.

Viruses aren't the only things that can destroy your data. Also, be aware of bugs, time bombs, and Trojan Horses.



To Kill a Virus

To identify, isolate, and destroy viruses—and then to repair the damage that they do—requires antivirus writers to think like virus writers. It's interesting to see the steps a software company goes through to create an effective virus killer. At PC Expo in New York, I had the opportunity to speak with Fifth Generation Systems about the procedures it went through to make sure Untouchable was safe, secure, and deadly. The key, said Jerusalem-based developer Yuval Rakavy, was to create an antivirus system that would still be undefeatable if a virus writer had every byte of code in the program.

All antivirus products depend first and foremost upon a scanning program that identifies the signature code of existing viruses. This works very well for non-self-mutating viruses that existed at the time the scanner was written, but most scanners are powerless against new viruses (the National Computer Security Association estimates that six new viruses are written every day) and against the new self-mutating viruses that essentially rewrite themselves each time they replicate. In creating Untouchable, Fifth Generation Systems included a

scanner as a first line of defense and provided it with the ability to detect self-mutating viruses. The scanner can even detect viruses within archived files.

Many antivirus programs are shipped with a supplemental TSR that runs continuously, watching for certain activities that are typical of viruses, such as system calls to write to the disk. But because the activities they identify are also common activities of normal programs, TSRs set off many false alarms. TSRs are also very vulnerable because they reside in memory, which is even easier to alter than disk files. So Fifth Generation Systems decided not to create a standard TSR but a supplemental scanner that examines the code in every program run and every floppy disk accessed by the computer.

The third leg of Untouchable is its integrity-checking system. On the hard disk and on a separate floppy disk, Untouchable keeps a checksum of all of your programs. By having Untouchable keep a record of these checksums on a separate bootable floppy, Fifth Generation Systems plans to make it impossible for viruses to escape detection, since all executable file infectors must alter program code in order to

replicate themselves. The integrity checker examines the whole system each time it's booted up. Every 14 days, the integrity checker checks all executable files against their checksums online. Then every 21 days, the user is required to boot from the floppy containing the offline database, and the integrity checker will then check for stealth viruses. It will identify changed program files, including updated program files.

Finally, Untouchable uses this checksum to repair any damage that may have been caused. "It's as safe as restoring from a backup," says Vicky Gore, senior product marketing manager. If Untouchable cannot repair the damage 100 percent, it will refuse to recover the file.

What's next in virus technology? Viruses can be written that piggyback on other viruses and are set to activate only when the original virus is removed and its damage is repaired. Untouchable is designed to cope with this situation.

Are there any existing viruses that piggyback on others? "At this point, that's pretty theoretical, but it's a possibility," Ms. Gore says. "That's part of the game—to be able to think about where virus writers are going and to be able to protect users from them."

—ROBERT BIXBY

Bugs, or simple errors in program code, can be intentional or accidental. A bug can be purposely put into a program as a limitation, or it can be something that the programmer overlooked in the original programming. While a bug could conceivably erase all of the data on your computer, it doesn't spread to other programs like a virus. Usually, bugs simply crash the program that's running and do no further damage.

A time bomb is a routine within a program that "explodes" after a given period. Time bombs can be installed on purpose and often are installed with the user's knowledge. For example, licensed programs that are only permitted to be used for a particular period might contain a time bomb that makes the program erase itself after a given date or a set number of times the program is used. Like bugs, time bombs are usually limited to the programs where they reside—they don't infect other software. But occasionally, a maliciously created time bomb causes damage that is quite extensive.

A Trojan Horse is a disguised program. To all outward appearances, it's an ordinary program, but the program is actually a cover, with the true damage-causing routines hidden underneath. So, when you run the program, you might think you are trying out a shareware disk optimizer. Only after the Trojan Horse has run will you discover that your hard disk has been scrambled.

Stalking the Beast

Viruses are spread when software is transferred from computer to computer. Shareware and illegal, pirated copies of programs have gotten a bad reputation as vectors for viral infection, but it's possible for a commercial, sealed-in-the-box program to have a virus.

Sealed commercial programs are least likely to have viruses, simply because their distribution is more tightly controlled. A commercial program is generated by its author and duplicated by the publisher or subcontracted to a duplication house. Once duplicated, the program is

sealed and distributed. It's possible for the dealer to infect the program accidentally if that copy is used for demonstrations. But commercial publishers, as a rule, are extremely cautious about the integrity of their products, especially since the company's reputation could be destroyed if a virus is distributed with its software—to say nothing of the product liability considerations.

Shareware and pirate programs are duplicated, distributed, and duplicated again—often passing through several levels of users. A virus could find its way into a program at any of these stages. With so many distribution levels, it's difficult to track a virus back to its source.

As a general (although by no means absolute) rule, commercial distributors of shareware programs and major online services check all submitted programs for viruses before permitting users to obtain them.

Conceivably, you could receive a virus each time you get a new program, and it's possible your system could already be infected. You

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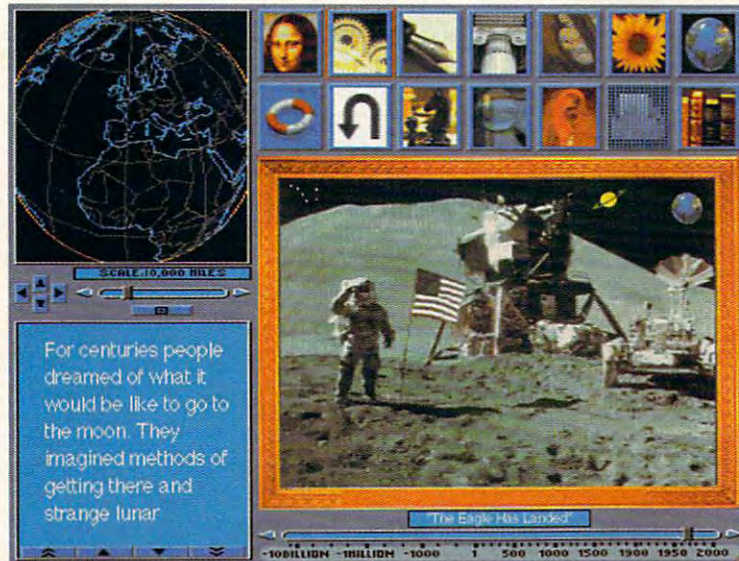
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The State of the Virus

Here, in brief, is the virus story:

There are two general types of computer viruses: boot sector viruses and executable file infectors. Boot sector viruses occupy part or all of your boot disk's boot sector. They are spread primarily by booting your computer with a floppy in the drive and the drive door closed. If the floppy in the drive is infected, attempting to boot your computer from the infected floppy will infect your hard disk partition table, which will in turn infect any subsequent floppy you insert into the drive.

Much more pernicious and hard to guard against are the executable file infector viruses. These viruses attach themselves to program files (like exe and com files) and spread each time the program is run. Often, these programs also install themselves as TSRs and infect every program that is run.

How Widespread Are Viruses?

According to Robert C. Bales, executive director of the National Computer Security Association (10 South Courthouse Avenue, Carlisle, Pennsylvania 17013; 717-258-1816), a survey showed that among North American corporations with more than 200 PCs (for a total installed base of 618,000 PCs), 63 percent had experienced a virus attack. Nine percent characterized the attack as "a disaster," with disaster defined as "20 or more machines affected and out of service for four hours or more." These companies reported average losses of \$7,000.

Know Your Symptoms

How can you know if you are infected? Here are the most common viruses (provided by Fifth Generation Systems).

Stoned. Also known as Donald Duck, Hawaii, Marijuana, New Zealand, Sex Revolution, and Stoned II, the Stoned virus is a boot sector virus. Once the computer is infected, Stoned goes to work relocating and overwriting your boot sector and partition table and writing itself to any floppies that you insert. On startup, your computer will display the message *Your PC is now Stoned*. More of a nuisance than a danger, Stoned can be hazardous primarily to very small hard disks whose FAT can be partially overwritten by Stoned's program code.

Jerusalem. Also known as Friday the 13th, Jerusalem B, PLO, and Russian, the Jerusalem virus is an executable file infector that increases exe file size by about 1800 bytes. The virus loads itself into memory, where it monitors your computer activity and infects your executable files each time they are run. A frequently run file may eventually grow too large to load. The virus causes divide overflow errors and snaillike system performance (within 30 minutes of infection, your computer's speed will drop to one-tenth its normal speed). If this is your first inkling of a problem, count yourself lucky: If the virus goes undetected and uncorrected, the next time the 13th of a month falls on Friday, you'll find yourself with no executable files on your hard disk and with a collection of damaged overlay files.

Disk Killer. Also known as Ogre and Disk Ogre, the Disk Killer virus is a boot sector infector, but its behavior makes Stoned look benign by comparison. Within 48 hours of infection, Disk Killer begins destroying the information on your hard disk. The only preliminary symptoms are a loss of 3K on floppy disks or 8K on hard disks, and cross-linked files. By the time you see the virus's message, *Disk Killer . . . Warning! Don't turn off the power or remove the diskette while Disk Killer is processing!*, it's too late. Disk Killer has begun to work.

Joshi. Also known as Happy Birthday Joshi, Joshi is a boot sector infector and a stealth virus. Joshi overwrites your floppies' boot sectors and your hard disk's boot sector and partition table with its own code. It's a fairly clever virus in that it knows when you are trying to detect it with a scanner, and it will make things look as if nothing is wrong with your boot sector or partition table—hence the name *stealth*. It writes to your 1.2MB floppies as if they were 360K floppies. The information it writes will remain accessible until you remove Joshi. Then that information will only be accessible if you change the 1.2MB media descriptor byte to make the disk look like a 360K disk. On January 5, Joshi will display the message *type Happy Birthday Joshi!* and lock up your computer until you do so.

Cascade. Also known as 1701, 1704, Fall, or Falling Letters, Cas-

cade is one of the more famous executable file infector viruses. It infects com files, increasing their size by about 1700 bytes. It loads itself as a TSR and infects any com files you run. It causes characters to cascade down a VGA or CGA screen.

Dark Avenger. Also known as 1989, Bulgaria, or Sophia, the Dark Avenger executable file infector virus is as scary as its name. It attaches itself to com, exe, and overlay files, adding about 1800 bytes to their size. It loads itself as a TSR and spreads its infection almost every time you access your disk. Every sixteenth time Dark Avenger runs, it overwrites a sector at random (which can cause cross-linking and damage to your FAT). On a large hard disk, the virus can run rampant for some time before it's detected. By then, large areas of your hard disk will be filled with worthless data. Infected files might contain ASCII messages such as *Eddie lives . . . somewhere in time. Diana P. and This program was written in the city of Sophia (C) 1988 - 1989 Dark Avenger.*

Sunday. An executable file infector, Sunday attaches itself to com, exe, and overlay files, increasing their size by about 1500 bytes. Each time you run a program, the program is infected. If the virus encounters a system clock setting of Sunday, it will display this message: *Today is Sunday! Why do you work so hard? All work and no play make you a dull boy! Come on! Let's go out and have some fun.* The virus then deletes any files you run.

Brain. Also known as Pakistani and Pakistani Brain, Brain is a boot sector infector. It moves and overwrites the boot sector of a floppy disk. When the computer is booted from a floppy, the viral code loads as a TSR and begins infecting executable files as they are run. If the floppy disk has no volume label, Brain will give it the label (C)Brain. If you examine the boot sector of the infected floppy from an uninfected machine, you will see this message: *Welcome to the Dungeon (C) 1986 Basit & Amjad (pvt) Ltd. Brain Computer Service. 730 Nizam Block Allama Iqbal Town Lahore-Pakistan. Phone: 43079,442348,28053. Beware of this virus . . . contact us for vaccination.* Infected floppies may have cross-linked files and bad areas in the FAT. The two copies of the FAT will be different.

—ROBERT BIXBY

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Virus Paranoia

One year ago, the name Michelangelo panicked hundreds of thousands of computer owners. With the fires of hysteria fanned by news broadcasts and eager computer salespeople, thousands of antivirus programs were sold. Michelangelo's trigger date came and went with barely a whimper. A couple of computers turned out to be infected, and a few users found out that they had made lucky investments—successfully eliminating viruses, including Michelangelo, before they activated. But for the most part, users wondered what the commotion was all about.

Most of the media reports described the potential damage by viruses in great detail but overstated the danger, implying that any computer could be infected and damaged by this one particular virus. The few stories that informed users that only certain people might be affected were lost in the flood of sensationalist stories.

The fake virus is an offshoot of virus paranoia. A disgruntled employee might purposely erase his or her computer's drives, claiming that a virus destroyed the system. A careful examination of the computer's remaining contents can often determine whether or not there was actually a virus that affected the computer.

A good backup program is just as important as a virus detector, and using both programs should be a regular habit. However, users aren't as conscious of the potential damages from not backing up their computers. While your hard disk is always at risk from a virus attack, it's also at risk for accidental erasure. If your hard drive was erased by a virus, you should be aware that your backup probably also includes the same virus and must be carefully disinfected with an antivirus program to prevent your data from being erased again.

No matter how good a virus detector you have, you still need a good set of backups.

The earliest viruses were relatively simple routines, and virus detectors could easily disinfect computers. Unfortunately, as antivirus programs became popular, authors wrote more sophisticated viruses that could hide from detectors. Stealth viruses are viruses that are specifically designed to avoid antivirus programs that search for viruses by known patterns.

The latest tools for virus programmers are utilities that create self-mutating viruses. These viruses change themselves each time they duplicate. While self-mutating viruses are more difficult to detect, a sophisticated virus-detector vaccine system can prevent them from harming your system.

The important thing to realize is that the virus-antivirus war will never end. A brand-new antivirus program will only detect the viruses it's been designed to detect and patterns for similar types of viruses—including ones that haven't been written yet. But as virus writers get their hands on antivirus programs, they'll write new viruses specifically designed to outwit and bypass those programs. Fortunately, most antivirus software publishers offer low-cost updates to their packages, and update routines are often available for free from online services and bulletin boards.

It's quite possible for you to accidentally hide a virus from your own antivirus programs. Compressed files use sophisticated routines to save disk and file space, making them especially efficient for modem transfers. Unfortunately, compressed code is more difficult to examine, and most virus detectors cannot detect viruses within compressed files. Once any files are uncompressed, they should be inspected by an antivirus program before you run them.

While you can use the best antivirus programs to protect your own computer, how can you protect data that you transfer to and from other people's computers? Whenever you give files to another user, you should always format the disk and then copy only the needed files to that disk. If the user returns the disk, you should treat it as if it were infected. Any files received from others should be carefully examined before use.

Viruses are a problem, and it's unlikely that they will disappear any time in the near future. But as with human viruses, there are sensible precautions you should take to prevent yourself from getting infected. In other words—always be sure to practice safe computing. □

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can get a virus from a downloaded program via a modem or from a floppy disk. On the other hand, a data file (text, graphics, database) cannot be infected because those files are only accessed when another program reads their data. (The Macintosh operating system is a rare exception—Mac data files can be infected by viruses due to the way the Mac stores data and resource forks.)

As a general rule, a virus only works on a particular type of computer. A Macintosh virus won't do anything to an MS-DOS machine or vice versa. Since viruses are programs, they have to run on that computer's operating system. However, it's possible for another computer to act as a carrier, permitting viruses to be transferred.

The best method of avoiding viruses is through awareness. Understanding how viruses are spread and being aware of viruses each time you obtain a new program are the best ways to prevent a virus from infecting your system. It's still possible for a virus to slip through, however.

There are many good antivirus utilities—programs that specifically look for viruses and warn you when a virus attempts to infect your computer or to activate. Some antivirus programs will even erase a virus if they

find one and attempt to restore your program to its original state. Commercial virus protection software ranges in cost from \$19 to over \$500.

A typical virus protection program runs from your autoexec.bat file and examines your computer's hard drive each time it's booted. Each time a new program is installed on your computer, the new program is checked to ensure that it's clean. As a general rule, viruses are detected by looking for known viruses and monitoring suspicious activity. Suspicious activity can include programs unexpectedly changing their size, routines monitoring the computer's clock (very often, viruses are set to trigger on a predetermined date), or routines trying to format your hard drive. Any of these can conceivably be part of a legitimate program, and antivirus programs vary in their ability to filter out viruses.

Always Check Your Sources

You should be careful where you obtain an antivirus program. If you obtain a shareware program or a copy of an existing program, you should be certain that it doesn't have its own viruses hidden within. There have been programs distributed as virus detectors that are actually Trojan Horses which install viruses.

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(800) 441-7234
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PC-cillin—\$139.00
PC Rx (a software-only version of
PC-cillin)—\$69.00
Trend Micro Devices
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Torrance, CA 90501
(800) 228-5651
Requirements: IBM PC or compatible, 9K RAM, one 25-pin parallel port (for PC-cillin)

PRODUCTIVITY CHOICE

Get in on what could be tomorrow's standards with these new, original drawing tools.

William Harrel

INTELLIDRAW 1.0

What do you get when you combine a draw program with rudimentary CAD and presentation features? IntelliDraw, the exciting new Aldus addition to the Windows draw-program market. But IntelliDraw is not just another vector graphics program. Sure, it sports a standard draw-program interface with Bézier drawing and editing, but it's also equipped with sophisticated technical drawing and simple animation.

Whether you need to create simple drawings to embellish reports or draw up plans to redesign the office floor plan, IntelliDraw will make your job easier and more fun.

It's a snap to install the program: Just fire up the installation program, and you're done. It is not, however, as easy to learn. IntelliDraw is powerful; you'll have to spend some time with it to master all of its rich, innovative features. Some of the pain of learning the program is assuaged with a well-done 90-minute training video that covers almost all the important features. After watching it, I understood IntelliDraw's sheer power and couldn't wait to get started. If you're serious about mastering it, however, you'll want to watch the video more than once—it covers a lot of territory.

Like most high-end draw programs, IntelliDraw supports multiple layer control, or layering. This feature lets you place objects or groups of objects on separate layers so that you can show and hide them or work on them separately. Layering is a must



when you are creating complex drawings. A palette of action buttons lets you lock objects on a page or link them to other objects as well as group and ungroup objects. The action buttons let you perform a number of functions simply; other programs require you to wade through endless dialog boxes to achieve the same results.

Unlike other draw programs, IntelliDraw lets you add as many pages to a project as you like, which is handy for creating multiple views of the same drawing for proposals and reports or for creating animations with the program's Flip Book option. And, memory permitting, you can work on an unlimited number of documents at once.

IntelliDraw's Toolbox is full of easy-to-use drawing tools, such as the Connector tool, which allows you to draw lines that automatically snap to and connect objects. Connections can be locked, stretched, rotated, or drawn at right angles. The program also introduces two new drawing tools, the Symmetricon and Connectigon. The Symmetricon creates symmetric

objects with a variable number of reflection points. In other words, if you set the reflection points to 4, when you draw in one direction, the object mirrors at three other points. There's no easier way to draw multireflected shapes, such as stars or pinwheels. The Connectigon is a polygon tool that automatically connects points of the object being drawn to points on other objects, allowing you to create complex shapes from multiple polygons. When stretched, attached polygons move together so you can sculpture shapes.

Another impressive feature is Auto Align. A pair of crosshairs follows your mouse as you draw, like automatic intersecting rulers. The crosshairs act as guides and run the length of the document window, allowing you to align the object being drawn to other objects. Auto Align also lets you arrange existing objects in relation to one another. When two or more objects are exactly centered, the guides form a cross over them. Unlike other draw pro-

grams (which use grids and an alignment dialog box to accomplish this), IntelliDraw doesn't make you turn off Auto Align to place objects freely, nor do you have to open a dialog box to align them. The crosshairs constantly inform you where an object is in relation to other objects in your drawing.

Keep Aligned locks objects into position in relation to other objects. Aligned, linked, and connected objects keep their relationship to their counterparts, no matter how you manipulate separate objects in the drawing. If, for example, you move a wall in a floor plan, the other walls, hallways, and doors stay connected and resize accordingly. This ability to automatically redraw connected objects makes IntelliDraw ideal for drawing simple CADlike diagrams, and layering allows you to get relatively complex. You can even assign measurement lines and figures that automatically adjust themselves when you resize elements in the drawing.

Yet another slick feature is the user-defined symbol library, to which you can add and delete objects. You can also edit symbols once they're defined. Symbols are linked. If you use the same symbol several times throughout your document, you can edit it once in the symbol library, and IntelliDraw will update every occurrence in the document. This is not, however, DDE or OLE and will not work across several drawings.

There's also a collection of intelligent clip art. You can add drawers to file cabinets or change the shapes of trees simply by double-clicking on them. For example, you

can change a pine to an oak with a couple of mouse clicks. Change a chair into a sofa by stretching it. No—you don't get a distorted, elongated chair, as you do with other clip art. This intelligent clip art actually converts the chair to a sofa.

Of course, IntelliDraw isn't perfect. Primarily because of the program's power, it's not always easy to locate functions. Many functions are original to IntelliDraw, such as creating duplicates (complete with connections) by pressing Ctrl and dragging with your mouse. Therefore many functions aren't necessarily familiar or intuitive. Unfortunately, there are some common functions equally difficult to locate—how IntelliDraw fits text on a path, for instance. Most programs have a simple command for this function. But IntelliDraw requires several steps that entail ungrouping a text block and then choosing a couple of other commands to achieve the same effect. In fact, this particular function was so obscure that I had to call Aldus for help. There is, however, a floating Info window (similar to some other programs' status line) that not only tells you the name of the tool or menu item the mouse cursor is pointing to, but which also suggests what you can use the item for.

An important drawback to mention is IntelliDraw's lack of support for color separations. Creating camera-ready art for multicolored documents could be a problem. You can, however, print separate layers, which will give you spot color separations.

Since IntelliDraw is supported by Silicon Beach, a subsidiary of Aldus, the technical support policy is different from

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the support policies of other Aldus products, such as PageMaker and FreeHand. The company's usual support policy is 90 days free and then paid support through subscription or a 900 number. IntelliDraw support, however, is free for an unlimited period. This is good news because this program will take you some time to learn.

Color separation and complexity issues aside, IntelliDraw is a great, innovative draw program, especially for just \$299. It fits neatly into most applications, except for commercial prepress. And there's an identical Mac equivalent, so it's easy to distribute drawings across platforms or on a network. IntelliDraw is a solid performer. Spend some time to grasp its power, and it will pay you back double. □

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ART WORKS

Robert Bixby

CANDID SNAPSHOTS

What are your alternatives when you want to get images into your desktop publishing system? The hand scanner is the first option to explore. In fact, if the hand scanner has one single purpose for which it was clearly designed, it was scanning photos into a computer. (Here's a tip: Buy a small sheet of window glass or thick clear plastic, such as a clear report cover. Cover your photo with it as you scan it with a hand scanner. Using the glass or plastic results in a much smoother scan and reduces the possibility of scratching the picture.)

COMPUTE has covered both color and gray-scale hand scanners in reviews and Test Lab, so most regular readers are thoroughly familiar with these options.

Another alternative is the flatbed scanner. These scanners have been available so long that they've begun to appear regularly among resellers' wares. You can find a wide selection of good quality discontinued flatbed scanners

Taking snapshots with your computer has never been easier.



for about the same price as new hand scanners.

Watch out for outdated features lists when looking over this hardware (you'll probably want gray scale as a minimum capability; if you can get color or OCR with the scanner, you'll value either of these).

Recently, I had the pleasure of reviewing three pieces of imaging hardware. First, and by far the most expensive and capable, was the Canon CJ-10 color scanner, printer, and copier. It's based on the Canon color copier. If you make color copies, it's likely that you've seen this unit in action. It's essentially a 400-dpi color ink-jet printer bound to a high-resolution color scanner.

To turn the color copier into a desktop computer peripheral, Canon added a control module on which the copier stands and a SCSI interface card for your computer. Using Aldus PhotoStyler, you can scan in images, edit the images with a full range of tools, and then print the images.

One drawback to the system is that it uses special paper. This seems like an unfortunate limitation for a machine that costs almost \$8,000. If, however, you are doing color proofs and standard-width (8½-inch) paper is adequate for your purposes, I think the printer does a better job than the Tektronix Phaser, which is currently a standard in color proofing. And the Tektronix doesn't scan. It only prints.

But what if you don't want to capture an existing photograph, but you do want to get started in the art of electronic photography? Electronic cameras have arrived. Canon makes the Xapshot, and Logitech makes the Fotoman. If you aren't interested in conventional photography and you don't mind being tied to your computer, you might consider purchasing a black-and-white

television camera (Damark has advertised a surveillance camera for around \$200) or using your camcorder camera in combination with Digital Vision's long and growing line of image capture boards for the PC. Another option is Electrim. Electrim recently sent me two cameras for capturing images. The EDC-1000 digital camera captures gray-scale images of 192 x 330 pixels (\$400). The EDC-1000C captures color images of 751 x 488 pixels (\$950). As you will guess from the number of pixels involved, the 1000C will not work with a standard VGA card, although Electrim is working on more flexible software that will enable the color camera to be used with standard VGA systems at reduced resolution. Electrim also manufactures a high-resolution 753 x 488 pixel gray-scale camera, the EDC-1000HR (\$850), which also requires Super VGA for full performance but will operate at lower resolution with standard VGA.

There is nothing fancy about the systems. All you get are a camera head (a tiny black box about half the size of a bar of soap), a cable, a card, and image-capture software. More sophisticated image-editing software is available from Electrim for the EDC-1000 for an additional \$150. If you're interested (as I am) in capturing three-dimensional, real-world images making use of lighting techniques, these cameras will serve you very well. The high-resolution systems require at least 800 x 600 resolution at 256 colors. Electrim markets a Genoa Super VGA board for \$190 that will fill the bill. Lenses are sold separately (\$50 for a 16 mm, \$60 for an 8 mm, and \$180 for a 12-75 mm zoom lens). For more information, contact Electrim, P.O. Box 2074, Princeton, New Jersey 08543; (609) 683-5546. □

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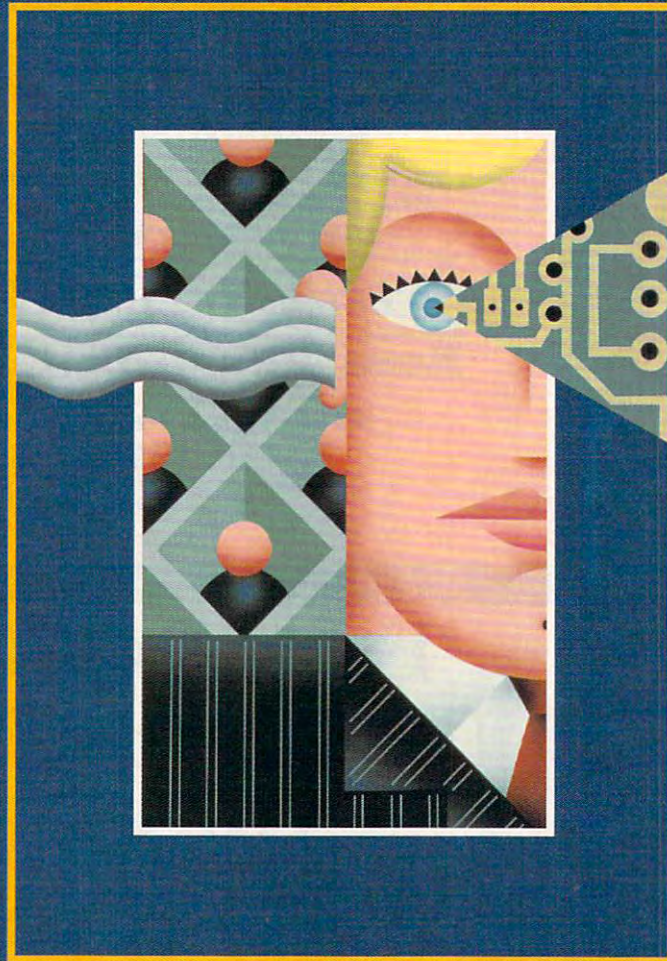


ILLUSTRATION BY JOSÉ CRUZ

DROP-KICKED INTO IT, YOU HAVE TO START WITH A PLAN.

ON YOUR OWN

Back in the seventies and eighties, starting a business from home had an aura of mystery and glamour. Bright, young entrepreneurs taking on the stodgy corporate world. The two Steves starting Apple Computer from their garage. Ben & Jerry's. That sort of thing.

Nowadays, with America's corporations downsizing and the economy slowing to a crawl, starting a home-based business has become more of a necessity than an adventure for millions of reluctant entrepreneurs. Today's home business owners are less likely to be high-tech whiz kids chasing the American Dream than fortysomething out-of-work former corporate employees with mortgages and kids. While they may

ARTICLE BY ROSALIND RESNICK

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fantasize of one day getting rich, for the most part they're content just getting by. Often, the transition from office-based employee to home-based entrepreneur is a difficult one. Apart from the marketing, capital, and cash flow problems endemic to any startup business, there's also the potential for loneliness and isolation.

But a growing number of people are stepping off the corporate track and starting businesses from home—people as diverse as Atlanta greeting card designer Lee Grey, Kentucky freelance writer Peter Lloyd, and California horse breeders Ken and Eugenie "Oogie" McGuire.

Grey, 31, formerly a software engineer, put his consulting projects on hold in June to devote his full attention to his fledgling business. Lloyd, 45, quit his job at an ad agency nearly three years ago to start a freelance writing business that includes radio voice-overs and commercials for car dealers. The McGuires, a husband-and-wife business team, still toil at full-time day jobs while building their business on the side.

And what about you? Are you still sitting on the sidelines, afraid of leaving your dead-end job to leap into the unknown? Or has your boss already made that decision for you?

Here's a guide to starting your own business from home:

1. Choose a business. There are hundreds of businesses you can start from home—everything from desktop publishing and computer consulting to running a mail-order company. The key is to find the business that's right for you, the one that will turn your own unique blend of skills, experience, and interests into a profitable company selling products or services the marketplace demands.

It's also important to find out if working from home on your own is right for you. If you're the sort of person who needs a boss looking over your shoulder, then working from home may not be right for you. Supportive friends and family members are also important—especially when you're starting out and clients aren't yet banging down your door.

Lloyd says that after he quit his ad agency job, he got lots of calls from headhunters trying to lure him back to the office-based world. Fortunately, he says, his wife wouldn't hear of it.

"She said, 'Now, don't you dare take that job,'" Lloyd recalls.

2. Consider the legal implications. Do you need a permit or an occu-

Common Sense

Thinking of starting a business from home? Often, the little things mean the difference between success and failure.

Here are some tips from Chuck and Sue DeFiore of DeFiore Home Business Solutions, a consulting firm in Rancho Cordova, California, that specializes in advising small and home-based businesses.

1. Read, read, and read some more. That's the only way to keep learning about your business—and yourself. Become a compulsive reader, reading things other people ignore. Don't stop reading when you think you've run across something that has nothing to do with your business.

2. Pick a business name that describes what you do. A name that doesn't tell what products or services you offer can hurt your efforts to get your business off the ground. Avoid using just initials until you get as big as, say, AT&T. Also, when the time comes to create a logo, leave the abstract symbols to the faceless multinationals. Your logo should say what you do.

3. Sock away some money for a rainy day. Few businesses are profitable from day one. That's why it's important to have at least six months' living expenses in reserve before you quit your job and take the plunge.

pational license? Will you be required to register your business, get a tax ID number from the Internal Revenue Service, or file articles of incorporation? Check your local zoning laws, too. Many communities frown on home businesses in residential neighborhoods but make exceptions for professionals such as doctors, lawyers, artists, and writers. As a rule, retail stores and manufacturing operations run from home are taboo.

3. Make a business plan. Most people wouldn't think of setting out to visit Aunt May in Iowa without a road map, but many entrepreneurs set out in their new ventures without even the sketchiest business plan. That's often a mistake because a well-written business plan can establish your company's goals and help you achieve them. When writing your plan, ask yourself what business you're really in, how market conditions can

affect your business prospects, and how you intend to marshal the human, financial, and technological resources at your disposal.

"Drafting a business plan was vital," Oogie McGuire says. "We're looking at such a long time frame from starting our business to being profitable that, without the business plan, I wouldn't be able to judge if we were going in the right direction."

When it comes to writing a business plan, there are plenty of helpful files available online in places such as CompuServe's Working from Home Forum. There are also a number of off-the-shelf software programs that walk you through the steps of creating a professional-looking business plan. These include How to Write Your Own Business Plan, BizPlanBuilder, Entrepreneur Magazine's Developing a Successful Business Plan, and Tim Berry's Business Plan Toolkit 4.0.

How to Write Your Own Business Plan consists of four sections. First, a questionnaire containing approximately 200 questions covering every phase of business operation helps the user understand what a business will require and whether it's likely to succeed. The second part of the software is aimed at projecting profits and losses to determine where the break-even point will be. This part of the software allows you to play what-if, so you can see the effect of unexpected events.

The third area walks you through writing your business plan. It includes sections such as Mission Statement, Competition, and Research and Development. The fourth section contains a sample business plan.

How to Write Your Own Business Plan was created by Max Fallek, a member of the Small Business Administration National Advisory Council and author of *How to Set Up Your Own Small Business*.

BizPlanBuilder is a set of templates to be used in your own word processor and spreadsheet. The business plan itself is prewritten in the form of modules, many of which are applicable in most situations. There are built-in comments providing ideas, suggestions, and questions to help you decide what information to include in your business plan. All you have to do to create the actual business plan is to fill in the relevant details and values in the files where XXX appears in the examples. The file format is a generic one that can be imported into most word processors. The financial spreadsheets help you make projections based on your best

Everything You Ever Wanted To Know About Writing A Business Plan But Were Afraid To Ask

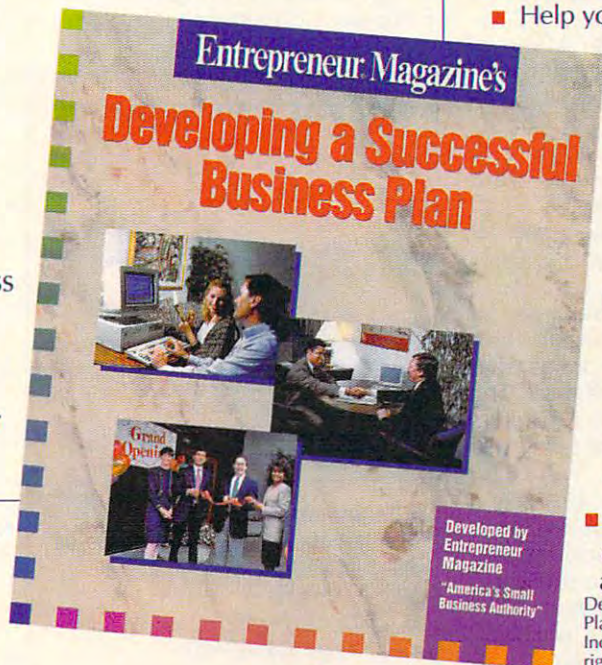
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guesses about how your business will grow. To supplement these libraries of text files and spreadsheets, the manual includes a reference that explains many of the terms used and the strategies you should employ.

Business Plan Toolkit 4.0 follows the pattern of providing worksheets for use with your figures, but its approach to the actual writing of the plan is a little different. Instead of providing a boilerplate business plan to be edited, Palo Alto Software provides a business plan processor—sort of a cross between a database input form and a word processor—that lets you use your own language in your business plan while making sure the words are in the right place.

4. Line up financing. Many of today's big businesses started out on a shoestring. While banks often hesitate to loan money to small, untested businesses, there are other sources at your disposal—your savings, your credit cards, the equity in your home, your retirement plan, or even your parents' nest egg.

Your suppliers can also be a source of credit. The McGuires, for example, bought many of their Arabians at rock-bottom prices after the horse market had crashed. The sellers were more than happy to provide generous payment terms with little money down.

5. Invest in technology. Unlike in a corporate office, there's no secretary to type your memos, no bookkeeper to keep tabs on your accounts receivable. That's why it makes sense to leverage your efforts by enlisting technology to do these clerical chores for you. Most likely, you'll need a computer, some kind of word-processing and financial software, an answering machine, a telephone with speed dial, a fax machine, possibly a modem, and a copier. While that may sound like a tall order, with PCs and fax machines plunging in price, you can probably get everything you need for under \$2,000. (See "Quest for Perfection" in the June 1992 issue of COMPUTE for more information about assembling the perfect PC for various home business applications.)

Oogie McGuire says she tracks her business with an Excel spreadsheet and a specialized database program that keeps tabs on her horses' health records and expenses. "I know to the penny how much it costs per horse to produce," she says.

6. Polish your image. Professional-looking business cards and stationery often separate the successful companies from the wannabes. Remember: Being small doesn't mean

you have to look small-time. Luckily, there are numerous desktop publishing programs on the market that make creating good-looking letterheads a snap. (Check out "First and Lasting Impressions" in the May 1992 issue of COMPUTE for pointers on putting together your own business documents and designs.) And if graphic artistry is not your forte, you can always hire a professional to do the job for you.

Grey, the greeting card designer, helps promote his colorful, computer-generated cards with a business card that reads, "Grey Matter," in boldface type, followed by the words, "A Huge Conglomerate in the Mind of Its Sole Proprietor." Underneath this phrase is

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7. Set up your office. It's important to set aside a place where you can work in peace and your business proposals won't accidentally get tossed out with yesterday's newspapers. A good-size desk, a comfortable chair, a file cabinet, and a well-stocked bookcase are all important aspects of a successful home business. You'll get more work done if your surroundings look businesslike.

8. Decide on a work schedule. One of the advantages of being your own

boss is that you can set your own hours. Even so, it's important to set up a daily work schedule to give yourself some discipline. And if your clients are large companies, you may find yourself working business hours in order to accommodate them.

Actually, many home business owners don't run into trouble because they work odd hours or too few hours but rather because they work too many hours. Working long and hard can be a key to success, but if you don't pay attention to your personal need for rest and recreation, you might become a drudge. Drudges get the work done, but they often lose their creative edge, along with the self-confidence and energy needed to take on challenges. With your PC only a few steps away, it's tempting to spend all day (and all night and all weekend) toiling away. Remember to take breaks.

9. Market your services. No matter how terrific your business plan is, the world generally won't beat a path to your door unless you get out and do some marketing. While you may not have the money to take out a big ad in the *Wall Street Journal*, you can get yourself noticed by lecturing about your specialty to local business groups and networking within your industry.

If you have a modem, consider logging on to CompuServe and joining the Computer Consultant's Forum and the Working from Home Forum. McGuire says she's even used CompuServe to meet potential buyers for her horses and mules.

10. Plan for the future. While much of your time will be taken up with the day-to-day concerns of running your business, it's important to have a long-range plan. That will probably mean expanding your business (unless you're committed to staying small), either through hiring employees and moving into office or warehouse space outside your home, teaming up with another company in a joint venture, or selling stock and going public. You may also want to consider selling your business someday.

While nothing you do will necessarily guarantee the success of your home business, following the ten steps listed above will give you a fighting chance. The most important thing to remember, seasoned business owners say, is that you shouldn't give up. No matter who you are or how many things you do right, there's nothing you can do to stop a market from shrinking or a major client from filing for bankruptcy. Even Apple Computer wasn't built in a day. □



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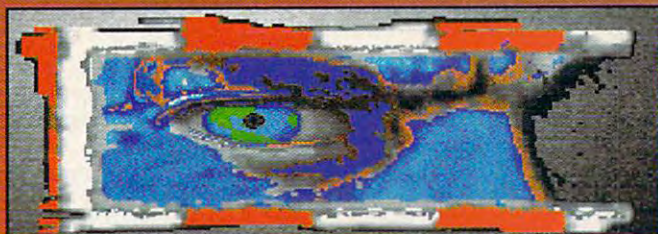
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PERSONAL PRODUCTIVITY

Daniel Janal

WARRANTIES

You're racing toward a deadline when your monitor blanks out, your hard disk crashes, and your fax card is on the fritz. Who's going to pay?

That depends on what your warranty says. A warranty is an obligation to repair something or replace it for free for a fixed period of time. Warranties are part of every computer and software sale. But if you read them closely, you'll find that warranties are very unique and individual. There is no universal code of law or conduct that covers computer parts, supplies, and maintenance contracts or service agreements.

Except in a few states, customers have no specific minimum rights to warranties or maintenance contracts. The Uniform Commercial Code makes some protections for the consumer, such as that the goods must be of an acceptable standard, but the manufacturer can disclaim that provision.

"You'll always find the UCC disclaimed. Instead you'll find a limited warranty, a money-back warranty, or a store warranty. You get a limited warranty and little else," said New York area attorney Lance Rose, who wrote the book *SYSLAW*, a guide to the law for bulletin board operators.

Your rights vary from seller to seller. Here are some questions you might ask the dealer about the warranty.

- How long is the fixed period of time?
- Who will pay for the delivery and return of the product?
- Will the work be done at your place or theirs?
- How long will repairs take?
- What are you supposed to do in the meantime?

According to Rose, to be a fully informed consumer, you should know the answers to

these questions. If you don't know the answers, you might find out the hard way.

"Buy from someone who offers a money-back guarantee or who offers to replace something if it is defective within a reasonable period of time, such as 30-60 days," says Rose. "Also, make sure the seller pays for shipping and that there is no restocking fee."

If the company doesn't honor its claims, you can complain to the Federal Trade Commission or to local or state agencies.

The best way to protect yourself from all warranty problems, according to Rose, is to pay with plastic. "If you have a legitimate dispute, call your credit card company and refuse to pay when you get billed," he says. The credit card company has a resolution process that manufacturers will abide by. "It is the best possible remedy you have."

When you buy your equipment, the salesperson might ask you to buy a maintenance contract. A maintenance contract is an operational understanding between seller and buyer. "You don't have any implied warranties. This is a straight contract. You get what it says, and you don't get what it doesn't say. If you want your equipment back in a month after taking it in for repairs, you need to have that written into the contract," Rose advises. "You have to look closely at the terms of the deal. You cannot presume anything. You have to look at whether repairs are done on site, by mail in, or by some other method. Will they give you a loaner? Reimburse you for shipping costs? How will they ship? How long will it take to repair? You need to know."

A software maintenance contract should spell out such details as how many hours of tech-

nical support you will receive and who will provide service.

"You should check out providers of maintenance and find out if the people are experienced," Rose said. "Maintenance can be done well, or it can be done badly."

"Take into account how long you plan to use it," he says. "For a lot of equipment, a maintenance contract for a year or two might be too long because you can buy a new piece for a price that's in the same range as the contract price."

As computer prices fall, computer manufacturers are using service and warranties as selling points.

For instance, Gecco Computers offers a two-year warranty on all parts, even monitors. It also offers two-year on-site service on all its sales. Dell Computer has a one-year warranty and an optional four-year extension. IBM offers a three-year warranty for its new family of premium PS/2 computers, three years of on-site service, and a four-hour average response time. Its older PS/2 computers carry a one-year warranty.

Whatever the warranty states, follow these rules.

1. Keep your boxes so you can safely ship the product back to the manufacturer or to a repair facility.
2. Check the parts immediately upon receiving them to see if they work properly.
3. Keep all paperwork, such as receipts, warranties, and contracts.
4. Make sure you have all claims from the manufacturer or store representative in writing.
5. Pay by credit card because the credit card companies will hold payment and investigate claims.
6. Deal with established companies who will be around long enough to honor their warranties to the letter. □

Be sure you know what you're getting when you sign up for a service contract.

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DISCOVERY CHOICE

Gain a new appreciation for history with this detail-rich text adventure.

David Sears

TIME RIDERS IN AMERICAN HISTORY

How many dishes did the average Puritan woman have to wash after Sunday dinner? Who held the higher rank, Sitting Bull or Crazy Horse? Enquiring minds want to know, because the despicable Thanatopsis Dread has stolen a communications satellite and now beams warped, tabloidesque newscasts down to an unsuspecting public. "Teenage mutant babysitter gets hit with pie in face before taking oath as first U.S. president!" Dread's trying to rewrite history. He seeks nothing less than world domination. This is Time Riders in American History, and your mission is to discover the truth and tell the world before Dread succeeds.

You are a team leader—one with a lot of work ahead. You know the occupation of the first president wasn't babysitter; it was general. But how do you tell the world? And when you know a newscast is fishy, where do you look for the truth if you can't quite put your finger on it?

The last time many of us studied history, we probably studied it along with 50 other equally uninterested college freshmen or high-school seniors. Who cared what happened when? We looked the future dead in the eye and pinned our hopes on ideal jobs. The past could remain unread or forgotten. Besides, didn't we know enough facts already?

George Orwell didn't think so, and if you've read his work, you might agree that a



sense of history would serve both his characters and our own American society well. Sit down with Time Riders for just a few hours and fill in the gaps. Don't expect a smooth trip—the surprising potholes in your memory can jar you wide awake.

Never mind that The Learning Company targets kids 10–17 as potential game players; the data here belongs to us all. Before you finish a mission, you'll know who invented the phonograph from who invented the telephone. You'll know that Puritan families shared a single pewter plate at dinner and had only one chair in their homes. You'll even know that Sitting Bull outranked Crazy Horse. If you already know all these things, your kids may not. Let them have a turn at Time Riders, and they'll play for hours, gaining an appreciation for an often shunned subject.

You'll have a lot of work cut out for you if you choose to play. Your team of crime solvers includes a time line savant named Amanda and a mapmonger named Josh, both of whom prove very helpful in collating historical data so that you can make an informed choice (or at least an

educated guess) regarding past events. The real time traveler of the group—a feline droid called KAT (short for Knowledge Access unit)—will actually visit the past to snare a few interviews with the people of the day.

After each dreadful newscast, you visit Amanda's room; she keeps her Time-Line unit there. Make a logical first choice from the descriptions of four eras that the machine displays. Obviously, some knowledge of American history helps at this point, but a close reading of the descriptions will help most novice historians select the proper era. Once you've made your selection, you'll have to choose a period and then a specific year. This way, you reduce the game's span of more than 400 years (1492–1905) to a specific moment in time. If Amanda agrees with your selections, she sends you to Josh for some historical orienteering. If she doesn't, you may try your luck with the Time-Line unit again.

Certain of his topology, Josh can help you find the exact spot an event occurred, no matter when. Using his GeoFax machine, you scroll

across a relief map of North America. Where was the O.K. Corral? Where exactly was the battle of the Little Bighorn? Click on the Overlay button to drop a net of data over the otherwise unhelpful images—plains suddenly become the homes of Indian nations; stretches of the Wild West resolve into constituent states. Every clue helps when you must locate a pin in a very large hayfield—in this case, a whole country. When you pick your spot, head to the TimeTube to dispatch KAT to the past for interviews. Don't worry if Josh cautions against your choice of event locations; before KAT leaves, you may reconsider them. Time Riders doesn't follow a point system. Instead, naturally, you work against time. Too many mistakes on your part, and Thanatopsis Dread takes the world.

Once in the workroom, you just pull the launch lever to send KAT on her way to the past. When she returns, she flops over and folds up—a disturbing effect at first. But she does this only to project her recorded holographic interviews. These interviews grant you an insider's perspective on history. And rather than presenting mere facts to read, the holographs make you feel almost as if you were gossiping with your neighbors.

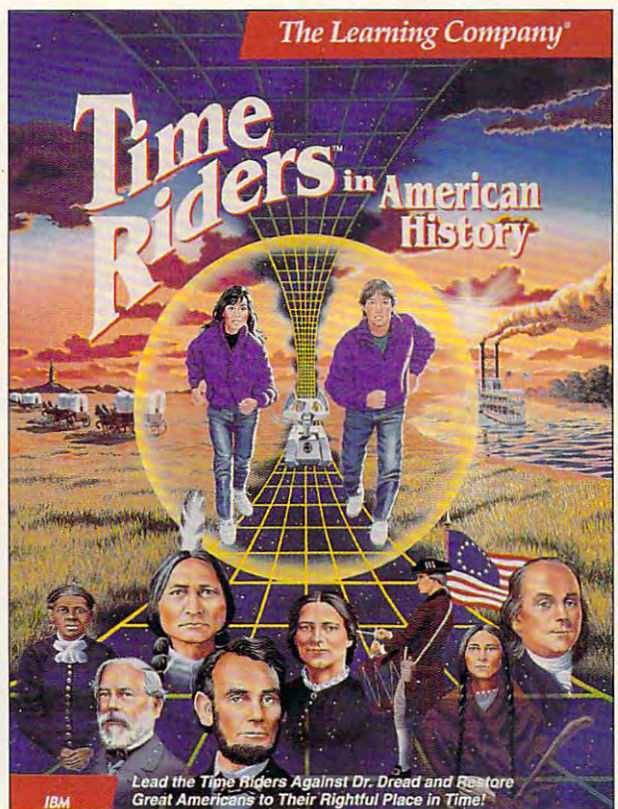
As soon as you've gathered enough details to successfully operate the Biodata machine, you can choose your man (or woman). The list of historical figures ranges from settlers to Chinese immigrants to Apache warriors. If you didn't know that you were after George Washington, you might need every clue KAT's interviews could

provide just to limit your options to a manageable few.

To further narrow the field, you might adjust the Biodata parameters to screen for gender and occupation. A search for a female social reformer consumes considerably less time than a sweep of all the biographical entries—time you must conserve in order to make the necessary data uplink with Dread's news satellite. Miss the window, and you'll have to wait for tomorrow's news to try again.

Time Riders acquaints you with more than just major events. The weirder parts of history lurk there, too, like this entry found under the era heading 1824–1854: "Dangerous hogs ran wild in most cities. Hogreeves walked two by two scouting hogs. Used rattles and brute strength to shoo hogs away." Rattles? Brute strength? Who were these mighty men, these hog wrestlers? Did any of them suffer fatal injuries on the job? Time Riders turns up these data gems, but gameplay may never reveal enough information to satisfy a piqued interest. Not quite a hypertext game, Time Riders fails on only one count: It moves where it will, not necessarily where you need to go. On the other hand, nothing prevents you from consulting a respectable encyclopedia for further information, and a "read through" option could easily deflate the fun here.

The colorful Biodata portraits of the historically significant make a fine addition to the game's detailed maps, and the browse function puts an abridged life story for each figure at your fingertips. Confident you can match the correct date and place with



the correct face? Skip the interviews and save some time; go to the Biodata machine and choose your person. After the uplink, you'll know for certain. Dread's skewed headline goes through, or your accurate one airs. To borrow from Poor Richard (you'll run into him more than once in the game), "Haste makes waste." Any discrepancies in date, place, and person cause Dread to gloat.

Best of all, Time Riders doesn't exclude minority groups. It does an exemplary job of including historically significant women, African-Americans, and Native Americans. This is one well-rounded text adventure worth the time of any enquiring mind. □

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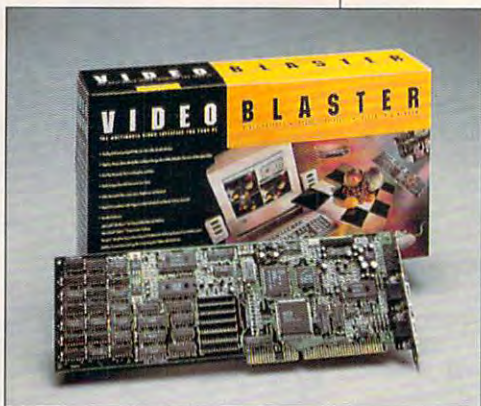
MULTIMEDIA PC

David English

CUT AND PASTE VIDEO MOVIES

Wouldn't it be great if you could hook your VCR or camcorder to your PC and bring video directly into Windows? Wouldn't it be even better if you could save that video to your hard drive and then cut and paste the video into your Windows documents just as easily you can cut and paste words and numbers into your word processor and spreadsheet files?

With the Video Blaster and AVI, you can capture a video movie, save it, and embed it in your Windows documents.



Sound far-fetched? Not anymore. You can do this now by combining Microsoft's new AVI software package with a Video Blaster card (Creative Labs, 1901 McCarthy Boulevard, Milpitas, California 95035; 408-428-6600; \$495). It's so easy that you'll soon have video movies with your kids waving to you as they say "Good morning, Dad" or "Keep up the good work, Mom." You could even send a Word for Windows file to your sister in Alaska with your New Year's greeting at the top of the page.

I wrote last month about Microsoft's new AVI (Audio Video Interleaved) software package. It should be shipping under the name *Microsoft Video for Windows* by the time you read this. AVI lets you run full-motion video in Windows 3.1 with no ad-

ditional hardware—other than a sound card if you want to hear the video's synchronized sound. On the downside, AVI movies run at 15 frames per second (rather than the 30 fps that's standard for most video), your videos usually run in a 160-pixel-by-120-pixel size window (just one-eighth of a standard screen), and the files can be extremely large (even compressed, a 30-second video can use up four or five megabytes on your hard drive). If AVI goes over as well as QuickTime, a similar technology on the Macintosh, we'll soon see disk- and CD-ROM-based programs with lots of AVI files you can play with.

But what about making your own video movies? With a Video Blaster and a video camera, you can capture your own full-motion video and, using the AVI utilities, save it to your hard drive as an AVI file. You can then use your standard Windows tools, such as Media Player, to work with your new video file. You should also be able to cut and paste your videos into any OLE-compliant Windows application.

Even without AVI, you can use the Video Blaster to save individual video frames in BMP, Targa, TIF, PCX, MMP, and EPS formats and display (though not save) a full-motion video in any size—from icon to full screen. A captured image can have as many as 2 million colors, but it can't be any larger than 640 pixels × 480 pixels. You can freeze, crop, resize, zoom, and scale single-frame images, as well as adjust their hue, saturation, brightness,

and contrast. A JPEG (Joint Photographic Expert Group) compression kit lets you compress your captured images to a fraction of their original size.

You also get a generous selection of DOS and Windows utilities that let you test your Video Blaster's setup, adjust its settings, and switch among its three video sources (these can be any combination of composite-video sources, including VCR, video camera, videodisc, and broadcast video) and four audio sources (microphone and line-in from the Video Blaster card, and FM and line-2 from a Sound Blaster or other sound card). You can mix the four audio sources with the software-based stereo audio mixer. And to get you started using your video in multimedia presentations, the package includes Macromedia Action, Tempura Show, Tempura GIF, and a handy utility, called MMPlay, that lets you combine animation with live video.

The Video Blaster card takes up a single 16-bit slot and requires Windows 3.1 and a VGA or Super VGA card with a feature connector. Not all VGA and Super VGA cards have a feature connector, so be sure to check with your dealer or with Creative Labs to be sure your card is compatible. (Media Vision is working on a similar AVI-compatible video card, called the Pro MovieSpectrum, which won't require a feature connector.)

In the future, you can expect to see inexpensive video cards with built-in compression chips that will dramatically speed up your AVI files. These chips will allow you to expand the size of your video windows to half or full screen and switch to the preferred speed of 30 frames per second. This compression technology will enable us to overcome the next big hurdle in the transformation of the PC into a multimedia workstation. □

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Alfred C. Giovetti

OUT OF THIS WORLD

The spatters of rain on the wind-screen obscure the view of the small road leading to the door to the underground linear accelerator laboratory. The driver of the car shields his eyes from the explosion of white light as lightning blasts the ground too near the car for comfort. As the man's hearing clears from the roar of thunder, he begins to hear the screech of brakes that bring the sleek blue sports car to a halt near the aboveground entrance.

The entrance opens quickly as the electronic surveillance identifies the would-be intruder as one Professor Lester Chaykin, a brilliant, young, crimson-haired scientist who is returning to complete work on experiment 23. He moves quickly to the desk and fires the particle down the mile-long tube which terminates in the chamber above the desk. As the particle travels down the chamber, lightning strikes and penetrates the tube. The lightning and particle mix and race to the chamber. Immediately upon impact, the chamber, the desk, the man, and some other items disappear from our world, traveling a dimensional rift to appear 20 feet below the surface of a lake in Another World.

Thus begins Eric Chahi's second hit computer game, which was two years in the making. The first, *Future Wars*, skyrocketed the small, French-owned Delphine Software into international fame in its partnership with Interplay Productions. This new success, *Out of This World*, was



first released in Europe under the title of *Another World* and has already won nothing but accolades and awards. It's an action-adventure game that requires thought in addition to quick reactions.

As with *Future Wars*, the most striking thing about *Out of This World* is its use of cinematic techniques such as zoom, panorama, closeup, and scaling shots. The opening scene is well orchestrated and similar to the beginning of a movie, with all the elements necessary to set the scene and build suspense. The scene where Chaykin arrives on the planet uses multiplane animation of up to six planes, similar to Disney animated films.

There are several levels of action, with the protagonist in the foreground plane, a carnivorous beast tracking the hero in one plane of the background, and even the moon on the farthest plane. *Out of This World* comes very close to being interactive cinema—quite an accomplishment, considering its 16-color, predominantly blue-, black-, and gray-

shaded palette. Chahi is a true artist and an avid movie buff, and his study of the cinematographer's art has resulted in the flawless execution of the beautiful, highly detailed scenes that can only be referred to as art in action.

The animated characters are clear, sharp, and distinct portrayals that seem to be living, breathing creatures. This may be the first time flight simulator-like filled polygons have been used in an action-adventure game. The polygonal graphics do not move to represent the 3-D presentation of a static item but instead are adapted to portray in two dimensions the living bodies of the characters and monsters. By changing the location of the point that defines the lines of the polygons, the characters' movement is uniquely fluid. It's a flowing animation technique, one surprisingly realistic in its representation of the true movement of living tissue.

Out of This World is a combination of action and logical, satisfying puzzles. You move from the point of entry in the

world to the point where our hero liberates a world from slavery by his own struggle to be free of bondage. Many of the head-slapping puzzles link one screen to another with the use of logical clues that keep you coming back for more realtime action. One puzzle requires you to observe an alien guard on another level—or, rather, observe his reflection on a metal ball. At a precise moment you must shoot the ball so that it drops on the guard. It takes timing and precision, but it isn't impossible. If you think through most puzzles, you'll eventually gain the satisfaction of completing them.

Another integral part of *Out of This World* is the effective use of the alien handgun, a combination shield, blaster, and explosive fireball generator. Knowing when and how to both use and recharge this weapon determines your failure or success. You use the gun to outwit the guardians and monsters. The pistol energy shield blocks blaster rays, while fireballs blast through doors, rock walls, and other energy shields.

As in other action-adventure games, such as *Gods and Prince of Persia*, *Out of This World* has aspects of both the realtime arcade game and the graphic adventure. These side-scrolling, fast-moving games require you to think on your feet, or at least on the edge of your chair—action and fast reflexes alone are not enough to traverse the labyrinth of screens to the winning cut scenes. Even combat in *Out of This World* is a blend of puzzle and realtime action.

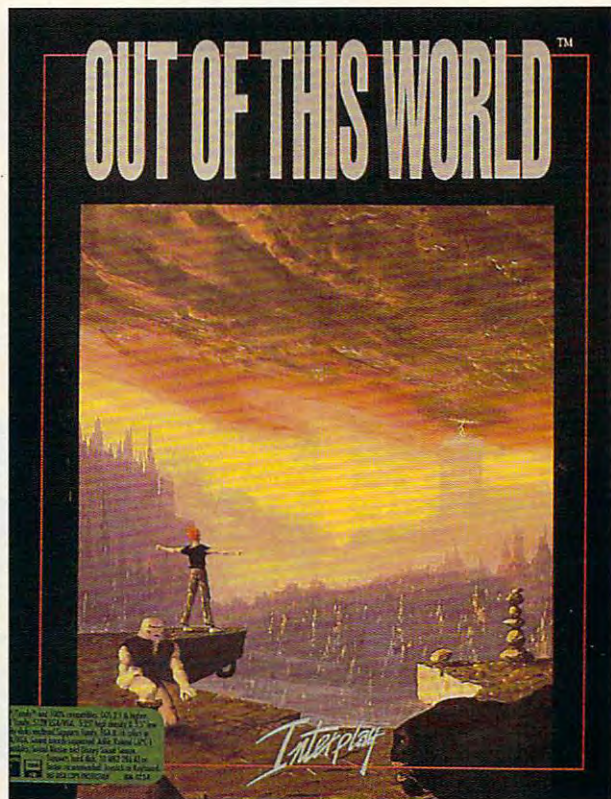
Out of This World is sprinkled with cut scenes, where

the course of the action is taken over by the computer, and you become the observer of a short movielike sequence. These cut scenes add to the game's cinematic quality and increase your involvement in the plot, which is in turn enhanced. The winning cut scene is very satisfying and is of sufficient duration to reward you handsomely for your efforts.

Like any other good role-playing or graphic adventure, *Out of This World* has a save-game feature. By pressing the C key and inputting one of a series of codes at any point in the game—even for a short time after the main character's death—you can restore the game to one of many corresponding critical points in the plot. The codes are revealed to you after you've successfully traversed these areas of the game. The save and pause features in action adventures make the games more enjoyable, for they alleviate your having to return to the beginning of the game each time you attempt to successfully traverse the game screens.

Music for most versions of the game includes a balanced and entertaining introduction, ending, and score mixed in Delphine's own music studio. Over 140 fully digitized sound effects are used to punctuate the action and keep you involved with the plot. While keyboard or joystick control is supported, the joystick provides better control.

The only black mark I gave to *Out of This World*, except one for its brevity, is for its arcane, color-coded, symbol-based, codewheel. I had trouble using the codewheel, even after receiving instructions



from the folks at Interplay.

What makes *Out of This World* so spectacular? Its satisfying blend of realtime arcade action, cinematic techniques, logical and workable puzzles, unique application of filled-polygon graphics, excellent use of color, artistic graphics, engaging story, and personality-filled characters. Besides, it's great fun. Many people will play it to completion just to see one more beautiful cut scene.

Out of This World clearly rivals any first-rate film production in its production quality and entertainment value. If you miss this highly acclaimed, award-winning action adventure, you'll never forgive yourself. □

IBM PC or compatible (10-MHz 80286 or faster recommended); 512K RAM (EGA or VGA) or 640K RAM (Tandy); Tandy 16-color, EGA, MCGA, or VGA; hard disk recommended; supports Ad Lib, Roland LAPC-1, Sound Blaster, and Disney Sound Source—\$59.95

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GAMEPLAY

Paul C. Schuytema

IF YOU CAN'T BEAT 'EM, MODEM

Playing against the computer is great, but victories either seem to come too easily or are nearly impossible after a while. What's needed is a true flesh-and-blood opponent. Thankfully, head-to-head (human versus human via a modem link) capability is now being included in a large selection of really great games.

I've always been a fan of flight simulators, and now more and more of them come

ter Falcon, but Knights makes up for its graphics with incredible playability. Hours melt away when you're playing. In Knights of the Sky, you're given a choice of Allied and German planes to fly so you can set up a handicapping system based on the abilities of the plane, placing an advanced player in a primitive plane.

If flight sims aren't your cup of tea but you like the war genre, check out Perfect General (QQP, 1046 River Avenue, Flemington, New Jersey 08822; 908-788-2799) and the WWII Battle Set for historical war gaming.

This war game places you in a generic WWII setting. The interface is a wonderful evolution of the old hex-grid war games of the 1970s. When you're playing against a modem opponent, the game takes

on a new dimension: line of sight and hidden troops. It's very spooky to see a line of enemy tanks suddenly appearing from behind a grove of trees.

If you prefer your war gaming to be more abstract, check out BattleChess (and the soon-to-be-released BattleChess 4000) for Windows (Interplay Productions, 17922 Fitch Avenue, Irvine, California 92714; 800-969-4263). The animations of battle coupled with the unpredictability of a real opponent work perfectly together. And for some deep psychological reason, seeing the pieces duke it out and knowing that there's another human on the other end make victory mighty sweet (and losing almost bearable).

If war gaming isn't your style, there are a couple of

great addictive word games out there. Wordtris (Spectrum HoloByte) and Lexicross (Interplay Productions) offer special delights in modem play, if words are your thing.

Most of these games contain a small communications program, allowing you to dial and answer. If you have a friend who owns the game, call your friend and get one computer ready to receive the call and the other ready to send. Hang up and let the computers do the work (the manuals do a very good job of explaining the procedure).

But what if you don't have a friend who has the game you want to play? Try the classifieds in computer gaming magazines. They have listings of opponents, complete with phone numbers, and lists of the games they have.

And if you find someone halfway across the country you want to play against, you don't have to pay premium telephone rates. CompuServe runs a modem-to-modem (MTM) gaming lobby, with a standard \$12.80-per-hour connect charge (for 1200- and 2400-bps modems), regardless of who or where your opponent is. You can set up a profile of yourself or search the database to find an opponent and issue a challenge. You finally meet in the MTM lobby, where you can chat and then begin play.

To use this service, you'll need a communications program that allows you to exit without hanging up (such as Procomm Plus). CompuServe will prompt both players to exit and start the game, and then you're playing. When you're done, you end up back in the lobby to set up for another game, issue a challenge, discuss strategy, or just hang up. Use your modem to mine the online world; there's fun to be had. □

Use your modem to mine the online world; there's fun to be had.



equipped for modem play. One of the most advanced simulators, Falcon 3.0 (Spectrum HoloByte, 2490 Mariner Square Loop, Alameda, California 94501; 800-695-4263) offers breathtaking graphics and speed. Over the phone lines, the game presents you with a dogfight between F-16s (you can play cooperatively, but the dogfight is a whole lot more fun).

While Falcon is the current king of the high-tech, modern-era flight sims, MicroProse (180 Lake Front Drive, Hunt Valley, Maryland 21030; 410-771-0440) is soon to release modem-capable F-15 Strike Eagle III. From what I've seen, the graphics will be amazing.

MicroProse also publishes Knights of the Sky, a World War I dogfighting simulator. The graphics seem simple af-