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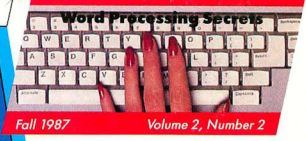

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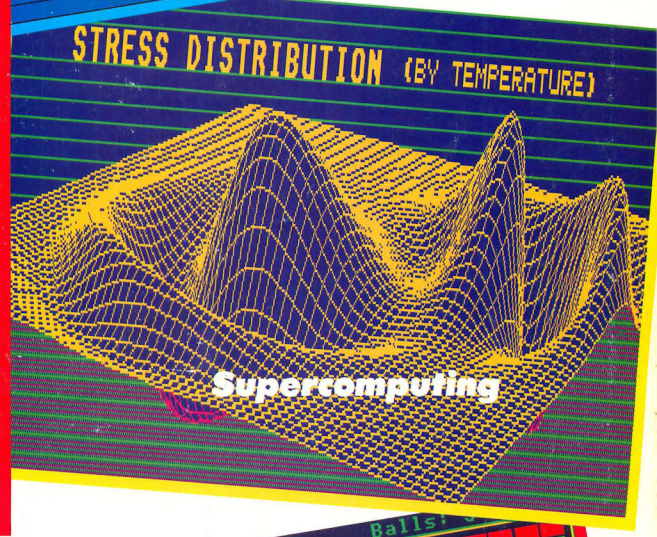

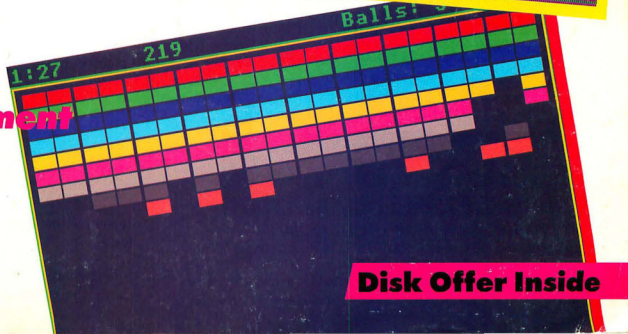

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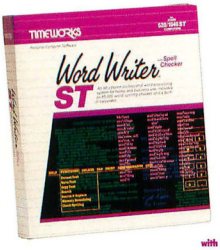

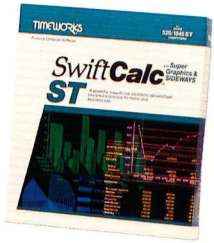

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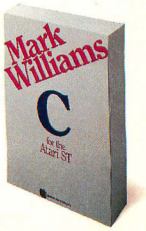

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FALL 1987

THE ST QUARTERLY

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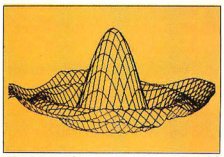

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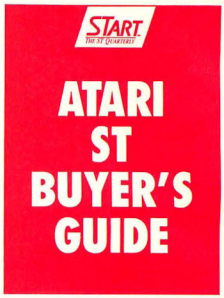
EDITORIAL



Big news for START subscribers! In just two months, you'll be holding something special in your hands: the START Atari ST Buyer's Guide. It's a special *bonus* issue of START, packed to the brim with reviews, comparison charts and news of hardware and software for your ST. Exciting things are happening in the ST world, and the place to see it all is in the START bonus Buyer's Guide.

The Buyer's Guide will be on sale on newsstands November 1st, but if you're a START subscriber, you'll get it free– *in addition* to all your regular subscription issues! That's a real bonus, at no extra charge! If you're not yet a subscriber, it's not too late–you can still get the bonus Buyer's Guide, along with four issues of START complete with the START disk and all START programs, for the regular subscription price. Just fill out the subscription card you'll find bound into this issue.

We think you'll want to be here, too–to see all the new and exciting things we've been conjuring up for the premier ST magazine. You've told us you want more news and reviews–easy-to-use technical tips, tutorials that don't take an engineering degree to understand–and ongoing coverage, advance looks and perspectives on every part of the ST world.

In the months to come, you'll see it all, from news and reviews of hot ST hardware and software, including the laser printer and the Mega ST, to new columns and tutorials on graphics, word processing, MIDI, games, desktop publishing, business–even a special column for new ST owners, to help you get the most out of that sleek grey rectangle once you've uncrated it.

And of course, you'll still find the high-powered technical information that's made START the place programmers and developers turn–and that's made START *the* place to turn for the best ST programs in every issue!

As we grow, we want to hear from you. Remember, START is *your* magazine, so let us know how we're doing.

Jon A. Bell

Jon A. Bell
Editor
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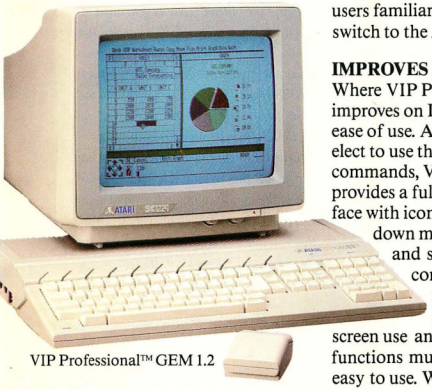

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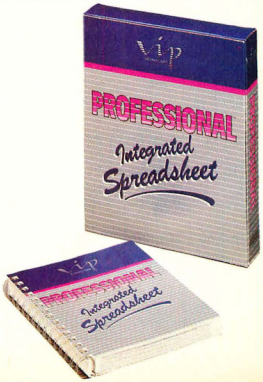

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CAN'T START WITH START

Could you suggest any books or publications which could help me learn and understand more about my new 1040 ST? This is my first computer. I enjoy reading your articles, but frankly, I don't understand most of them. I wish they were written a bit more clearly so a beginner like me could keep up with them. I realize most of your readers are more informed, but it's very annoying to own a machine with so many things going for it and not be able to utilize it to its fullest.

Patricia Manzo
Winthrop, MA

START's sister publication, Antic *magazine, contains a special section called The ST Resource in every issue. Every month the ST Resource includes type-in listings and many short reviews of the hottest new ST software.*

The Atari ST for Beginners *from Abacus is another good place to start—it begins at the very beginning, with a chapter on setting up your ST. Abacus also offers a complete line of ST books at various technical levels.*

Finally, check out the next issue of START for our new column for new ST owners—and anyone else who wants to get the most from an ST!

GFA JOYSTICK ACCESS

I am attempting to find a way to read the joystick with GFA BASIC. Can this be done? Do I need to use joystick "packets," like the ones described inside Atari ST documentation?

David Snyder
Elkhorn, IL

David, it's very easy to access the joystick using GFA BASIC—just PEEK(&HFFFC02) and you'll have value from the joystick in port 1. The joystick value is a number between 0 and 10. Imagine the joystick as a compass; then N returns 1, S gives 2, W is 4, E is 8, NW is 5, SW is 6, NE is 9, and SE is 10. Zero means the joystick is centered, and 3 or 7 means your joystick is broken—they should never appear. If the firing button is pressed, the number will be higher by 128. (This is the same 1-2-4-8 bit pattern for the N-S-W-E joystick movement that's used on 8-bit Atari computers.)

You can also track what's going on with the keyboard and mouse with the same PEEK. Keyboard info comes through in the form of "make" and "break" codes—a "make" code is generated when you press a key, and the "break" code is generated when the key is released. You can tell the "make" code from the "break" code, because the break code has the high bit set—it's 128 higher. Figure 1 shows the "make" codes for the ST keyboard.

Finally, mouse movements are also returned through this PEEK, but they happen so fast they're unusable—instead, use one of the mouse commands available in GFA BASIC. (And remember that, while this is a quick-and-dirty way to get joystick and keyboard information, it's not *documented, and may not work on future STs.)* ▶

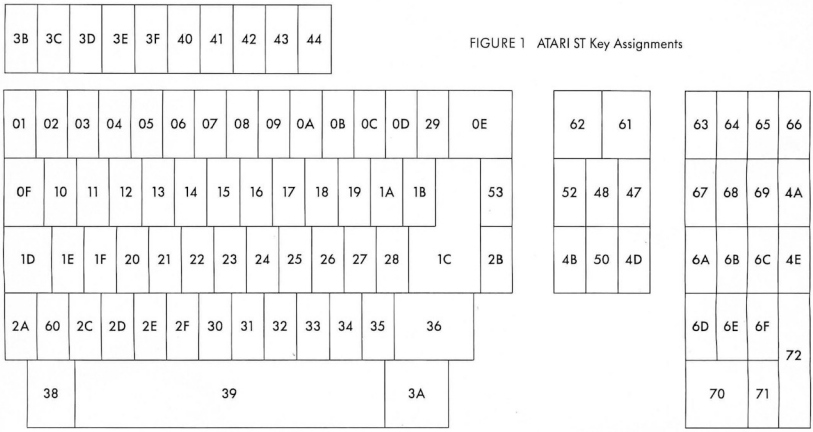

FIGURE 1 ATARI ST Key Assignments

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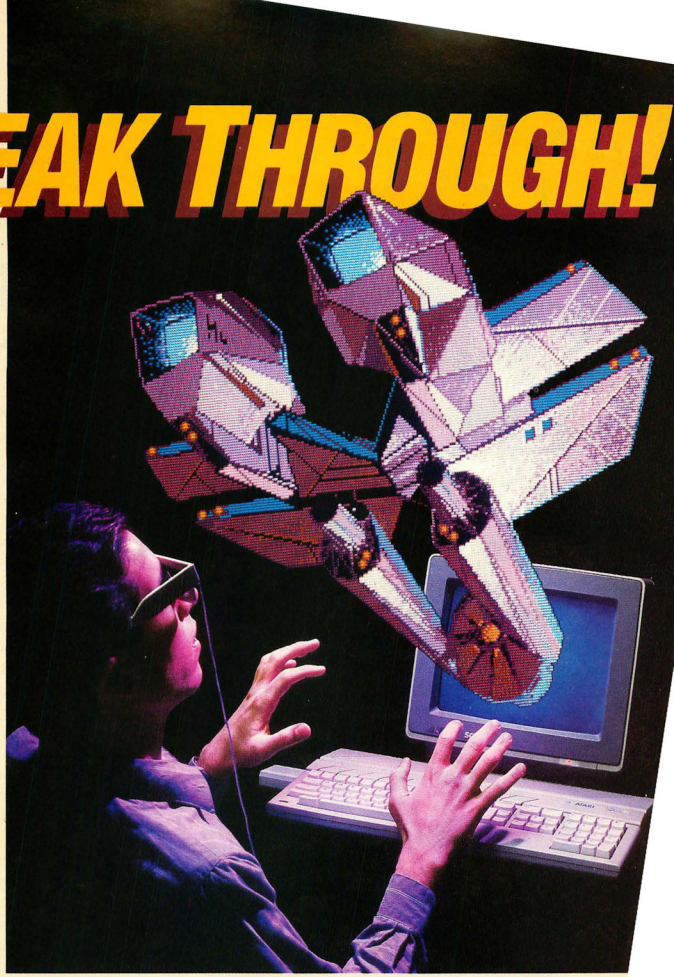

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HELPING RAY TRACER TRACE RAYS

Help! I've always been able to run the programs in your magazine, but Tom Hudson's Ray Tracing Construction Set (START, Spring 1987) has me stumped. I would greatly appreciate it if you could provide a step-by-step procedure for getting this program to run. My system is a 520 ST with one single-sided drive and a color TV.

Alan Krechman
Tarrytown, NY

Sorry about the confusion, Alan. Here's how to get the Ray Tracer to start producing pictures.

First, uncompress and copy TRACER.PRG and EXAMPLE.CTL to a fresh disk. Then use DEGAS (or a DEGAS-compatible drawing program such as Flicker, from the Summer 1987 START) to create four pictures, one for each wall, and save them as .PI1-type pictures (uncompressed). Copy these four new pictures to the same disk as TRACER.PRG. The Ray Tracing program will supply the checkerboard for the ceiling and floor, and automatically distort the pictures into the correct images for the four walls.

Next, use an ASCII word processor, like 1ST Word or WordWriter ST, to edit the EXAMPLE.CTL file. Look for the line that reads "e:\pictures\lwall.pi1", and change it to the filename of your picture for the left wall. Repeat the process for the other three pictures (change "e:\pictures\rwall.pi1" to the filename for your right wall picture, "e:\pictures\bwall.pi1" to the name of your back wall picture, and "e:\pictures\fwall .pi1" to the name of your front wall picture). Each picture name appears twice, so be sure you get them all.

After you've changed the wall picture names, find the line that reads "c:\graphics \ray1.pi1" and shorten it to just "ray1.pi1" – then find the line that reads "c:\graphics\ray2.pi1" and shorten it to "ray2.pi1".

Now save the modified EXAMPLE.CTL file to disk. Be sure to save this file in ASCII format. (For example, in 1ST Word make sure WP format is not checkmarked, and with WordWriter save the file as ASCII.)

Finally, put the disk with TRACER.PRG, EXAMPLE.CTL and your four pictures into drive A: and reboot. Double-click on TRACER.PRG, and when the file selector box pops up, click on EXAMPLE.CTL. Be prepared to lose the next four or five hours as you play with the Ray Tracer. Have fun!

THE GDOS LOWDOWN

All right. No gobblydegook. I've been reading about GDOS for months, and still don't know what it is! Could you please explain it in simple terms?

Stanley Beck
Chalmette, LA

Stanley, for all the hoopla GDOS (the Graphic Device Operating System) is causing, you'd expect it to be really something, wouldn't you? The truth is there's no magic concerning GDOS, and anybody can understand what it's supposed to do.

When your ST shows you a picture, it's composed of individual dots. That's true whether you're seeing it on a TV screen, a printer or any other output device. How nice an image looks depends directly on how many dots you draw it with – the more dots, the better. The ST monochrome screen shows 80 dots per inch, but a printer can show upwards of 300 dots per inch. (At the really high end, a good plotter or phototypesetter can get a thousand dots or more in each inch.)

Since your printer can show a much finer resolution picture than your TV can, it makes sense to be able to use the full resolution available for each different output device. That's what GDOS does with a properly written program. The program creates its pictures in an impossibly high resolution, then automatically scales the pictures down to the best resolution possible for your screen or printer.

And that's all there is to GDOS. Period.

WHERE'S MY DISK?

START is a magazine with programs on disk. Normally you will find the disk bound into the magazine and selling on the newstands for $14.95.

But some of you ST enthusiasts want to read START first, so we have provided a limited number of copies without disk for $4.00 each.

If this is your situation you can complete your copy of this issue of START by ordering the companion disk direct from us, for $10.95 plus $2.00 shipping and handling. See the order form inserted into this issue.

NEW YEAR'S RESOLUTION

I am confused about how the resolution of TV monitors is rated. I have seen monitors rated at 400 lines of resolution, while computer makers rate themselves according to how many columns of text they can handle, such as 40 or 80. How are they related? Is there a difference between vertical and horizontal resolution? How does a TV decide how many dots to display?

Dave Wright
Kingston, Tennessee

Dave, TV monitor manufacturers state the capability of their products in units like "vertical lines" or "bandwidth" basically because they don't know beforehand what computer a monitor will be hooked up to. A manufacturer can't actually say a monitor will support 80 columns of text because that depends on how small the computer makes the dots that form each character. To be safe, get the SC1224 Color Monitor Atari supplies for the ST series. If you decide to use another brand of color monitor and you want 80-column color text from your ST, get a monitor with a bandwidth of 10 Mhz or higher. If all you want is 40-column text, including low resolution graphics, any good monochrome or color TV will do fine.

Your last few questions are more involved. We need some basics of NTSC-format television signals, used in the Americas and Japan. NTSC television uses 30 frames per second, each with 525 scan lines. The electron beam that creates the picture goes back and forth, from the top of the screen to the bottom. Vertical sync—when the electron beam returns to the top of the screen—runs very close to 60 hertz (times per second, abbreviated Hz). Horizontal sync—when the beam returns to the left side of the screen, also known as the flyback *frequency—runs very close to 15,750 Hz. It takes two 60 Hz fields of 262.5 scan lines each to build one 525 scan line frame, resulting in an apparent 30 frame per second display. This is just fast enough to fool the eye into seeing smooth movement.*

Let's discuss horizontal resolution first. Since we need to show 262.5 scan lines in 1/60th of a second, (.0166666 seconds), we can determine the frequency at which some of the internal TV parts are working. For example, to find out how long it takes to draw each line, we divide the field rate (.01666666 seconds) by the number of scan lines needed per field (262.5), with the answer being very close to 63.5 microseconds (μsec).

We may assume that for a dot to appear, we need to turn the electron beam on. For no dot, we turn the scanning beam off. If we plotted the voltage necessary to do this on an oscilloscope, it would represent, in effect, a "square wave" signal.

Now, there is a section of circuitry inside a stock NTSC TV called the intermediate frequency strip, which, for reasons we don't need to get into here, limits the "square wave" (dot/no dot) frequency a standard home TV can pass along to the picture tube to about 4.5 Mhz. This is also known as the "frequency response" or "bandwidth" of the TV receiver. By using the formula from the paragraph above, we find we can turn the scanning beam on and off about 320 times per scan line without pushing the TV too hard. In other words, 320 dots/no dots divided by the time it takes for one scan line (63.5 μsec) equals 5.04 Mhz.

If, in our computer, we create dot-matrix characters eight dots wide, then we should be able to get 320 dots divided by 8 dots per character, or 40 characters, on each line of a standard TV set. If we try to pump out more dots than this—for example, the 640 dots necessary for 80 characters per line—we would raise the required frequency re- ▶

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sponse to about 10 Mhz. The TV, meanwhile, knows nothing of this and will simply limit the incoming frequency to about 4.5 Mhz. The result is dots that smear against each other, and a quite unreadable display.

So we've determined that basically the frequency response of a TV limits how many dots horizontally the TV can display. Now let's get to vertical resolution. Normally, computer displays don't follow the NTSC standard exactly. For example, NTSC specifies two fields of 262.5 lines each for a 525 line frame. The first field of each pair puts the odd-numbered scan lines on the screen, and the second field puts up the even-numbered scan lines. Because the two fields, presented alternately, appear to interlace with each other, this is known as an interlaced *picture.*

Almost every computer simply puts out two identical fields per frame, non-interlaced, yielding about 200 usable scan lines onscreen. (Some scan lines appear above the top of your screen and some appear below—that's called overscan.*) This accounts for why most consumer computers destined to hook up to a NTSC home TV allow a picture of about 320 dots wide by 200 dots (scan lines) high.*

To display more dots horizontally, the frequency response of the TV needs to be increased. To get 640 dots or more across on a line, look for a TV or monitor that is rated at 10-15 Mhz, rather than the 4.5 Mhz at which a stock television runs. This requires more expensive electronics, resulting in a more expensive TV. To get more dots vertically on the screen, we need to increase the flyback frequency. To get twice as many dots vertically, like the ST's monochrome 400 lines, we need to double the flyback frequency from about 15,750 Hz to around 31.5 Khz. Since we need to draw twice as many lines in the same amount of time per field, we need to draw each line twice as fast as normally.

There's still one other aspect of color TVs that determines just how many dots can show up onscreen. At the front of each color TV is a layer of phosphors, which glow when struck by the scanning electron beam painting your TV picture. The phosphors are usually arranged as triangular groups of red, green, and blue glowing phosphors. To create a white dot onscreen, all three phosphors (red, green, and blue) in that particular triangular group have to be struck by the electron beam at the same time, thus creating a white dot.

There are TVs with large groups of phosphors, and some with small groups. Naturally, the smaller the grouping, the more dots can appear—but that takes more precise manufacturing, and that's *more expensive. The size of the phosphor grouping is expressed as "dot pitch," and typically, for TV sets, runs about .31 to .45 millimeters. For example, this means for a TV set with a ".33" dot pitch, we could expect to get 3 pure white dots per millimeter per scan line. This works out to 30 dots per centimeter, or about 76 dots per inch of TV screen. A 13-inch (diagonal) TV screen is about 10 inches wide; with a dot pitch of .33 mm, this should allow us an upper limit of 10 times 76 or 760 dots per line, regardless of the internal electronics of the TV. If the dot pitch is too large, the groupings of RGB phosphors are larger than the dot the TV is trying to draw, resulting in just a portion of the triangular RGB phosphor group—for example, just the red-green or red-blue pairs—being illuminated. (This is one reason why "artifacting" happens on TV screens showing hi-res pictures.)*

Some monitors have a dot pitch as small as .16 to .20, with frequency response ranging up to 30 Mhz. To get the best possible picture, buy the highest frequency, smallest dot-pitch TV monitor you can afford.

(Thanks to Mark Sloatman, of Practical Solutions in Tucson, Arizona, for his technical assistance.) ■

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PIXEL-PRO

by Matt Loveless Consulting Editor

Above is an example of multiple techniques to enhance a digitized photo.

From left to right: *Original digitized photo*

One degree of graininess

5 x 5 chunkiness (used on background only)

Four degrees of graininess

Photography by Mary Lavery Pelaquin

"You've invented a new way for me to waste time."
–Dr. T Software programmer Tom Jeffries, after trying Pixel-Pro for the first time.

Image processing is one of those specialized areas in the computer world. There's a certain academic exhilaration attached to it, but in real life–in my life at least–it's about as exciting as watching dough rise. To tell the truth, I don't care about exploring the murky mists of inverse Fourier transforms, convolution kernals, and space invariant filtering. I don't want to reconstruct the Mona Lisa or enhance satellite photographs. I just want great graphics.

I admit it: I have almost zero artistic ability, but give me somebody else's artwork and a paint program and I'll stipple, distort and stretch the image to an ugly death. What I needed was a tool that would give me real destructive and manipulative image power.

That's why I created Pixel-Pro, START's Pixel Processor program. You can use it with almost any low-resolution ST picture. It does some of the same things that full-scale image processing systems do–but mostly, it lets you play with your ST pictures.

It's here! Pixel-Pro, the amazing new graphics program that lets you twiddle the pixels in your ST pictures! You can't make hundreds of julienne fries with it, but you can turn a beautiful digitized photo into a pixelized Jackson Pollack apparition! Pick a peck of processed pixels with Pixel-Pro, in the file named PIXELPRO.ARC on your START disk!

File PIXELPRO.ARC on your START disk.

USING PIXEL-PRO

To use Pixel-Pro, copy the file PIXELPRO.ARC to a fresh disk along with ARCX.TTP. Run ARCX and type in the filename PIXELPRO.ARC, and in a short time the program files will be ready to use.

Pixel-Pro works only with a color monitor. Set your desktop to medium resolution, then double-click on PIXELPRO.PRG. When the program runs, click anywhere in the dialog box to begin. The first thing you'll want to do is load a picture.

Pixel-Pro isn't a drawing program, and it does not create pictures. Instead, it works with low-resolution pictures you've already created with a video digitizer, NEOchrome, DEGAS, or even Flicker, the drawing and animation program from the Summer 1987 issue of START. Your pictures should be in uncompressed form, with the extender .NEO, .PI1, .PI2, or .PI3.

To load a picture, drop down the File menu and click on Load NEO or Load DEGAS, then select a picture with the file selector. Once it's loaded, you can view the picture by clicking on View from the File menu. The picture will be displayed for as long as you hold the mouse button down. If you clicked and released quickly on View, the screen may have only flashed momentarily. You must press and hold the button on the View option.

You can save your work at any time by clicking on Save NEO or Save DEGAS on the File menu. It doesn't matter which type of file the original was; you can save it as either. Keep in mind, however, that color cycling and other special features are not saved along with the file.

You can leave Pixel-Pro and return to the desktop at any time by clicking on Quit on the File menu. Be careful, though: you'll get no chance to back out of Quit. The program will exit immedi-▶

The prismatic pixel processor

From left to right:

3 x 3 chunkiness

5 x 5 chunkiness

Dominate

Reverse

ately, and you'll lose any picture that's still in memory.

When you choose an operation from a Pixel-Pro menu, you'll usually find yourself looking at your picture, with a set of mouse-controlled crosshairs on the screen. That means Pixel-Pro wants you to select an area of the picture to work on—a rectangle within which the selected operation will occur.

To select a rectangle, position the crosshair wherever you want one of the corners to start, then press and hold the left mouse button. The cursor will change to an arrow; move the mouse, and you can stretch a box onto the screen. You can abort the box at any time by clicking the right mouse button. You can also leave your picture and return to the GEM screen any time the crosshairs are active—simply click the right mouse button.

A SHORT TUTORIAL ON ST GRAPHICS

In order to understand many of the features of Pixel-Pro, it helps to understand the rudiments of ST graphics. Of course, you don't *have* to understand how the ST does its thing; if you like, you can just experiment with the program to see what happens. But in case you're interested, we'll cover some of the basics, so you'll understand what's happening.

The Atari ST supports three graphics modes: high-resolution monochrome, medium-resolution color and low-resolution color. Pixel-Pro was designed to work exclusively with low-resolution color pictures (even though you must run the program from a medium-resolution desktop). A low-resolution picture is made up of 64,000 dots (called *pixels*)—320 pixels wide and 200 pixels high—and each dot is one of 16 different colors. You can select which 16 colors it uses (out of 512 possible colors) by specifying the colors in terms of red, green and blue.

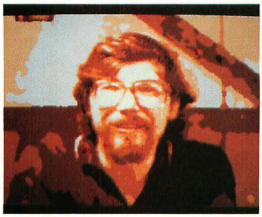
Pixel-Pro doesn't create pictures—but it works wonders with pictures created with NEOchrome, DEGAS, Flicker, or a video digitizer.

Why red, green and blue? Look closely at your ST monitor's picture tube and you'll see that it's coated with three different types of phosphor dots—some are red, some are green and some are blue. The phosphors are grouped into trios—each with one red, one green and one blue phosphor. By varying the intensity of the light that each phosphor gives off, the ST can show different shades of color. If just the red phosphor is on, for example, the trio will show up as a shade of red. If both the red and green phosphors are on full, the trio will appear yellow (remember, light colors add differently than paint colors). If red is on full and green is at half intensity, it will look orange.

Since each phosphor has eight different possible intensities with the ST, there are 512 different combinations possible. ST colors are usually described in terms of their RGB content (the amount of Red, Green and Blue). Black, for example, is 000 (no red, no green, and no blue); bright red is 700 (all red, no green, and no blue); and a light grey is 444 (equal proportions of all three colors).

In the ST's low resolution, you can select 16 of those 512 colors to use for your picture, and each pixel in the picture is one of those 16 colors. In other words, out of 512 possible colors you select 16 for your palette, and from those 16 you select one palette color for each pixel. Thus, each pixel's color isn't specified as red or green—it's "color number 5" or "color number 13." As a result, you can change your picture without actually changing any pixel information—just change color number 13 from, say, 347 (3 parts red, 4 parts green and 7 part blue) to 730 (7 parts red, 3 parts green and no blue), and any pixel that was set to color number 13 will automatically change.

(In the not-too-distant future, there may be increased resolution and more colors onscreen at once for the ST—but



for now, that's what we're limited to.)

The 16 colors in any low-resolution ST picture are collectively called the palette, and each pixel selects its color from the palette with a number—0 through 15. In hexadecimal, that's 0 through F—or in binary, 0000 through 1111 (see *Table 1*).

The special chips in the ST that speed up graphics display read those numbers in binary—in fact, they split each one off into its four bits. Thus, 64,000-pixel low-resolution picture is effectively stored as four 64,000-bit images called *bit planes* (see *Figure 2*). For example, a pixel with palette color 13 (binary 1101) is represented in memory by a 1 in bit-plane 0, a 0 in bit-plane 1, a 1 in bit-plane 2, and a 1 in bit-plane 3:

```
1 1 0 1
| | | |
| | | plane 0
| | plane 1
| plane 2
plane 3
```

Plane 0 holds the value for bit 0 of every pixel, plane 1 holds the value for bit 1 of every pixel, and so on for planes 2 and 3.

Pixel-Pro was originally designed to work with digitized pictures, which usually have a very distinct palette: 8 or 16 shades of one color, ranging from darkest to lightest. However, Pixel-Pro will have interesting effects on any picture. Just keep in mind that the results may not always be predictable.

Now—back to the program!

PALETTE OPERATIONS

The simplest features of Pixel-Pro are the palette operations on the Palette drop-down menu. There are three: RGB Swapping, Tint and Ranges.

RGB Swapping. RGB Swapping allows you to swap the RGB components of the entire color palette. When you select this option, a dialog box comes up. The following swapping options are available:

red <=> green	Swaps red and green components
green <=> blue	Swaps green and blue components
blue <=> red	Swaps blue and red components

TABLE 1

Decimal	Hexadecimal	Binary
0	0	0000
1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	1000
9	9	1001
10	A	1010
11	B	1011
12	C	1100
13	D	1101
14	E	1110
15	F	1111

To look at your picture, click and hold on the View icon. The view ability from within dialog boxes differs from the View option on the File menu in that the bottom of the screen is replaced with the color palette, labeled 0 through F (the hexadecimal versions of the numbers from 0 through 15).

When you are done swapping, select either OK or Cancel.

Tint. Tinting allows you to increment or decrement the RGB components of the entire palette. There are two columns of colors, one for adding color and one for subtracting color.

Button	Affects:
RED	red components
GREEN	green components
BLUE	blue components
CYAN	green and blue components
YELLOW	red and green components
MAGENTA	red and blue components
WHITE	red, green, and blue components

Ranges. This option allows you to select the type of palette arrangement Pixel-Pro will operate on. The following options are available:

One color, 16 shades
Two colors, 8 shades
One color, 14 shades (CAD-3D)
Two colors, 7 shades (CAD-3D)

(Most digitizers use either 8 or 16 shades; the pictures of 3-D objects you create with CAD-3D use either 7 or 14 shades.)

The range information is not used by ▶

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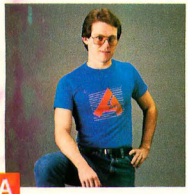

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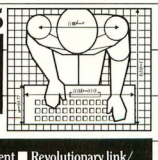

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all of Pixel-Pro's operations, and sometimes it's interesting to choose a range which does not correctly describe your picture.

THE COLORMAP

The Colormap menu has two selections: Edit colormap and Remap. A colormap changes the pixel values of a picture by mapping each possible value (0 through F) to a new value. For example, a null colormap, one that will have no effect, maps all 16 pixel values to themselves. That is, 0 would map to 0, 1 would map to 1, and 2 would map to 2. However, by defining a new colormap, you could map, say, color 0 to color 1, which would change all pixels with a value of 0 into a value of 1. To define a new colormap, use the Edit colormap option; to actually perform a mapping operation, use the Remap option.

Edit colormap. The Edit colormap dialog is fairly complex (see *Figure 3*). The actual colormap is displayed in the bottom third of the dialog box. Colors from the Source palette are mapped to colors in the Dest palette. When you first load Pixel-Pro, the colormap defaults to a null colormap, where every color is simply mapped to itself. To manually redefine the colormap, drag the desired Source color to the appropriate Destination (Dest) color. For example, to swap colors 0 and F, first map color 0 to color F: Point to the box marked 0 in the Source row, drag it to the box marked F in the Dest row, and release the mouse button. The boxes will flash and the Maps To row will be updated to show that color 0 now maps to color F. To complete the swapping operation, drag the Source box F to the Dest box 0. Now if you remap the picture, all pixels that were color 0 will become color F and all pixels that were color F will become color 0.

What I need is a tool that gives me real destructive and manipulative image power. Thus, Pixel-Pro was born.

You can have three entirely separate colormaps. You select the desired colormap with the bank buttons: Bank 1, Bank 2, and Bank 3. Any remapping operation (including the Edges operation under Effects) uses the colormap that is currently active.

There are also some preset colormaps for some of the more useful mapping operations. Clicking on the Presets button lets you choose from the following:

HI PASS	eliminates all but the brighter colors
LO PASS	eliminates all but the darker colors
DIM	dims the image
BRIGHTEN	brightens the image
DEFAULT	restores to a null colormap
NEGATE	negates the image
ALL TO ONE	maps all colors to one specific color

When you select a preset, it replaces the colormap in the current bank. Most of the presets depend on the type of palette you have selected with the Ranges option from the Palette menu. You can also change the ranges from within the Edit Colormap dialog by clicking on the Ranges icon. The presets are not intelligent, so they rely on the range you have selected; they work best with the default palette (16 shades of one color).

You can view the current picture at any time by clicking (and holding) on the View icon. You can leave the dialog by clicking on the Exit button, or remap immediately with the Remap button. If you get confused, click on Help.

EFFECTS

The features available from the Effects menu are about as close as Pixel-Pro ▶

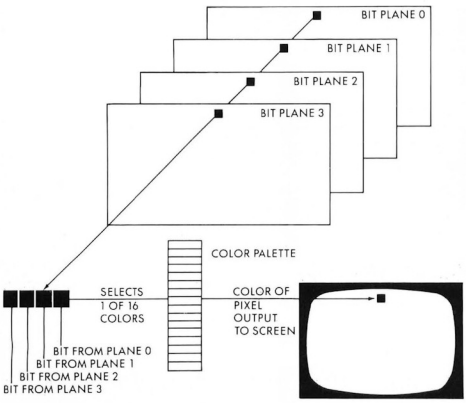


FIGURE 1. ST low-resolution display, illustrating bit planes

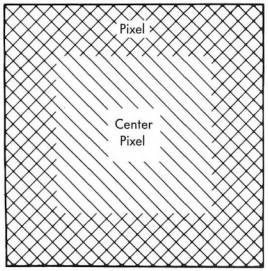


FIGURE 4. Pixel-Pro matrix.

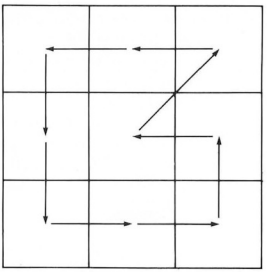


FIGURE 5. Grainy 3x3 Rotation Matrix

gets to image processing. Most of the effects are based on a pixel matrix or pixel neighborhood. To understand this, think of every pixel as being surrounded by a matrix of adjacent pixels (see *Figure 4*). The pixel matrix will likely be either 3x3 or 5x5.

Grainy takes a 3x3 pixel matrix and rotates it onto itself. Pixels are actually picked up and moved within the matrix (see *Figure 5*). The overall effect is to add a grainy texture to the image. If you use Grainy on the same area nine times, it will rotate back to its original state.

Chunkify takes the center pixel and expands it to a full 3x3 or 5x5 size matrix. As a result, the picture is the same size, but the pixels are much larger. Try following a 5x5 chunkify with a 3x3 chunkify.

Dominate passes over every pixel and looks at the matrix surrounding it. The center pixel is replaced with the dominant color in the neighborhood. If no color dominates, the pixel is left alone. The general effect is that large areas of color get larger and isolated pixels disappear. It's useful to precede a Chunkify with a Dominate.

Edges will modify the edges in an image according to the current colormap; if you haven't modified the default colormap, this will have no effect. You can select three levels of edge sensitivity (high, medium, and low). The sensitivity is based on the proximity of colors according to the Ranges you have selected.

Smooth is my attempt at an ultra-fast antialiaser. Antialiasing blurs an image by using a convolution kernal approximating a Gaussian filter—in simple terms, it removes the jagged edges from diagonal lines. Convolution operations on a full-size image take hundreds of thousands of multiplies and adds, and that's *slow*. Smooth merely fills corners with carefully selected colors—much faster, although it's not true anti-aliasing.

MODES

Preview lets you try an effect without permanently changing the image. Like all items on the Modes menu, you can toggle it on or off by clicking on it.

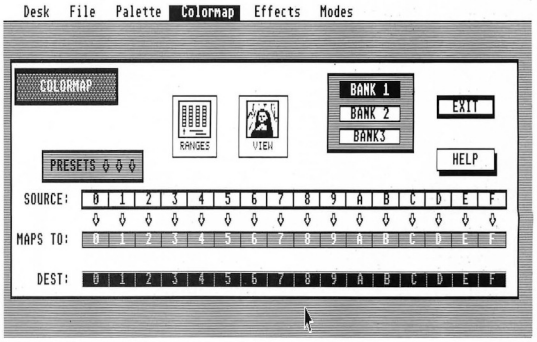
Planes The four plane options (0-3) and [Reverse All] allow you to choose which bit planes will be affected by the operations. If no planes are selected, operations will have no effect; the default is to have all planes active. You can toggle a plane on or off by clicking on it; you can also reverse the status of every plane by clicking on [Reverse All]. You can achieve some stunning transparency effects by turning selected planes off. When calculating a pixel, Pixel-Pro takes all planes into account, regardless of the Modes setting; however, it will only modify the planes that are active. That lets you create some striking effects as you process your pictures.

LIFE IN THE COSMOS

If you're interested in exactly how Pixel-Pro does its thing, you'll find the source code (written in Megamax C) Antic Online on CompuServe. I think you'll find it interesting to peruse and play with it, but please be judicious: Remember, it's copyrighted source code and may not be reproduced or used commercially without permission.

In any case, the key to getting the most out of Pixel-Pro is experimenta-

FIGURE 3. Colormap editing screen.



tion. Collect copies of your favorite low-resolution pictures, load them up and start twiddling those bits. You may find that your ST will never look quite the same again! ■

Matt Loveless is a free-lance software designer and writer who recently completed the Mega ST documentation for Atari.

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WHERE'S THE SOURCE CODE?

You'll find the source code for Pixel-Pro in Antic Online, CompuServe's Atari online magazine. Just log on to CompuServe, then type GO ANTIC and look for the file PIXELPRO in the "What's New" menu. You can download the file, then un-ARC it using ARC (or ARCX.TTP on your START disk).

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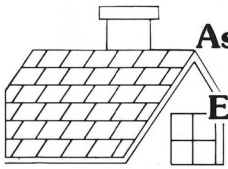

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THE FLEET STREET DESKTOP PUBLISHER

THE ST DESKTOP PUBLISHING BOOM CONTINUES

by Charles F. Johnson

Desktop publishing on the Atari ST is heating up. Fleet Street Publisher, from the British company Mirrorsoft, promises to bring real publishing power to the ST at an attractive price.

The program, which is distributed in the United States by Spectrum Holobyte, is completely GEM-based, using standard windows, drop-down menus, and dialog boxes. It lets you construct multi-page documents easily, using a variety of typefaces and type styles, and include pictures or illustrations, then print them with a dot-matrix printer. Overall, Fleet Street Publisher is a polished program with some very powerful features, some of which are not present in any other desktop publishing software for the ST.

WHAT YOU SEE IS WHAT YOU GET

Fleet Street, like most newer word processors and desktop publishing programs, follows the what-you-see-is-what-you-get principle. When you are working on a document, the screen always displays approximately what the finished, printed product will look like. For instance, as you type text, Fleet Street constantly adjusts the display according to the text settings in effect. If you include graphics in your document, you can see the pictures as you work, so you know exactly what you're creating.

The first desktop publishing programs for microcomputers were really just for doing page layout—you'd start with text prepared on a regular word processor and pictures from a digitizer or drawing program, and then assemble them into your final pages. Fleet Street is part of the next generation: It lets you compose your words while you're using Fleet Street, and even includes a simple drawing facility for graphics.

When you begin using Fleet Street, it functions as a rather limited word processor with standard word processing functions. The search and replace lets you search for strings of text backward and forward, and you may specify whether to ignore differences in upper and lower case. You do all your work in regular GEM windows; you may have several text windows with different documents open at the same time, and cut and paste text among them.

Fleet Street will read in ASCII text files created with other text editors and word processors. It won't actually convert files from non-ASCII formats, though. For example, to use First Word and Word Writer ST files you must save them in ASCII format first, and ST Writer files must be printed to disk.

Once you've created or loaded your text, Fleet Street lets you create a special document called a *page*, complete with columns, borders, headlines and illustrations. You can specify where in each page your text goes, in columns and partial columns. You can also link the columns together so that text automatically flows into the correct columns as you type.

A FONT OF FONTS

One of Fleet Street's real pluses is its good selection of fonts (see *Figure 1*). There are six different typefaces included with the program (and you can substitute other GDOS fonts for the six default faces). Fleet Street offers only a few different type styles—normal, bold, italics and underlined, and combinations of those features. It supports point sizes from 4 to 72, and there are other fine tuning controls for typefaces as well.

The first time you use a font, you must load it from the Fonts disk. That takes time—and it takes even more time for the program to convert the font to the proper size and style. It's a long wait compared to a regular word processor. Fortunately, once you've used a typeface it's stored in memory, so the next time you use it it's available almost immediately.

Fleet Street supports eight different units of measurement: points, picas, inches, centimeters, millimeters, percentage of current point size, relative units of current point size, and absolute units (1/10 of a point). You may never need to use some of those units, but it's nice to know that Fleet Street has such flexible measurement capabilities. You can usually choose which units you want to use for each specification—so, for instance, you can choose your type size in points and your page size in inches.

While editing a document, you may display rulers along the top and left sides of the current window, and the rulers can be in any of the available unit systems. As you move the mouse cursor within the window, little marks indicate its position on both rulers—quite handy for making accurate measurements.

PICTURES, TOO

Fleet Street has a very limited drawing facility. It offers only two options: draw and erase. There are no commands to create circles, ellipses, or connected lines, functions found in most ST drawing programs.

Fortunately, if you don't like drawing with Fleet Street there's an alternative: You can use picture files from DEGAS, NEOchrome and Mirrorsoft's Art Director in your documents. Fleet Street can't use these pictures directly—you must first convert them into Fleet Street's format with the Art Conversion utility that comes with the program.

Once they've been converted, you can load pictures into documents and manipulate them in a variety of ways. You can crop, resize and recolor them; you can modify them by drawing or erasing. You can position each picture with the mouse and rotate it up to 360 degrees in steps of one degree.

Fleet Street also includes a diskful of professionally created graphics that are ready to use. The pictures are grouped by category: "Church," "Country," "Animals," "Games," "Maps," etc. The program's British origin becomes apparent here—there are maps of Europe, the U.K. and the world (but none of just the United States), along with dartboards, rugby bats and a "dustbin lorry" (in American parlance, that's a garbage truck).

PRINTERS

The true test of any desktop publishing program must be its printed output, but I have some major misgivings about Fleet Street's dot-matrix print. In large-size type, Fleet Street's printing looks blocky, with a noticeable stairstep pattern on diagonal lines. Those "jaggies" are much more evident than in Fleet Street's major competition, SoftLogik's Publishing Partner (reviewed in the Summer 1987 START).

Sans Serif Typeface
Sans Serif Bold Typeface

Serif Typeface
Serif Bold Typeface

Helga Typeface
Helga Bold Typeface

Medieval Typeface
Medieval Bold

West End Typeface
West End Bold

College Typeface
College Bold

FIGURE 1: Fleet Street Publisher's Font Library

The current version of Fleet Street Publisher only works with a limited number of dot-matrix printers. Ideally you should use an Epson FX-80 or compatible printer for the best results (although my Star SG-10 printer worked perfectly with the program).

If you don't have an Epson-compatible printer, Fleet Street allows limited customizing of printer command sequences. You should probably call or write to Spectrum Holobyte before buying Fleet Street Publisher if you have any doubts about whether it will work with your printer.

For the best print quality possible, though, help is on the way. Spectrum Holobyte has promised to create a $30 printer driver for Atari's SLM804 laser printer. Better still, there should be a PostScript printer driver soon (for $50) that will allow Fleet Street to work with a full-scale typesetting system.

THE MANUAL

The Fleet Street package includes three disks, several function key templates printed on heavy paper, and an excellent manual in a small two-ring binder. ▶

The manual really shines in its tutorial sections. There's a step-by-step tutorial on using the program, of course, but this manual doesn't just walk you through the program. Chapter 7 leads you through the entire process of publishing a newsletter or book—everything from initial planning to the different kinds of inexpensive binding that are available.

Don't expect to breeze through the manual (it's hundreds of pages long) but take your time instead: this is complex

FLEET STREET NEWS

Bill Beret Returns After Fraud Scandal

By Otto Blunt

Legendary pop star and self-ordained Bhuddist monk Bill Beret returned to Britain yesterday from a long vacation that took him all over the world. But the holiday also saw him fall into very deep trouble when he was arrested on fraud charges in South America.

Bill (real name Joe Raphascutti), aged 32, is one of the most popular and highly-paid pop stars in the world. Sales of his most famous album "Large Lapels" have topped all known records. His jet-setting fans follow him everywhere trying to catch a glimpse of the famous hat from which he took his name. Also following him are legions of bodyguards and police.

On this particular trip the police were not there so much to guard him from his fans as to keep his creditors from catching up with him. Apparently, he was accused of syphoning off thousands of pounds from sales in the UK of his last hit, "Clothes I have loved", recorded on his Coat Hanger record label.

The truth was only revealed when he was arrested at a high society function in Brazil held in his honour.

The pop star would have been imprisoned for years, had it not been for the fact that everyone in the courtroom appeared to be a member of his family.

Bill now returns to his bachelor mansion in fashionable Peckham.

More pictures Page 4

Twenty Years Without a Bite!

By our Angling Writer

Fisherman Bob Jordan, 80, celebrates the twentieth anniversary of his last catch this week. It was twenty years ago that Bob last netted a fish at his local river, the River Parched. To celebrate the occasion, Bob has invited a host of local fishermen to the spacious Town Hall in Bedchester.

Tins of Beans

When asked about the absence of fish, he replied "Well, it's a mystery to me! Every week I would go to exactly the same spot under a lonely tree on the bank and every week, after a long day's wait, I would trudge back home empty-handed and open a tin of beans."

FIGURE 2: A Fleet Street Publisher example page

software, and has many features for you to become familiar with. Be warned, though: The index isn't spectacularly complete, and the table of contents has items that aren't actually in the manual. (The manual is the British edition, with a few page substitutions, and some pages simply didn't make it to the American version—for example, there are no "money-off vouchers" in the back of the book.)

PROS AND CONS

Fleet Street lets your document use as much memory as your ST has available. It will work with a 520 ST, but the more memory you've got, the better. The number of pages you can have also depends on the amount of graphics you use—pictures require more memory than text.

You can easily reposition columns of text and graphics on a Fleet Street page. You may also select which text attributes you wish to move—for example, you could move a block of text maintaining just the type style (but not indentation and justification). This makes it very simple to merge two very different text files into one consistent piece of text.

The Key Macro function is convenient and flexible; you can assign up to 20 text strings or typographical styles to the ST's function keys F1 through F10 and Alt F1 through F10.

You can define sections of a page to print out, instead of having to print entire pages. This makes it easy to quickly test new ideas for layouts or check to see how a particular picture will look when printed.

On the down side, Fleet Street makes no explicit provisions for headers and footers. (The manual recommends using macros to simplify creating a header or footer manually.) The program also gives you no warning prompt when you delete or overwrite a file—once you select the file to delete or overwrite, it's beyond recall. My feeling is that whenever a program is about to do something that will permanently alter a file, it should always give you a chance to change your mind.

My only other major criticism of Fleet Street Publisher is that it is heavily copy protected. The program will run from a hard disk, but it always asks you to insert the original master disk in drive A at the start of the program. Fortunately, all three disks that come with the Fleet Street package work as master disks for the copy protection.

CONCLUSION

Fleet Street Publisher raises the competition for desktop publishing on the ST to a new level. It's a polished program that comes with a good supporting package, including an excellent manual and a library of fonts and pictures. At $119.95, the price is very attractive.

With any software purchase, it's important to carefully compare all available programs before you buy one. Consider how you'll use desktop publishing—what's important to one user may not be quite as vital to another. For many people, Fleet Street Publisher's reliability, features and price will outweigh its flaws. ■

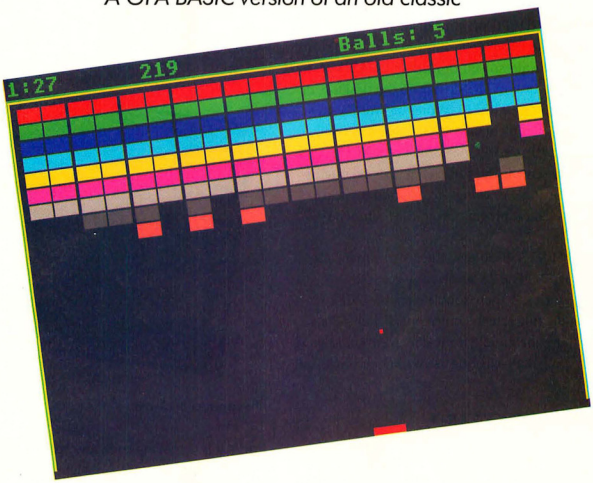
Charles Johnson is a professional musician who's toured the world playing guitar with George Duke, Stanley Clarke and Al Jarreau.

Fleet Street Publisher, Mirrorsoft Ltd, Headington Hill Hall, Oxford OX3 0BW, England. Distributed in the USA by: Spectrum Holobyte/Division of Sphere, Inc., 1050 Walnut, Suite 325, Boulder, CO 80302, (303) 443-0191, TWX 9109402506. Price: $119.95. Requires: 520ST w/ TOS in ROM, monochrome monitor preferred.

CIRCLE 205 ON READER SERVICE CARD

Brickyard!

A GFA BASIC version of an old classic



by PATRICK BASS
START TECHNICAL EDITOR

The year: 1976. The game: Breakout. Back then, it took legendary hacker Steve Wozniak to create Atari's ultimate version of the popular Pong arcade game. Eleven years later, all it takes is GFA BASIC. START Technical Editor Patrick Bass lets you knock out those bricks, then shows you how it's done!

Well, you can't say I didn't wait. I sat and tapped my foot for almost two years, waiting for Atari to release ST versions of the legendary games they're famous for. I wasn't greedy. But after all this time, all I saw was Star Raiders – none of the simpler, standard games. Why not?

Well, to make a long story short, I decided to do it myself. I had written Breakout-type games before on a number of different computers, and I was sure that GFA BASIC from MichTron was powerful enough to give a reasonably good showing, so I decided to write my own quick ST interpretation of this classic theme. ▶

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Brickyard...

RECOVERING BRICKYARD

You'll find Brickyard on your START disk under the name BRIKYARD.ARC. To play the game, copy this file and the program ARCX.TTP to a fresh disk. Next, double-click on ARCX.TTP, and in the box that comes on screen, type in the filename BRIKYARD.ARC. The disk will spin for a minute or so, and when it's finished you'll find BRIKYARD.BAS, BRIKYARD.PI1, and BRIKYARD.PRG on your disk.

BRIKYARD.BAS is the GFA BASIC source code for the game. It's saved as a text file, so you don't need GFA BASIC to examine it; you can SHOW or PRINT it from the desktop, or load it into a word processor like ST Writer or WordWriter ST. (To load it into your copy of GFA BASIC, you'll need to merge it.) BRIKYARD.PI1 is a DEGAS-format picture that forms the game's title screen. You can change this picture using any DEGAS-compatible drawing program—like Flicker, the drawing and animation program from the Summer 1987 issue of START.

You don't need GFA BASIC to play the game, either—it's compiled as BRIKYARD.PRG. Be sure you've got BRIKYARD.PI1 on the same disk, then double click on BRIKYARD.PRG. When the title screen comes up, click on [Play]. Your mouse will move the paddle from side to side, and you'll get five tries at keeping the ball going as you knock bricks out of the wall.

PLAYING IN THE BRICKYARD

Once you've played the game, return to the title screen to see the options that are available. (You can return to the title screen at any time by holding down both mouse buttons.) Unless you've changed the screen with a drawing program, you may want to put on your sunglasses—we'll be staring at those flashing lights for a while!

From the menu you can play the game (using [Play], of course), or quit and return to the Desktop by clicking on [Quit]. There are also ten other controls you can change and play with:

SOUND ON/OFF This switch controls whether your ST will beep when the ball hits a wall, ball, or paddle. Even when the sound is off, you'll still get a booping noise when the ball misses the paddle.

AUTOMATIC PLAY ON/OFF When Automatic Play is on, Brickyard runs as a demo game—the paddle centers itself under the ball and follows it automatically, without your guidance.

ENGLISH ON/OFF There are two different ways for the ball to bounce when it whacks the paddle. When English is off, the ball will rebound at the same angle at which it struck the paddle. When English is on, the ball bounces at an angle proportional to where it struck the paddle. If the ball strikes the left side of the paddle, it will bounce further to the left; on the right side, it bounces further to the right.

NEVER MISS ON/OFF For practicing, it's nice to not have to worry about the ball rolling off the bottom of the screen. When Never Miss is on, the ball will bounce back up whether it struck the paddle or not. When Never Miss is off, the ball will continue normally.

TOP ATTACK ON/OFF There are two basic ways of playing Brickyard. When Top Attack is off, the ball will only knock out a brick when it's moving toward the top of the screen. When Top Attack is on, the ball will also knock out any

Title screen of Brickyard

bricks it hits moving back toward the bottom of the screen—which can push your score higher much faster. Play with this switch and check for yourself how it changes the playing strategy.

BALL SIZE This lets you change the size of the ball. Point at Ball Size and press the left mouse button to decrease the size of the ball; hold down the right mouse button to increase it. You may vary the ball's size from a single pixel to a square five pixels high and wide.

PADDLE SIZE This lets you vary the size of the paddle. Again, the left mouse button decreases the paddle size, and the right button increases it. The paddle width may vary from a single pixel to 50 pixels wide.

BALLS Here you may select how many balls you get, from 1 to 99 balls per game.

COLS This lets you choose how many columns of blocks there are, from 1 to 99 columns.

ROWS Finally, this lets you change the number of rows of bricks, from 2 to 9 rows.

THE FACADE BEHIND THE FRONT

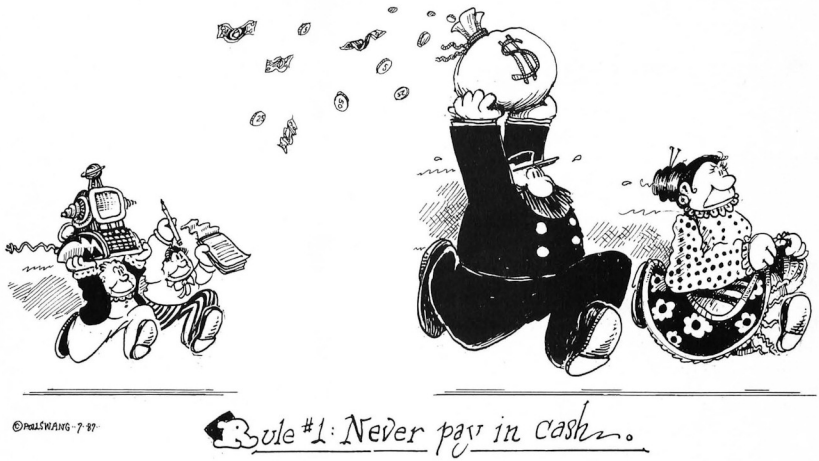
If you're a programming type, let's get our hands dirty—the source code is in the file BRIKYARD.BAS.

continued on page 96

How Not To Run A Computer Store

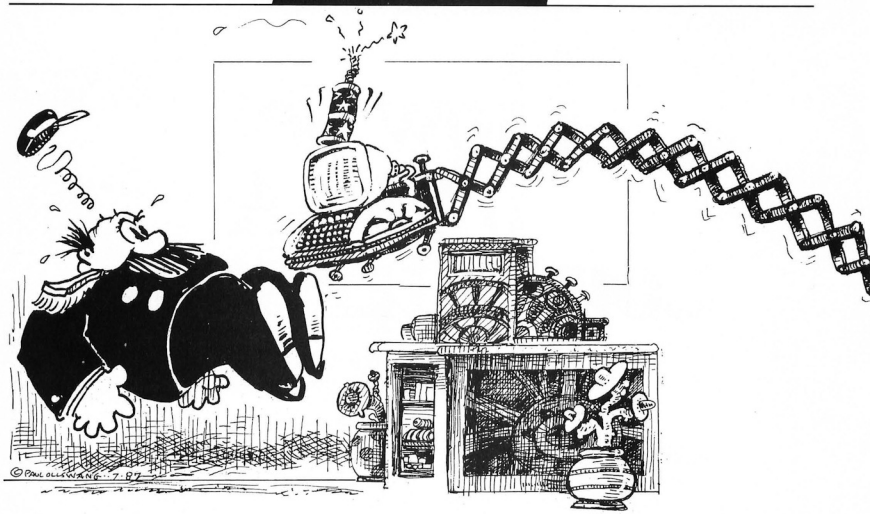
Or, the trials and tribulations of a Northern California computer consumer

by FRANK KOFSKY



Buying a computer looks easy, and it should be. But at some computer stores, you pay your money and take your chances. Frank Kofsky made the rounds of his local dealers, and he shows the danger signs to watch out for—and what to do if you're sold a lemon.

Illustrations by Paul Ollswang



ALWAYS STAND BEHIND YOUR PRODUCT; AS FAR BEHIND AS POSSIBLE...

It's common knowledge that the personal computer industry is in a slump these days. After I bought an Atari 1040 ST system, the experience led me to wonder whether some computer-store owners aren't trying to turn the slump into a funeral.

Not all computer stores are contributing to this trend, of course, but for those who are, I've formulated a few well-intentioned suggestions for how to speed up the process—and send the computer business straight into the ground.

If you don't stock it, knock it.

I decided early on that I wanted an Atari ST and an Epson printer. (Those are the only real brand names in this story, by the way—all other names have been changed.) One of my first stops was the local outlet of a well-known chain of business-oriented computer stores—I'll call it CompuBiz—to look at Epson printers. All went well with the salesman until I mentioned the word "Atari."

At this, the salesman curled his lip—his whole face, in fact—and gave me a look of consummate disdain. "We can't guarantee that any of our printers would be compatible with (*sniff*) an Atari," he said, then turned on his heel and marched rapidly toward the rear of the store. End of discussion, evidently.

Had I bathed that day? Were my armpits appropriately cleansed and scented? Was I emitting harmful amounts of gamma radiation? Reassuring myself on all counts (yes, yes, and no), I reflected on what had just transpired. Computer novice that I am, even I know that almost all word-processing programs for the ST include Epson printer drivers, and some even use Epson codes as their default settings. But the CompuBiz salestroll wasn't interested in whether most software would be compatible. Apparently, he wasn't even interested in selling me a printer. He didn't sell Ataris, and that was the end of that.

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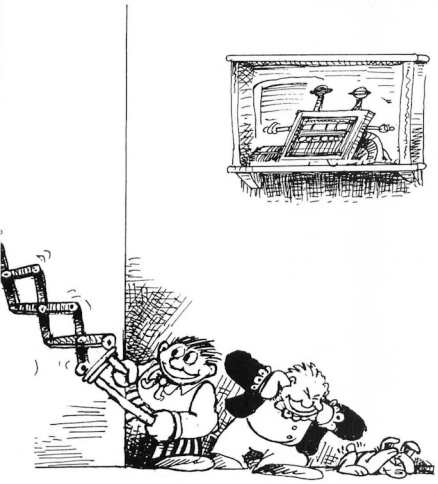
If you don't stock it, knock it.

I observed a variant on this theme when I bought my ST from a nearby Atari dealer, The Chip Shop. I'd already managed to procure my printer of choice—an Epson LQ 800—and when I mentioned this to the store's manager, she rejoined with, "Dear me, I hope you have better luck with your Epson than most of *our* customers have."

Imagine how thrilled I was to hear these words. What was



the problem with Epson? I asked, heart filled with dread. Oh, nothing much, really—it was just impossible to get parts, tractors, ribbons, and so on. But all was not lost! Since I had not yet opened the carton, I could still return it and buy a different printer—for example, one of the brands her store happened to sell. I told her I'd get back to her.

(Later I did a bit of research on Epson—which, yes, I should have done before, but better late, etc. A few telephone calls demonstrated to my satisfaction that Epson accoutrements were widely available, and the scare-story about their scarcity was, to put it charitably, wide of the mark. But if you don't stock it. . .)

No profit in computers? Try usury.

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But once we left the realm of encouraging abstractions for that of the coldly concrete, it turned out that the "assistance" came at a stiff price. For a three-month loan of $169, I would pay interest of only $27. That's a paltry 15.97 percent interest for three months (which, multiplied by four to get the annual interest rate, is. . .).

Need I explain why I haven't been back since?

Always stand behind what you sell – as far behind as possible.

The main reason I wanted a computer in the first place was for writing historical books and articles. I was especially keen on a word processing program that would put footnotes at the bottom of the page and still set the page breaks automatically; I also hoped to be able to go back and forth from double-spaced text that I had written to single-spaced and indented quotations, again with automatic pagination preserved. After sniffing around a bit, I came across Zippywriter II, a program that, the salesman assured me, would give me just the capabilities I needed.

You can imagine what came next. I learned what I like to think of as the Fundamental Theorem of software: There can be a big difference between the promotional claims made for a program and what the program can actually do. So, alas, it was for Zippywriter—wonderful in the describing, not so hot in its performance. Suffice to say that Zippywriter did *almost* all the things it was supposed to—almost, but not quite.

After fiddling with Zippywriter for a week, I finally gave up and decided to return it. Thus I encountered the First Corollary to the Fundamental Theorem: Just *try* to get a refund on software after you've removed the shrinkwrap. I now have a word-processing program that's a serviceable paperweight, but isn't good for much more. My pain is only somewhat diminished if I call this a learning experience.

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How Not To Run...

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My wife Bonnie and I watched a demonstration of Splotch, a popular ST drawing program, and we were both intrigued. Even though my monitor is monochrome, I thought Bonnie might strike up a friendship with the ST if she could play around with this fascinating software. My one reservation was that my Epson printer was a 24-pin model, while the printer drivers included with Splotch are for 9-pin printers. I decided the logical place to get advice was at Slipped Disk, the store where I bought the printer, which has a franchise to sell both Atari and Epson products.

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Later that week, we decided to try Stumpp's, a chain of stores oriented toward home computing–Macintosh, Amiga, Atari. . . and, it turned out, *caveat emptor.* Will Splotch print properly on an Epson LQ 800? Gee, I don't know. Any chance we could look at the owner's manual? Oh, yeah–good idea. And so it went. The manual, it turned out, was uninformative on the subject of printer drivers, so it was back to the salesman: Can we return this program if it doesn't work with our printer? Sorry, we can't, etc. Sorry yourself–and no sale!

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Don't ask me. . . period.

At the other extreme is TechTime, a store with the most knowledgeable staff I've ever seen. They like their computers. I mean, they *really* like their computers. I honestly don't understand how this place stays in business–I don't think I've ever seen the owner bestir himself to actually wait on a customer, and his sales staff, if that's the appropriate term, takes its cues from him. They obviously know about their wares; the problem is that they're more interested in using the equipment *themselves* than in selling it to any would-be customer. They sit with their faces glued to the screens of their respective monitors, letting customers fend for themselves as best they can. There have been times when I've come into the store, with no other customers present, and stood for ten minutes waiting for one of the salesmen to get off his, er, chair. No, I don't go to TechTime anymore; my willingness to bang my head against a brick wall is distinctly limited.

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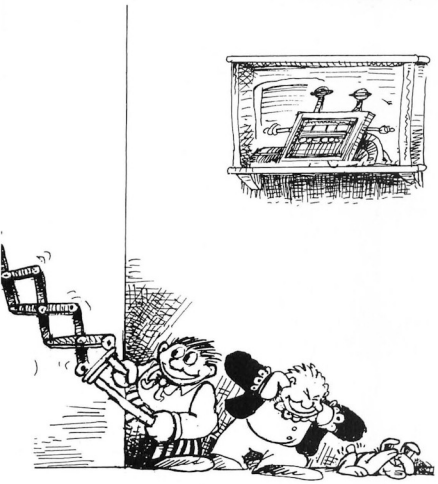

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virtually every industry in a capitalist economy. In its early days an industry consists of many small companies producing for the same market. Because of the uncoordinated nature of this production, sooner or later supply outstrips demand, and weaker companies disappear through bankruptcy, merger or takeover. Ultimately, if the cycle is not interrupted (by agreements to fix minimum prices, restrict output, etc.), the industry becomes mature—that is, it's dominated by a handful of very large oligopolistic corporations.

At "TechTime," they *really* like their computers—a lot better than they like selling them to customers.

The automobile industry provides a textbook illustration: dozens of auto makers before World War II, about 10 or 12 immediately after the war; the consolidation of individual companies into General Motors, American Motors, and so on. It's clear that this "maturation" cycle is currently running its course among computer manufacturers, and nothing this or that comparatively tiny retailer does will affect the outcome one whit.

Still, a retailer isn't completely tossed on the salad of fortune, as it were. Whatever happens to the industry as a whole, some computer stores survive and thrive. Yes, their prices are higher than mail-order companies that sell the same products—but prices, after all, are not everything. Many people prefer to pay a little more in exchange for the service that a local merchant can (and a mail-order company cannot) provide.

Unfortunately, compared with photography and stereo stores, some computer retailers offer service that is at best unsatisfactory and at worst non-existent. Last year, for example, I helped some friends upgrade their stereo system; I had no problem finding stores whose personnel I could trust to steer us in the right direction. I have done the same for other friends who were interested in getting started in photography.

But so long as computer stores don't have employees who can answer reasonable questions, and provide reasonable support, as a computer consumer I have to protect myself as best I can. My number-one rule now? Never pay cash. Checks can be stopped. Credit-card transactions can be cancelled if the product is returned—and most credit-card companies don't look kindly on retailers that abuse their customers. Perhaps if enough computer purchasers take advantage of these facts to avoid being stuck with hardware and software they can't use, computer store owners will wise up and begin insisting that their employees know what they're selling.

I enjoy going to stores and picking out the merchandise. But right now if I had to advise people in the market for a computer, I would counsel them to buy an ST and a couple of the outstanding software packages—and do most of their shopping by mail. I'd make that recommendation with some reluctance, but I don't enjoy paying higher prices for the privilege of having my intelligence insulted by salespeople who are insufficiently informed about the products they handle, and having my presence ignored by people who would rather play with their toys than assist the customers—with no assurance that I will receive either satisfaction or the return of my money.

As long as these practices persist at my local computer stores, I'm afraid I can't muster much sympathy for those mourning the decline of their business. As far as I can see, their fate is richly deserved, for they have helped bring it upon themselves. ■

Frank Kofsky teaches history, and is now living happily with his ST and several mail-order software packages.

MOVING?

Don't leave START Behind!

Please fill in this coupon and mail to START, The ST Quarterly, P.O. Box 2370, San Francisco, Ca 94126-2370.

New Address
Name

Address

City State Zip

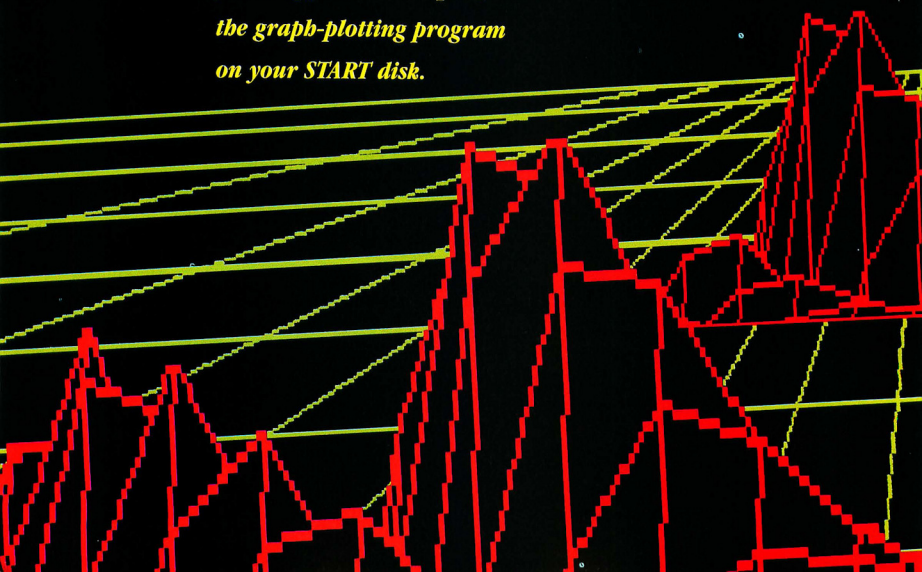
Place current address label here.

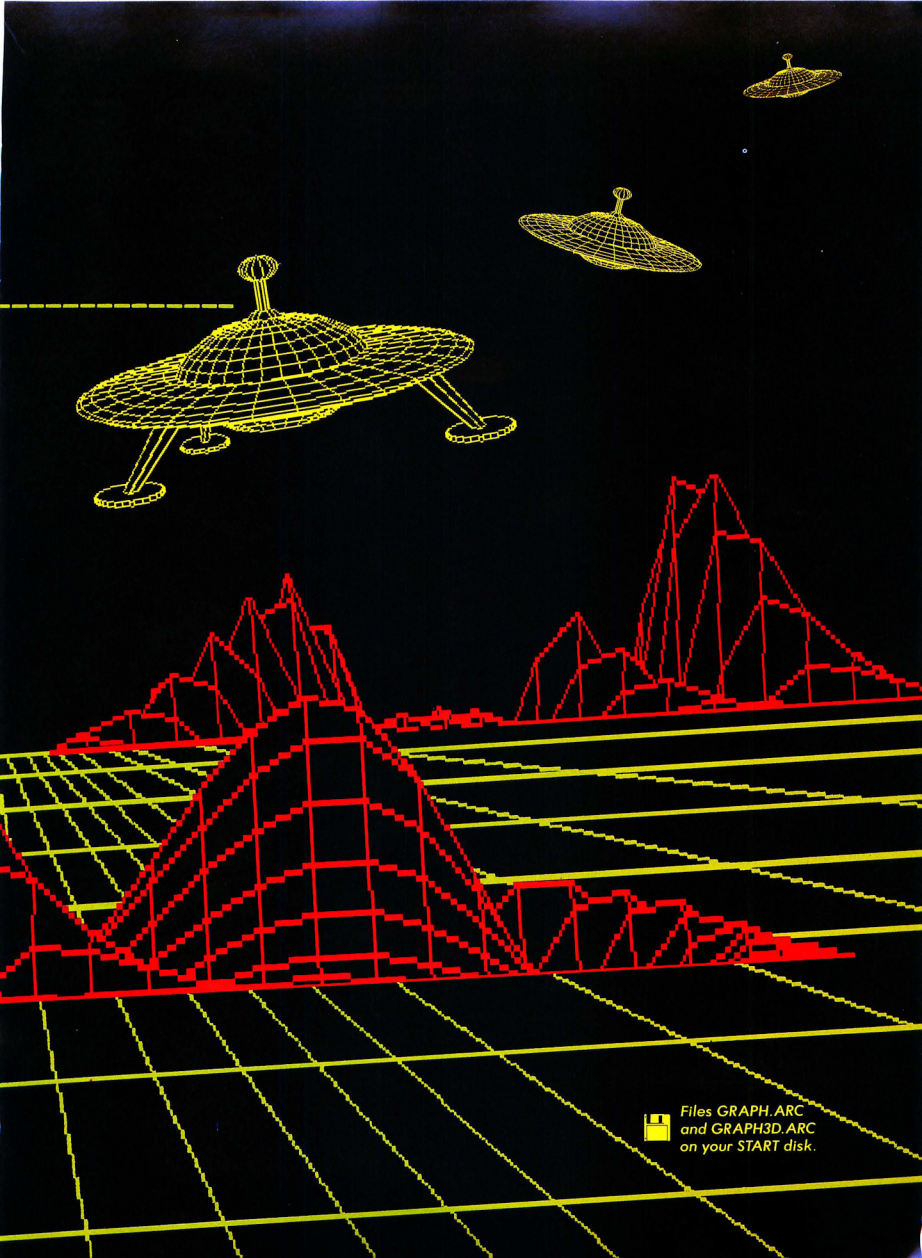
WHAT'S YOUR SINE?

Grapher plots mathematical functions

by Delmar Searls

Quick —
what does the graph of
SIN(X²) *COS(X + 2) look like?
If you've ever had trouble visualizing
what an equation looks like,
you'll appreciate Grapher,
the graph-plotting program
on your START disk.




Files GRAPH.ARC
and GRAPH3D.ARC
on your START disk.

WHAT'S YOUR SINE?...

The scene: It's 11:35 p.m., and you're sitting in your dorm room, poring over a trigonometry book, staring at equation after equation full of complex mathematical functions. You grasp most of it, but it's tough to visualize exactly how some of these equations would look as graphs.

Fortunately, there's a solution: You turn to your ST and type the equations into Grapher or 3-D Grapher, the Personal Pascal graphing programs on this issue's START disk.

Grapher will automatically graph each function on your monitor screen. You can choose either a rectangular or polar coordinate system, and with a rectangular coordinate system you can choose the horizontal and vertical scales independently. Grapher works in either monochrome or color, low- or medium-res, and it allows you to choose the color of the graph.

3-D Grapher only works with rectangular coordinates, not polar—but with 3-D Grapher you can plot graphs in three dimensions and rotate them any way you like. Like Grapher, 3-D Grapher lets you choose the resolution and colors.

Grapher and 3-D Grapher are great for anyone who needs to draw graphs, including teachers and (harried) students in algebra and trigonometry classes. Since you can enter the function you want graphed, it's easy to investigate what happens to the shape of a graph when you make small changes in the function.

RUNNING GRAPHER

Grapher and 3-D Grapher work in similar ways. To use either one, copy the file GRAPH.ARC or GRAPH3D.ARC to a fresh disk, along with ARCX.TTP. Run ARCX, then type the ARC's filename; your disk drives will spin, and soon you'll have a runnable version of the program you've chosen.

Let's start by exploring Grapher, the 2-D version. When you run GRAPHER.PRG, you'll first choose a text interface or a GEM-based interface. The text interface accepts input from the keyboard only; it uses default values to keep your typing to a minimum. The GEM interface makes use of dialog boxes for all input, and the only keyboard entry is the function you want graphed.

ENTERING THE FUNCTION

To graph a function, first type it in as you would write it in BASIC. *Table 1* contains a list of symbols and functions you can use. To see a sample graph, for SIN(X), simply press the Return key (or click on the OK button, if you are using the GEM interface).

Grapher draws graphs of single-variable functions; the only variable you should use in your function is X. When entering numbers you may use either integers or fractions. As in BASIC, every arithmetic operation must be explicit. In algebra the expression 2*X* means "2 times X"; to use the same function in Grapher you must type 2*X.

Table 2 shows how you can generate the graphs of many other common functions using the ones built into the program. It's just a matter of writing them in terms of the ones we have available.

The exponentiation operator is Normally this operator can only be used if the exponent's base is non-negative. (The way Personal Pascal performs exponentiation prohibits negative bases.) However, Grapher is a little bit more sophisticated; it allows a negative base *if* the exponent is an integer.

Suppose you want to graph the cube root of X. The equation is Y = X ^ (1/3). Since the exponent (1/3) is *not* an integer, the function can only be evaluated (and the graph drawn) for positive values of X. To graph it all we divide it into two parts both drawn on the same grid: Y = X ^ (1/3) and Y = -(-X ^ (1/3)).

Grapher will check your function carefully for syntax errors. If it finds one it points out the approximate location

In addition to integer or decimal numbers, the items in this table can be used in writing the function to be graphed by Grapher. A list of the priorities of the various operations is also included for your convenience.

Functions:
ABS(X) Absolute value of X
COS(X) Cosine of X
EXP(X) Exponential (e ^ X)
LN(X) Natural logarithm of X
SIN(X) Sine of X
SQR(X) Square root of X
TAN(X) Tangent of X

Unary operator:
– Negation

Binary operators:
+ Addition
– Subtraction
* Multiplication
/ Division
^ Exponentiation

Variable:
X The only variable allowed

Grouping symbols:
(Left parenthesis
) Right parenthesis

Priority from highest to lowest:
Expressions inside Parentheses
Functions
Exponentiation
Negation
Multiplication and Division
Addition and Subtraction

Within an expression, two or more operations having the same priority are processed from left to right.

Table 1

of the error; the actual error is usually connected with the value or symbol just before the error pointer. If an error does get by these checks and is caught when the function is evaluated, you'll get a "Postfix Error" message. Some functions may also cause floating-point overflows or division-by-zero errors in Personal Pascal. (This won't happen often—and then it's usually with really weird functions.)

DRAWING THE GRAPH

Grapher allows you to choose from three different grids: rectangular, polar or trigonometric. The rectangular grid is the normal Cartesian coordinate grid. A polar grid consists of a series of circles with lines radiating out from the center every 5 degrees. In a polar coordinate system, X represents an angle in radians and Y is a radius; a point is plotted by moving out the correct distance at the given angle. A trigonometric grid is a rectangular grid with the X-axis labeled in terms of $\pi/2$, π, $3\pi/2$, and 2π; it's useful for graphing trigonometric functions.

After choosing the grid type, you must choose the scale for labeling the graph. For example, if you choose a value of 2 for the X-Scale, the X-axis (to the right of the origin) will be labeled 2, 4, 6 and 8. Each label corresponds to a grid line. If you are using a rectangular grid, you can choose the horizontal and vertical scales independently. With a polar grid, the only scale is the radius scale which corresponds to the scale of the X-axis. With a trigonometric grid, the X-axis scale is fixed but you can choose the scale for the Y-axis.

Next you must pick a color for the graph. When you're graphing more than one equation, you'll probably want to use a different color for each function.

Finally, you must choose how the grid is to be drawn. One choice is to clear the screen, draw the grid, and then draw the graph. Another is to clear the screen but *not* draw any grid—the graph is simply drawn on the clear screen. (Some polar equations generate pretty patterns that are better seen without the grid—try Y=SIN(121*X).) The third option is to draw the new graph on top of the previously drawn graph. This is useful when you want to show the graphs of two or more functions on the same display.

After you've entered your function and chosen the graph options, the program will automatically graph your function.

For a rectangular or trigonometric grid, the graph is drawn from left to right. After it's finished plotting, the display will remain until you press the Return key or click the left mouse button. Then the display will be saved into a buffer, and you can choose new graph options.

A polar graph has no predetermined stopping point, since the angle keeps increasing indefinitely. You can stop graphing at any time by pressing the Return key (the left mouse key will *not* work here). The display will remain on the screen until you press [Return] a second time or click the left mouse button.

If you enter "Q" (or click on the QUIT button) for the graph option, you will return to the function input section. This allows you to change the function and draw a different graph. To quit the program, type the letter "Q" or click on the QUIT button in response to the function prompt, and you will return to the Desktop.

Some of the additional mathematical functions that can be written in terms of the built-in functions in Grapher.

Secant:	SEC(X) = 1/COS(X)
Cosecant:	CSC(X) = 1/SIN(X)
Cotangent:	COT(X) = 1/TAN(X)
Hyperbolic Sine:	SINH(X) = (EXP(X)—EXP(~X))/2
Hyperbolic Cosine:	COSH(X) = (EXP(X) + EXP(~X))/2
Hyperbolic Tangent:	TANH(X) = (EXP(X)-EXP(~X))/(EXP(X)+EXP(~X))
Hyperbolic Secant:	SECH(X) = 2/(EXP(X) + EXP(~X))
Hyperbolic Cosecant:	CSCH(X) = 2/(EXP(X)—EXP(~X))
Hyperbolic Cotangent:	COTH(X) = (EXP(X)+EXP(~X))/(EXP(X)-EXP(~X))

Common Logarithm (base 10): LOG(X) = LN(X)/LN(10)

Table 2

3-D GRAPHER

After writing Grapher, I became interested in the problem of doing the same thing for functions with two variables. These graphs are three-dimensional, with the value of the z-coordinate dependent on the x- and y-coordinates.

The result was 3-D Grapher. Like Grapher, it lets you choose your own colors and adjust the coordinate axes. With 3-D Grapher you can also choose the viewpoint, as well as draw the graph with hidden lines.

USING THE PROGRAM

When you run 3DGRAPH.PRG, you'll find seven options on the main menu: Color, Grid, Function, View, Draw, Help and Quit. Click on the Help button to see the instructions for using the program. There are seven help screens and you can move backward and forward through them as necessary.

Watch out for one thing: When adjusting the display colors, it is possible to set the background and text colors to▶

the same color. If this should happen you will not be able to see the mouse arrow on the color selection screen! Fortunately, there's an easy remedy—just press the Escape key to restore the default colors and leave the Color option.

You'll find that the most time-consuming aspect of 3-D Grapher is the calculation of the z-coordinates. With 16 grid lines per positive axis (the default) there are a total of 33 grid lines crossing each axis and 1089 points determined by the grid. The calculation for each of these points involves a number of floating point operations and function calls. In addition, the program has to evaluate the expression you entered at the keyboard, which takes more time.

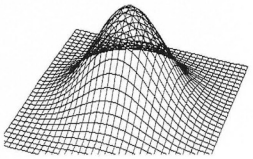


Figure 1. One way of drawing graphs of three-dimensional functions. The graph is thought of as a wire-mesh. You can see right through it.

The second most time-consuming aspect is the transformation of the point coordinates based on the view parameters. A new transformation is required every time you change the viewpoint, change the perspective option, or change the screen scale.

For both the coordinate and transformation calculations the execution time is roughly proportional to the square of the number of grid lines. Consequently, I suggest that you stick with the default values (16 for each positive axis) until you're satisfied with the appearance of the graph.

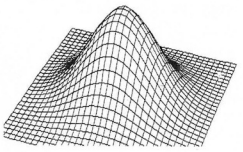


Figure 2. In many cases the graph is thought of as a solid surface. In that case, nearer portions of the graph may hide portions farther away.

If you increase the number of grid lines, you must also adjust the grid scale if you want the graph to have the same general appearance. Suppose the grid scale is 0.15 with the default number of grid lines. If you multiply the number of grid lines by 1.5 (up to 24 per positive axis) you must divide the grid scale by the same factor. That is, the grid scale would need to be changed to 0.10 (0.15/1.5 = 0.10). In both cases, then, the coordinate values would range from -2.4 to 2.4; by steps of 0.15 in the first case and by steps of 0.10 in the second.

In choosing colors, I've found that graphs on a black background (color intensities: 000) look really nice. I often use blue (007) for the top and red (700) for the bottom of the graph.

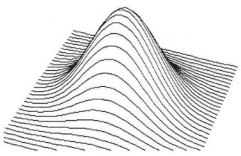


Figure 3. Sometimes the graphs are drawn with only one set of grid lines.

Figures 5 through 9 illustrate what the program can do. It takes a little bit of playing around to get a graph to look nice. In particular, a change in the grid scale can make a tremendous difference in how a 3-D graph looks. Such changes increase or decrease how much of the function will be displayed.

HOW THE PROGRAMS WORK

Grapher and 3-D Grapher face a common difficulty: evaluating the mathematical formula that you type in. The problem is that certain types of computations have a higher priority than others. For example, to evaluate the expression

```
3 + 2 * 4
```

the multiplication should be done first (2 * 4 = 8), followed by the addition (3 + 8 = 11). If we want to do the addition first, we put it inside parentheses:

```
( 3 + 2 ) * 4
```

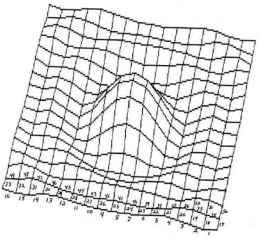


Figure 4. The hidden line algorithm used in the program is based on the fact that the graph is drawn from front to back. The exact order in which the line segments were drawn on this graph are indicated by the numbers next to each segment. Enough segments are numbered to indicate the drawing order.

Because of different priority levels, it is fairly difficult to write a routine that directly evaluates mathematical expressions in the form we usually write them. (This form is called *infix* notation because the arithmetic operators come in between the corresponding operands.) Most compilers (and my program) first convert the infix expression into a form more convenient for computation. This form is called *postfix* notation.

In postfix notation, an arithmetic operator follows its operands. For example, the infix notation to add 2 and 3 is "2 + 3". In postfix notation it would be written "2 3 +"; the plus sign means "add the last two numbers." The big advantage to postfix notation is that the computations are performed as they are encountered. You don't need to worry about priorities, so parentheses aren't necessary.

After you've typed in the equation

for your function, the infix expression you've typed is converted into a postfix expression by the procedure **Convert**. As the graph is drawn, the value of the postfix expression for different values of X is returned by the function **Evaluate**. Understanding how each of these procedures work depends on understanding a data structure called a *stack*.

A stack is a temporary buffer for holding data, and it works something like a stack of dishes: you only add a dish by putting it on top of the stack, and only remove it by taking a dish off the top. As a result, the last dish added to the stack is the first one removed. A data stack works the same way. Values are always added to the "top" of the stack, and the only value that can be removed is the topmost one. Because the last number you added to the stack is the first one you can remove, a stack is often described as a LIFO, or last-in-first-out, structure.

To see exactly how these programs use a stack to interpret and execute an infix expression, let's look at two of the procedures in Grapher (the 2-D version): **Convert** and **Evaluate**.

CONVERT

The **Convert** procedure changes an infix expression to postfix. It uses a data stack for temporary storage of the

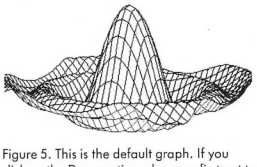


Figure 5. This is the default graph. If you click on the Draw option when you first get to the main menu, this is what you'll get.

operators. (In this case "operators" means mathematical functions as well as the ordinary arithmetic operators.) The data stack is initialized by pushing a null element onto it, which makes it easier to detect errors in the postfix expression.

The processing algorithm scans the expression from left to right. Whenever a numeral ('0'-'9') or a decimal point is encountered, the program continues scanning until it reaches a non-numeric character. The string is then converted into its numeric form, and appended to the postfix expression.

When an alphabetical character is encountered, the program assumes it is

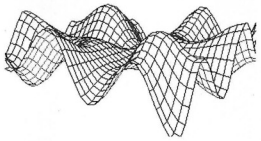


Figure 6. Z = (Y*SIN(X)+X*SIN(Y))*4; grid scale + 0.50; default number of grid lines.

either a function or the variable X. If it's an X, it's appended to the postfix expression. If not, the program continues to get alphabetical characters to check the spelling. The only other valid characters are arithmetic operators and left and right parentheses. Invalid characters will cause a syntax error message to be printed with an arrow pointing to the approximate location of the error.

When an operator is encountered, the program compares the operator's priority with whatever is on top of the stack. Operators on the stack with a priority greater than or equal to the current operator are pulled from the stack and appended to the postfix expression. The current operator is then pushed onto the stack. Notice that if the current operator's priority is greater than that of the topmost operator, it is placed on the stack immediately.

When a left parenthesis is encountered, it is pushed onto the stack. When a right parenthesis is encountered, operators are pulled from the stack (one at a time) and appended to the postfix expression until the corresponding left parenthesis is on top of the stack. Both parentheses are then discarded.

This algorithm is repeated up to the end of the infix expression. When the last character has been processed, the operators left on the stack are pulled from the stack one at a time and appended to the postfix expression. Finally, the null element is pulled from the stack, leaving it empty. Throughout this process, the routine must watch out for errors; for example, if the algorithm is processing a right parenthesis there had better be a matching left one.

Here is the routine restated in pseudocode. PUSH places an item on top of the stack, PULL removes the top element, and "TOS" means the operator on the top of the stack.

```
PUSH(NULL)
  WHILE THERE ARE MORE TOKENS
    SCAN FOR NEXT TOKEN
    CASE TOKEN OF
      OPERAND: APPEND TOKEN TO
      POSTFIX

      "("      : PUSH(TOKEN)

      ")"      : WHILE TOS <> "("
                 DO

                   APPEND TOS TO
                   POSTFIX
                   PULL(TOS)
                 ENDWHILE
                 PULL(TOS)

      OPERATOR: WHILE PRIORITY
                (TOKEN) <=
                PRIORITY(TOS) DO
                  APPEND TOS TO
                  POSTFIX
                  PULL(TOS)
                ENDWHILE
                PUSH(TOKEN)

  ENDCASE
ENDWHILE
WHILE TOS <> NULL DO
  APPEND TOS TO POSTFIX
  PULL(TOS)
ENDWHILE
PULL(TOS)
```

WHAT'S YOUR SINE?. . .

Let's work through an example: the infix expression 1 + SIN (3*4 + 2).

Infix Expression	Postfix Expression	Stack
1 + SIN(3*4 + 2)		NULL

First, the "1" is appended to the postfix expression.

+ SIN(3*4 + 2)	1	NULL

The next character is "+", which goes on the stack.

SIN(3*4 + 2)	1	NULL +

The next item is "SIN", which has higher priority than "+", so it's added to the stack.

(3*4 + 2)	1	NULL + SIN

The next item is "(" and it is pushed onto the stack.

3*4 + 2)	1	NULL + SIN (

"3" is appended to the postfix expression.

*4 + 2)	1 3	NULL + SIN (

The "*" goes onto the stack since "(" has low priority.

4 + 2)	1 3	NULL + SIN (*

The "4" is appended to the postfix expression.

+ 2)	1 3 4	NULL + SIN (*

The next item is "+". Since "*" has higher priority than "+" it is appended to the postfix expression and pulled from the stack. The "+" is then pushed on the stack.

+ 2)	1 3 4 *	NULL + SIN (
2)	1 3 4 *	NULL + SIN (+

"2" is appended to the postfix expression.

)	1 3 4 * 2	NULL + SIN (+

")" causes the top "+" to be appended to the postfix expression, then the parentheses are both discarded.

)	1 3 4 * 2 +	NULL + SIN (
	1 3 4 * 2 +	NULL + SIN

Since there are no more new characters, SIN and + are appended to the postfix expression.

	1 3 4 * 2 + SIN	NULL +
	1 3 4 * 2 + SIN +	NULL

Finally, NULL is pulled from the stack. The resulting postfix expression, 1 3 4 * 2 + SIN +, can then be evaluated with the procedure **Evaluate**.

EVALUATE

The **Evaluate** procedure takes a postfix expression and evaluates it from left to right, performing the necessary arithmetic operations as it goes. Unlike **Convert**, which uses a stack only for operators, **Evaluate** uses the stack only for values. As numbers are encountered

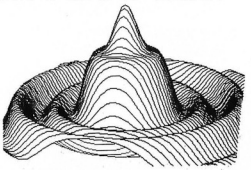


Figure 7. Z + 1.25*(COS(D)+COS(2*D)*2 +COS(6*D)/4); grid scale = 0.10; 32 grid lines per positive axis. The "Lines both ways" feature was turned off in the View option.

they are placed on the stack. When an operator is encountered, the top one or two (depending on the operator) numbers come off the stack for the operation, and the result is returned to the stack.

For example, the postfix expression we just generated with Convert, 1 3 4 * 2 + SIN +, is evaluated as follows.

	STACK
Push 1 onto the stack	1
Push 3 onto the stack	1 3
Push 4 onto the stack	1 3 4
Remove top two, multiply, and push result onto the stack	1 12
Push 2 onto the stack	1 12 2
Remove top two, add, and push result onto the stack	1 14
Remove top value, find Sine, and push result onto the stack	1 0.24
Remove top two, add, and push result onto the stack	1.24

The single value remaining on the stack is the final value of the postfix expression. If at any time there are not enough values on the stack to perform an operation, or if there's more than one value left at the end, then a postfix error occurs. This is caused by an error in the original infix expression.

When the postfix expression is evaluated the program checks for illegal arithmetic operations, such as division by zero. If this should occur, a Boolean "Undefined" is set to TRUE. The program then continues with the next value of X.

It's easy to see that evaluating the postfix expression is much more straightforward than working with an infix expression. If you're writing a program that needs to decipher arithmetic expressions, procedures like **Convert** and **Evaluate** are useful to have.

3-D COMPLICATIONS

3-D Grapher has special problems that arise because of the hidden-line and perspective features. Perspective is the easier problem; let's look at that first.

We're all familiar with perspective: If two lines are the same length but different distances away, the nearer one appears to be longer than the farther one. If this property is missing, a 3-D graph somehow just doesn't look quite right.

3-D Grapher includes a "Perspective"

Type a mathematical function into your ST and Grapher will draw a graph of the function on your monitor screen.

feature you can turn on (the default condition) or off from the View menu. The perspective transformation simply moves points that are logically behind the screen a little closer to the origin and points in front of the screen a little farther away. The distance is proportional to how far the point is behind or in front of the screen. ▶

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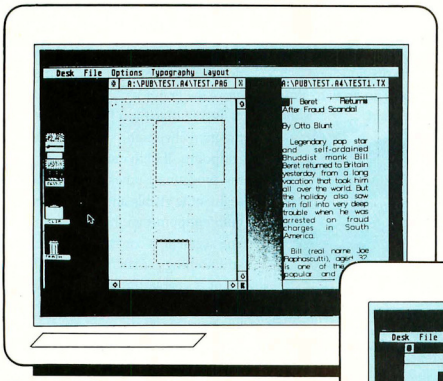

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WHAT'S YOUR SINE?...

On rare occasions (with vertical or nearly vertical line segments) this feature can fool the hidden-line logic because the orientation of the line is altered by the perspective transformation. Changing the view angle slightly or turning off the perspective feature will correct the problem.

But what about that hidden-line logic? How does it work?

The most common way of drawing 3-D graphs is to plot sections along lines of constant x and/or lines of constant y. The graphs can be thought of in two different ways. One approach is to think of the graph as a wire mesh where you can see through the "surface" defined by the function (see *Figure 1*). The second approach is to consider the graph as a solid object (*Figures 2* and *3*). In that case, parts of the graph closer to the viewer can hide other portions of the graph.

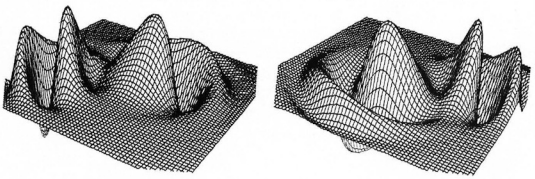

Figure 8 (A and B). Z =2*(2 ^ (-((X-.5) ^ 2+(Y-1) ^ 2))-2.5 ^ (-((X+2) ^ 2+(Y+1) ^ 2)))*COS(R); grid scale = 0.10; 32 grid lines per positive axis. This function basically superimposes two hills (the exponential functions) on a cosine curve symmetric about the origin. Two views are shown.

There are several ways of preventing these hidden lines from being shown. The method 3-D Grapher uses is fairly old but quite effective. The key is the order in which the lines are drawn: They must be drawn starting with the closest line and working backwards to the rearmost line.

HIDING FROM FRONT TO BACK

But it's a little more complicated. Each line is drawn as a series of line segments. In most cases, one of the two sets of lines—either the constant-x lines or the constant-y lines—will be more nearly parallel to the screen (see *Figure 4*). Let's suppose that the lines of constant y are more nearly parallel. In addition, one end of these more nearly parallel lines will usually be closer to the viewer than the other. Let's suppose the positive end of the line is closer.

The first (that is, closest) line of constant y is drawn from right to left (positive to negative). Next, the first segment of each line of constant x is drawn, again from right to left. Then the second line of constant y is drawn right to left, then the second segment of each line of constant x, and so on. Each succeeding segment in a given line is farther from the viewer than the previous one.

The program uses an array to store the highest and lowest points plotted in each column of pixels. A point whose y-coordinate is less than (or equal to) the minimum value for the corresponding x-coordinate would be visible since it lies below the graph (or the point has already been plotted). Similarly, a point whose y-coordinate is greater than or equal to the maximum value is visible since it lies above the graph. Other points (with y-coordinates between the maximum and minimum values) would be hidden by a solid surface and thus are not shown.

To make sure that the first point tested will automatically be visible, the array of maximum values is initialized at -32767, so the first y-coordinate will always be greater than the current maximum. For similar reasons, the array of minimum values is initialized at 32767. While the screen x-coordinates range from 0 to 639 at most, the arrays extend from -640 to 1280. In effect, the program is drawing the graph on a virtual screen that is three times wider than the physical screen and hundreds of times higher.

(On the ST's screen there's a complication to all this. While a graph's y-coordinates increase from the bottom of the screen to the top, the actual screen coordinates are the opposite: The topmost row has a y-coordinate of zero and the coordinates increase as you go down. Thus in the program, if a point has a y-coordinate less than or equal to the current minimum, that point is *above* the graph.)

Before drawing a line segment, the program checks the visibility of the two endpoints. If both endpoints are visible, the program assumes that the entire line segment is visible and it is drawn. If both endpoints are hidden, the entire line segment is considered to be hidden and nothing is drawn. If only one endpoint is visible, the program moves along the line segment plotting the visible portions. As the graph is drawn, the minimum and maximum arrays are updated. Since the graph is drawn from front to back, regardless of the viewing angle you choose the program can figure out how to draw the graph properly.

The hidden lines feature is active when you start the program; you can turn it off from the View menu. If you turn it off, the graph is drawn much faster, but of course it may be a little harder to visualize.

THE SLOW OPTION

It may have occurred to you that even if both endpoints of a line segment are visible, that doesn't necessarily mean the entire segment will be visible. That's a good point, although it's quite rare for only the middle portion of a line segment to be hidden. If it should occur with an equation you're trying to graph, try increasing the number of grid lines. That makes the line segments shorter ▶

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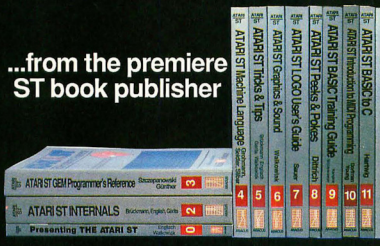

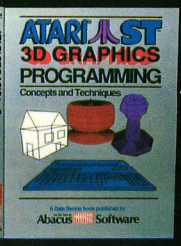

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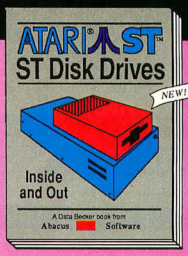

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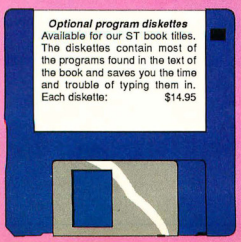

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and decreases the chances of this kind of error.

3-D Grapher also offers a second solution. Normally the program runs with the "Fast plot" option turned on (the default). If you turn this feature off from the View menu, the program will no longer make assumptions based on endpoints. Instead, it will plot only the visible points in each line segment on a point-by-point basis. This approximately doubles the drawing time, though it's still quite fast.

Grapher works in either monochrome or color, and allows you to choose the color of the graph.

THE PRACTICAL ST

With its graphics power, processing speed and low price, the ST is the perfect computer for students, or anyone who wants a practical tool for exploring higher math. Many people complain that there isn't more practical applications software for the ST. I hope Grapher and 3-D Grapher fill a need, and become a useful tool for students, mathematicians, and anyone who's simply curious about what an equation looks like. ■

Delmar Searls hopes to use the StereoTek glasses to produce 3-D Grapher in true stereo vision.

THE GAME OF KINGS

THREE ST CHESS PROGRAMS FIGHT IT OUT

By Christopher F. Chabris
Contributing Editor

At the first START magazine ST chess tournament, there weren't huge crowds. In fact, there weren't any spectators at all—just the participants, battling with knight and rook and pawn for days on end, in round after round of the Game of Kings. When it was finally over, and three human and five computerized players had ended their final matches, a new computer champion had emerged—one stronger than the best 1970s-era *mainframe* chess programs!

THE ST PLAYERS

There were three ST chess programs in the tournament: Chessmaster 2000 from The Software Toolworks and Electronic Arts, Psion Chess from Psion Limited and Atari Corp., and Techmate, from Szabo Software and MichTron. All three programs run on any ST–520 or 1040, monochrome or color. Each is completely graphics-oriented; the positions of the pieces on the two- or three-dimensional mouse-controlled board displays are readily discernable and don't strain your eyes. Each game will play either White or Black, allow you to take back moves, and recognize (and use) all the standard rules of chess.

CHESSMASTER 2000

I had high hopes for Chessmaster 2000 from The Software Toolworks (distributed by Electronic Arts). It arrived on the ST scene with a fanfare of glowing reviews for all the previous versions and David-and-Goliath stories of its victory at the 1986 U.S. Open Computer Championship. I was very impressed with every aspect of the program, including its

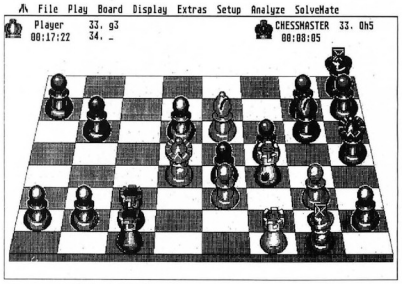

FIGURE 1: Chessmaster 2000

documentation and support of unusually high quality for the computer game industry.

Chessmaster 2000 offers the most, and best, features of any chess program on the market. You can adjust or turn on or off almost every feature, and alter the default settings as you desire. The play screen displays two chess clocks, and the GEM user interface conventions are followed well. Even though it's the most complex of the three programs and offers no online help, Chessmaster 2000 is easy and straightforward to use. The three-dimensional board display is realistic and pleasant, although the mouse control of piece movement is quite rough. Since you have to hold down the mouse button while you move your chosen piece to its destination square,▶

it's easy to slip and make the wrong move; the requirement that you place the base of the piece fully within the desired square only makes this problem worse.

Although Chessmaster 2000 provides twelve levels of play, represented by various average time consumptions and ranging from 60 moves in five minutes to one move in 100 hours, I would also like to see "sudden death" time controls and unlimited board layout customization. An alternate screen, accessible from a menu or the Escape key, displays the captured pieces, game score, and Chessmaster 2000's analysis and evaluation of the position. You can set up positions, save and load games (your own or 100 provided classics, including two by Chessmaster 2000 itself!), request hints, and have the program display all legal moves in a position (both useful for beginners).

Among Chessmaster 2000's more exotic features are its choices of "metal" or "wood" pieces, differing board colors (color monitor only), an "If the Boss Wanders By" menu selection that pops up a mock spreadsheet screen, and a coffeehouse playing style for novices that randomizes its move selection a little bit. You can even enter your name for display on screen instead of simply "Player." A very understandable digitized voice is available to announce the program and its moves—good if you don't pay full attention to your game, but a waste of time if you do. Fortunately, you can toggle the voice or the program's alternate music on or off.

The well-written documentation for Chessmaster 2000 includes a generic introduction to the game of chess and brief commentaries on the classic games as well as an ST-specific leaflet that explains the use of the program. Chessmaster 2000 suffers from only a couple of unimportant bugs—occasionally, a drop-down menu will remain down until you close it. The main disk of the two supplied in the package is copy-protected, but a backup is available for $5. Although I would have preferred no protection whatsoever, The Software Toolworks surprised me by offering a hard disk-installable version for $10.

PSION CHESS

Like Chessmaster 2000, a GEM-based program, Psion Chess projects a sophisticated European image with built-in support for six languages (English, French, German, Swedish, Italian and Spanish), online help files, and German-style pieces in the two-dimensional board display, the only one to occupy a movable window. Unfortunately, this port from the original Macintosh version underutilizes GEM (for example, many dialog boxes ask the generic "Are you sure? Yes/No" question rather than a task-specific "Begin a new game? OK/Cancel") and presents a simple but substandard user interface. I would have liked control key equivalents for menu choices and to be able to use desk accessories.

Judging from the impressive tournament results, though, Psion has chosen to emphasize playing strength at the expense of bells and whistles. The program offers more playing levels than Chessmaster, including a unique "Equal" mode that makes it spend just as much time as its opponent, and superfast two- and four-second speeds. The three-dimensional display is similar to Chessmaster's in appearance, but the better accuracy of the mouse control system is achieved at the expense of speed, since two long mouse clicks are necessary to pick up and deposit a piece.

In general, Psion's features are a well-chosen subset of

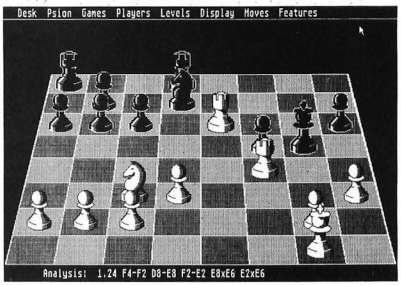

FIGURE 2: Psion Chess

Chessmaster's. All the essentials are available, but you won't find anything particularly innovative. The 24-page manual seems impressive until you notice that only four of those pages are in English.

Unfortunately, the real problem with Psion Chess is its unique "limboware" status: Psion Chess is a finished product, not vaporware or beta test rumor, but is simply unavailable as of this writing. Psion was released in late 1986 in final form and was available for a few months at several dealers, but by early 1987 it was off the market. Shortly thereafter, Atari announced plans to assume worldwide marketing of the ST version, but nothing has happened since. Atari's plans on distribution, as well as copy protection and other issues, are unknown. We can only hope that by the time you read this, Psion Chess is available again.

TECHMATE

Compared with Chessmaster and Psion, Techmate is in a different class in both features and playing strength. In this age of feature-laden, easy-to-use, GEM-based chess software, Techmate seems out of place with its spartan display, single mode of play, and stubborn refusal to resign even when faced with mate in one move. It has no three-dimensional display, although its two-dimensional pieces are the best of the three programs. It offers only sudden death time countdown, although you can set the number of seconds for each player to

complete the game. It has no facilities for saving games, keeping score, replaying games, or setting up arbitrary positions; for no apparent reasons, it does not "think" on its opponent's time and uses only a minuscule opening book.

But despite its numerous flaws, Techmate has entertained me by giving an exciting game of 100-second chess, an extreme form of blitz that would be difficult with Chessmaster or Psion given their awkward mouse controls. With Techmate, you just click as fast as you like on the piece and the square you want to move it to, and *bang!* the move is made. It can be disheartening at first to see Techmate respond just as fast (Chessmaster spends two or three seconds just sliding its pieces across the board, even in book openings). The support provided by Szabo Software for Techmate serves as a model for the entire software industry, and includes *free* newsletters and updates (I have received two of each) as well as a 50 percent discount on the next major revision, which is promised to have plenty of the bells and whistles missing here.

THE COMPETITION

There were five other players in the tournament: three human and two high-tech. All five–humans and machines–have ratings from the United States Chess Federation (USCF).

The USCF rates each player on a scale from 0 to 3000. A perfect player would be 3000, but a 3000-rated player could never really exist. The (human) world champion and his top rivals are rated around 2700, whereas the highest rated chess computer, HiTech, is rated around 2400. 2200 is Master level, 2000 is Expert level, 1800 is Class A, 1600 is Class B, and 1400 is Class C. The average serious novice is usually rated between 1100 and 1300 after his or her first tournament. Each tournament performance changes your rating according to the strength of the opposition and your score against it, although you always gain some points from a victory and lose some from a loss. (All three human players below are experienced tournament players.)

- Christopher Chabris is a computer science student at Harvard and is rated among the top 50 chess players in the U.S. under 21 years of age. He has a USCF rating of 2206–a Master.
- David Keck is a full-time programmer who works on IBM minicomputers. He has a USCF rating of 2127.
- Paul Keck is a freelance photographer. He has a USCF rating of 1455.
- Sargon III is often called the dean of microcomputer chess programs. We used the Apple Macintosh Plus version for the tournament (an ST version should be available soon). Sargon III's IBM PC version has a USCF rating of 1850.
- The Novag Superconstellation is a $200 dedicated chess computer with its own pieces and auto-sensory board; its brain is a 6502 processor, the chip that serves as CPU for the Atari 8-bit computers and the Apple II. It has a USCF rating of 2018.

ROUND 1

The tournament ran two rounds and 42 games, conducted over a period of nine days. You'll find the 12 most interesting games from Round 1 and all the games from Round 2 of the tournament on Antic Online, the Atari online magazine on CompuServe. Just log on to CompuServe and type GO ANTIC, then check the "What's New" menu to find the CHESS file. You can download and study the games, which I refer to below. Also, consult *Figures 1 through 3* in this article for piece positions, which I refer to in the game descriptions.

In the first round, five "test players" – three human beings and two computer programs–played two games each, one with white and one with black, against the three ST programs. In the second round, the three ST programs squared off in head-to-head competition, with each playing the two others four games each; by the end of the tournament, each program had played 18 games against rated opponents.

Figure 4 shows the crosstable for Round 1. On the left are the three ST programs being evaluated; on top, their five opponents. The notation is straightforward–for example, "W0 / B1" in the upper-left corner box indicates that when Chessmaster 2000 had the white pieces against Chris Chabris, the program lost, but with black it won. A score of 1/2 indicates a drawn game for both players.

In order to complete the 30 games reasonably quickly (after all, who likes to watch computers play chess against each other?), I established a time limit of 40 moves in 10 minutes.

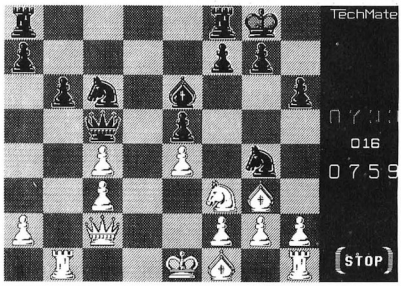

FIGURE 3: TechMate

While not truly "blitz" chess speed, this average rate of 15 seconds per move is too fast for official rated tournaments but slow enough, I believe, to demonstrate the approximate playing skills of the participants.

Unfortunately, not every computer participant had a 15-second playing level available. We chose the 10-second level ▶

for the Novag Superconstellation because its dedicated hardware was likely to compensate for its 8-bit processor. Techmate has no discrete levels, allowing only "sudden death" time controls of a certain number of seconds to complete the entire game. We allotted it 900 seconds, or 15 minutes, for each first-round game (holding its opponents to the standard 40 moves in 10 minutes limit). Given the tournament's average game length of 48 moves, Techmate averaged over 18 seconds per move. Szabo Software says Techmate uses an average of 2 percent of its remaining time per move, so its time usage was in the same range as that of its opponents. Additionally, since Techmate does not "think" while awaiting input moves, we followed the manufacturer's recommendation and whenever possible set its computer opponents to the corresponding "handicap" mode.

Chessmaster 2000 had mixed results in Round 1. Although it managed to score full points against the two highest-rated players, including a fine victory over me in which it nicely exploited my incautious play (see Game 1), it could do no better against Sargon III and was lucky to escape with a single draw against the Superconstellation. Its 55 percent score earned it a performance rating slightly but not significantly lower than its advertising claims.

Techmate was simply outplayed by all its opponents but tester Paul Keck, who was troubled by time pressure in all his games. Its small opening book allowed its opponents to consistently get an advantage going into the middlegame, where its play was marked by serious blunders, including both lost pieces and positional gaffes. Techmate's performance rating was largely a function of the quality of its opposition.

Psion Chess posted the best score by handling its computer opponents better than Chessmaster 2000; interestingly, it scored an astonishing 90 percent with the Black pieces but only 40 percent with the White, compared to a more normal 36 percent-64 percent ratio for Chessmaster. Its two wins over Sargon II were impressive demonstrations of technique; in one instance, it pounced on a positional error and patiently held the edge for twenty moves before converting it into a material advantage and simplifying into an endgame. But against me, despite playing creatively to obtain clear advantages in both games, it could only draw an endgame two pawns up in one and lose a winning position in the other (see Game 2).

ROUND 2

In round 2 the programs met in head-to-head competition. The time procedures used in Round 1 were applied here as well. *Figure 5* shows the results of the three four-game minimatches between the programs, their final ratings, and their total scores for the tournament.

After being disappointed with Techmate's performance in Round 1, we tried various increased time settings ranging from 1200 to 2000 seconds to complete the game in Round 2. But despite consuming as much as 35 seconds (on average) over some move sequences, Techmate registered little improvement. Against Psion Chess, three of four losses were attributable to wild lunges with the pawns guarding the king, which also often failed to castle into safety. In one game it missed three winning attempts in the endgame. However, it played Chessmaster 2000 evenly for most of one game and actually defeated it in another with some well-executed defensive ideas (see Game 3).

The crucial match was the final battle between Chessmaster 2000 and Psion Chess, which had each already proven superior to Techmate. But although Chessmaster 2000's loss to Techmate suggested that it would lose to Psion Chess, we hardly expected an 87.5 percent blowout. Psion built up impressive positional pressure as Black in the first game, but after Chessmaster's clever counterattack forced a trade of all the pieces but the rooks, we abandoned the game as a draw.

continued on page 52

Figure 4: Crosstable of Results for Round 1 of Experimental Tournament

	Chris Chabris (2206)	David Keck (2127)	Novag Superconstellation (2018)	Sargon III (1850)	Paul Keck (1455)	TOTAL POINTS	PERFORMANCE RATING
Chessmaster 2000	W0 / B1	W1 / B0	W½ / B0	W1 / B0	W1 / B1	5½	1971
Psion-Chess	W0 / B½	W0 / B1	W0 / B1	W1 / B1	W1 / B1	6½	2051
Techmate, 900 seconds/game	W0 / B0	W0 / B0	W0 / B0	W0 / B0	W1 / B1	2	1691

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DISK INSTRUCTIONS

Every issue of START, The ST Quarterly, contains articles written by some of the finest developers and writers in the Atari computer community. Many of these articles are programming tutorials, detailing how the wizards of the Atari world practice their arcane art. But anyone can benefit from the disk—we provide everything from tax templates for your spreadsheet to full-featured word processors, easy-to-use drawing programs and spectacular graphics demos.

START was designed as a magazine *with* disk, containing the finest ST programs available. If you purchased the $4 non-disk version of START you can still obtain the disk by sending us the bound-in order card or mailing $10.95 plus $2 for postage and handling to: START DISK #5, 544 Second Street, San Francisco, CA 94107. (Be sure to specify the disk you want.) Note: If you want *same day* service, call (415) 957-0886 and ask for the Disk Desk. Give us your MasterCard or Visa number, and we'll send your START disk out that very day!

All programs on the START disk are for your own *private* use, and are not public domain. Please *don't* copy your disk for your friends, accept a copy from someone, or upload these programs on a bulletin board system. That makes it more difficult for us to afford to bring you quality ST programs and incisive technical material. Software piracy hurts everyone.

GETTING STARTED

Use scissors to open your disk envelope along the outside vertical edge, then put the disk in drive A and double-click on the disk icon to see its contents. Refer to your ST owner's manual if you're uncertain about using the Desktop.

Important: Before you do anything else, *back up your START disk*—it's not copy-protected. Format a fresh disk as single-sided, and copy your entire START disk to it. Finished? Now place your original START disk in a safe place and begin using the new copy.

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ON THE DISK

ARCX.TTP The un-ARCing utility. Double-click on this to uncompress a file.

BRIKYARD.ARC START Technical Editor Patrick Bass creates a GFA BASIC version of what might be the most famous video game ever. To play, you'll need the program (BRIKYARD.PRG) and menu file (BRIKYARD.PI1); source code is also included.

CALC.ARC The START Scientific Calculator by Alex Leavens is a TI-35 programmable calculator desk accessory for your ST. Here's the program (STRTCALC.ACC) and resource file (STRTCALC.RSC).

GRAPH.ARC and GRAPH3D.ARC These two programs can graph almost any math function you can type. The programs are GRAPHER.PRG (2-D version) and 3DGRAPH.PRG (3-D version), and Delmar Searls's source code in Personal Pascal is included, too.

MWC2.ARC Here are Arick Anderson's benchmarks for the newest version of the Mark Williams C compiler.

PIXELPRO.ARC Matt Loveless lets you perform some professional effects with your ST pictures. Turn your favorite image into a slick video oil painting with this program (PIXELPRO.PRG) and resource file (PIXELPRO.RSC).

STWRITER.ARC Here's the latest, greatest version of ST Writer, the free word processor for the ST. Version 1.75 clears up some bugs and adds powerful new functions, including deadkey and merging non-ST Writer files. Here's the program (STWRITER.PRG), along with the manual (STWMAN) and all the files you need to use this fast, powerful word processor.

TRANSPUT.ARC Tom Hudson tested his ST with Kuma's 7.5 million instructions per second K-MAX transputer against an ordinary ST to see how much faster the K-MAX is, and these are the benchmarks he used. ■

START Programs on CompuServe

There's not enough room on the START disk for the source code from all the programs in this issue. You'll find the source code for Pixel-Pro and the START Scientific Calculator in Antic Online, CompuServe's Atari online magazine. Just log on to CompuServe, type GO ANTIC and check the "What's New" menu for PIXELPRO and CALC source code files. You'll also find Antic Online's regular features—the latest Atari news and show reports, online graphics, user group listings, user surveys and electronic feedback to START and Antic magazine, Tim Oren's online column on using GEM, and the Cyber Connection for owners of Tom Hudson's CAD-3D and Cyber Studio programs!

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SYSTEM REQUIREMENT: Atari ST minimum 512K. 0.5 meg drive & color or monochrome monitor.

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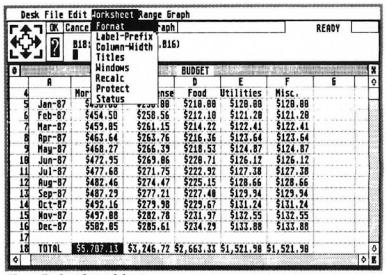
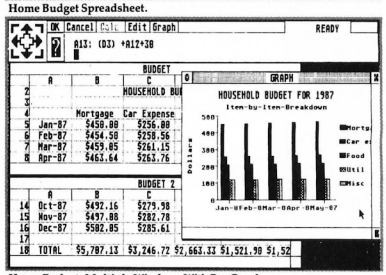
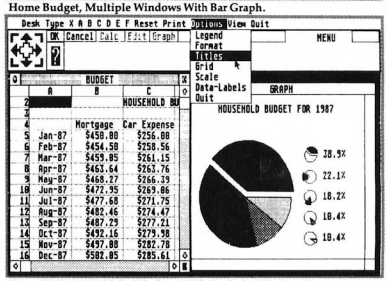


Home Budget Spreadsheet.



Home Budget, Multiple Windows With Bar Graph.



Home Budget, Multiple Windows With Exploded Pie Graph.

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Game of Kings...

In the second game, Psion's unorthodox opening confused Chessmaster, which dropped a pawn and squandered opportunities for counterplay in a long endgame. But Chessmaster seemed ready to turn things around in the next game (see Game 4), when it "outbooked" Psion's French Defense in the opening and built up a powerful attacking position. After a sudden blunder lost it the exchange, it fought back in distinctly non-computer style with a kingside attack and transposed to an unclear endgame with chances for both sides. However, Psion prevailed as Chessmaster lost two key pawns and was pushed back on the defensive, resigning after a titanic 77-move struggle. Now the clear winner, Psion demonstrated its clear superiority in the final, anticlimactic game with a pretty 5-move mating combination against Chessmaster's wayward king (see Game 5).

ANALYSIS AND RESULTS

The 42 games of the tournament illuminated several interesting aspects of the programs' play. Psion Chess demonstrated the most innovative opening repetoire, gaining early advantages in several games by taking its opponent "out of book," a tactic normally used *against* computers, not by them. Its creative, human-like style, comparable to that of the Superconstellation, generated fewer awkward "computer moves" than its competitors. But perhaps most significantly, Psion managed its time and analysis well enough to simply look deeper than its opponents.

Chessmaster's strength was in orthodox play—except when trapped by Psion's opening tricks, it reached a good position in the middlegame; it also countered to some extent the common tendency of chess programs to aim for reduced tension by keeping the queens on the board. However, it overlooked mate-in-2 in one game, and a tendency for illogical maneuvers continually got it in trouble. With its tiny opening book, often extending no more than four obvious moves, Techmate rarely survived the opening without losing pieces. But when it did, as in its three victories, its play was reasonably solid, leading us to speculate that its basic algorithms are little worse than those of Psion and Chessmaster, but that its supporting facilities are inadequate.

FINAL RESULTS

The final ratings for the programs, which include all 18 tournament games for each, show 200-point gaps between them. Techmate comes in at Class-B level, Chessmaster 2000 at Class-A, and Psion Chess as an Expert player. It was a surprise to see Chessmaster and Psion finish in the order opposite the one we had initially predicted.

I can't stress enough that these results are meant *only* as guidelines. The tournament adhered carefully to time procedures and other relevant chess rules, but it provided too small a sample of games to guarantee statistical accuracy. USCF rules specify that 25 games are necessary to establish a rating, and that those games may be played at speeds no faster than one move per minute. Neither condition was satisfied in our tourney, so you should view these results as experimental rather than definitive.

Which game is the best for you? If you are an expert-level or stronger player, Psion Chess is the best choice for an ST chess program, followed by Chessmaster 2000; Techmate is out unless you want a challenge at blitz time controls of two or three minutes for the entire game. If you are a serious tournament player but are still at a level below high Class-A, I recommend Chessmaster 2000 for its features and all-around high quality. Techmate would provide a blitz challenge, but is inadequate as a complete study tool. Beginners should also choose Chessmaster 2000, but should keep in mind that the ratings mentioned in the tournament section of this article can be altered easily by allotting more or less time or using a handicap mode—don't get scared away!

On a personal note, I'd like to thank David and Paul Keck for providing their time, expertise, and computers for this tournament, without which it would not have succeeded.

Figure 5: Crosstable of Results for Round 2 of Experimental Tournament

	Chessmaster 2000		Psion Chess		Technmate, 1200-2000 seconds/game		TOTAL POINTS	COMBINED TOTAL	FINAL PERFORMANCE RATING
Chessmaster 2000			W½	B0	W1	B1	3½	9	1904
			W0	B0	W1	B0			
Psion Chess	B½	W1			W1	B1	7½	14	2109
	B1	W1			W1	B1			
Techmate, 1200-2000 seconds/game	B0	W0	B0	W0			1	3	1700
	B0	W1	B0	W0					

Though they were the only participants in the first START ST chess tournament, Chessmaster 2000, Psion Chess and Techmate are by no means the last word in chess for the Atari ST. Later this year we can look forward to a new and improved Techmate II, along with the ST version of Sargon III from Spinnaker/Hayden. They'll be participating in the next START chess tournament—coming soon to a magazine near you! ■

Chris Chabris, chess player extraordinaire, has just finished his first book—Artificial Intelligence and Turbo Pascal, *published by Dow Jones-Irwin/Multiscience Press.*

Psion Chess. Atari Corp., 1196 Borregas Avenue, P. O. Box 3427, Sunnyvale, CA 94088. (408) 745-2000; or Psion Limited, 2 Huntsworth Mews, Gloucester Place, London NWI 6DD, United Kingdom. Current program status and price are unknown.

CIRCLE 206 ON READER SERVICE CARD

Chessmaster 2000, Electronic Arts, 1820 Gateway Drive, San Mateo, CA, 94404 (415) 572-2787. $44.95; or from The Software Toolworks, One Toolworks Plaza, 13557 Ventura Boulevard, Sherman Oaks, CA, 91423. (818) 907-6789.

CIRCLE 208 ON READER SERVICE CARD

Techmate. Michtron Inc., 576 S. Telegraph, Pontiac, MI, 48053, (313) 334-5700. $49.95; or from Szabo Software, P.O. Box 623, Borrego Springs, CA, 92004

CIRCLE 209 ON READER SERVICE CARD

United States Chess Federation, 186 Route 9W, New Windsor, NY, 12550. (914) 562-8350.

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the successor to Pascal

- FULL interface to GEM DOS, AES and VDI
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Pascal and Modula-2 source code are nearly identical. Modula-2 should be thought of as an enhanced superset of Pascal. Professor Niklaus Wirth (the creator of Pascal) designed Modula-2 to replace Pascal.

Added features of Modula-2 not found in Pascal

- CASE has an ELSE and may contain subranges
- Programs may be broken up into Modules for separate compilation
- Machine level interface
  - Bit-wise operators
  - Direct port and Memory access
  - Absolute addressing
  - Interrupt structure
- Dynamic strings that may be any size
- Multi-tasking is supported
- Procedure variables
- Module version control
- Programmer definable scope of objects
- Open array parameters (VAR r: ARRAY OF REALS;)
- Elegant type transfer functions

Ramdisk Benchmarks (secs)	Compile	Link	Execute	Optomized Size
Sieve of Eratosthenes:	6.2	4.3	3.5	2600 bytes
Float	6.4	4.8	8.3	4844 bytes
Calc	5.5	4.2	3.3	2878 bytes
Null program	5.1	3.2	—	2370 bytes

```
MODULE  Sieve;
CONST   Size = 8190;
TYPE    FlagRange = [0..Size];
        FlagSet = SET OF FlagRange;
VAR     Flags: FlagSet;
        i:     FlagRange;
        Prime, k, Count, Iter: CARDINAL;
BEGIN   (*$S-,$R-,$A+ *)
  FOR Iter:= 1 TO 10 DO
    Count:= 0;
    Flags:= FlagSet(); (* empty set *)
    FOR i:= 0 TO Size DO
      IF (i IN Flags) THEN
        Prime:= (i * 2) + 3; k:= i + Prime:
        WHILE k <= Size DO
          INCL (Flags, k);
          k:= k + Prime;
        END;
        Count:= Count + 1;
      END;
    END;
  END;
END Sieve.
```

```
MODULE Float;
FROM MathLib0 IMPORT sin, ln, exp,
                     sqrt, arctan;
VAR x,y: REAL; i: CARDINAL;
BEGIN (*$T-,$A-,$S-*)
  x:= 1.0;
  FOR i:= 1 TO 1000 DO
    y:= sin (x); y:= ln (x); y:= exp (x);
    y:= sqrt (x); y:= arctan (x);
    x:= x + 0.01;
  END;
END float.
```

```
MODULE calc;
VAR a,b,c: REAL; n, i: CARDINAL;
BEGIN (*$T-,$A-,$S-*)
  n:= 5000;
  a:= 2.71828; b:= 3.14159; c:= 1.0;
  FOR i:= 1 TO n DO
    c:= c*a; c:= c*b; c:= c/a; c:= c/b;
  END;
END calc.
```

Product History

The TDI Modula-2 compiler has been running on the Pinnacle supermicro (Aug. '84), Amiga (Jan. '86) and will soon appear on the Macintosh and UNIX in the 4th Qtr. '86.

Regular Version $79.95 Developer's Version $149.95 Commercial Version $299.95

The regular version contains all the features listed above. The developer's version supplies an extra diskette containing a symbol file decoder – link and load file disassemblers – a source file cross referencer – symbolic debugger – high level Windows library Module – Ramdisk and Print Spooler source files – Resource Compiler. The commercial version contains all of the Atari module source files.

Other Modula-2 Products

Kermit	– Contains full source plus $15 connect time to Compuserve.	$29.95
Examples	– Many Modula-2 example programs to show advanced programming techniques	$24.95
GRID	– Sophisticated multi-key file access method with over 30 procedures to access variable length records.	$49.95

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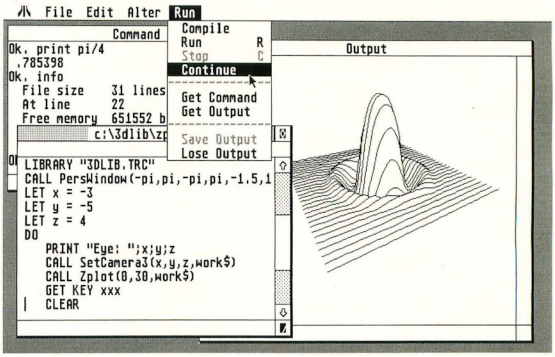

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CIRCLE 047 ON READER SERVICE CARD

LANGUAGE

- multi-line, user-defined functions
- local, global variables
- SELECT CASE, DO/LOOP
- recursion, modules
- GKS graphics, 2D transforms
- access to GEM, AES features

COMPILER

- compiles to fast, compact b-code
- parameter type-checking
- optional LET statement
- optional declared variable names
- Runtime package creates stand-alone file

LIMITS

- strings, program lines to 1 megabyte each
- floating-point 5e-309 to 1.8e+308
- 14-digit floating-point accuracy
- unlimited program size, data space
- variable names up to 31 characters

EDITOR

- full-screen, mouse-based editor
- global search, replace
- block copy, move, delete
- menu, function key, command line interfaces
- keyboard macros, script files

DEBUGGING

- set breakpoints and continue
- immediate mode execution
- visual trace, single-step execution
- cross-reference utility

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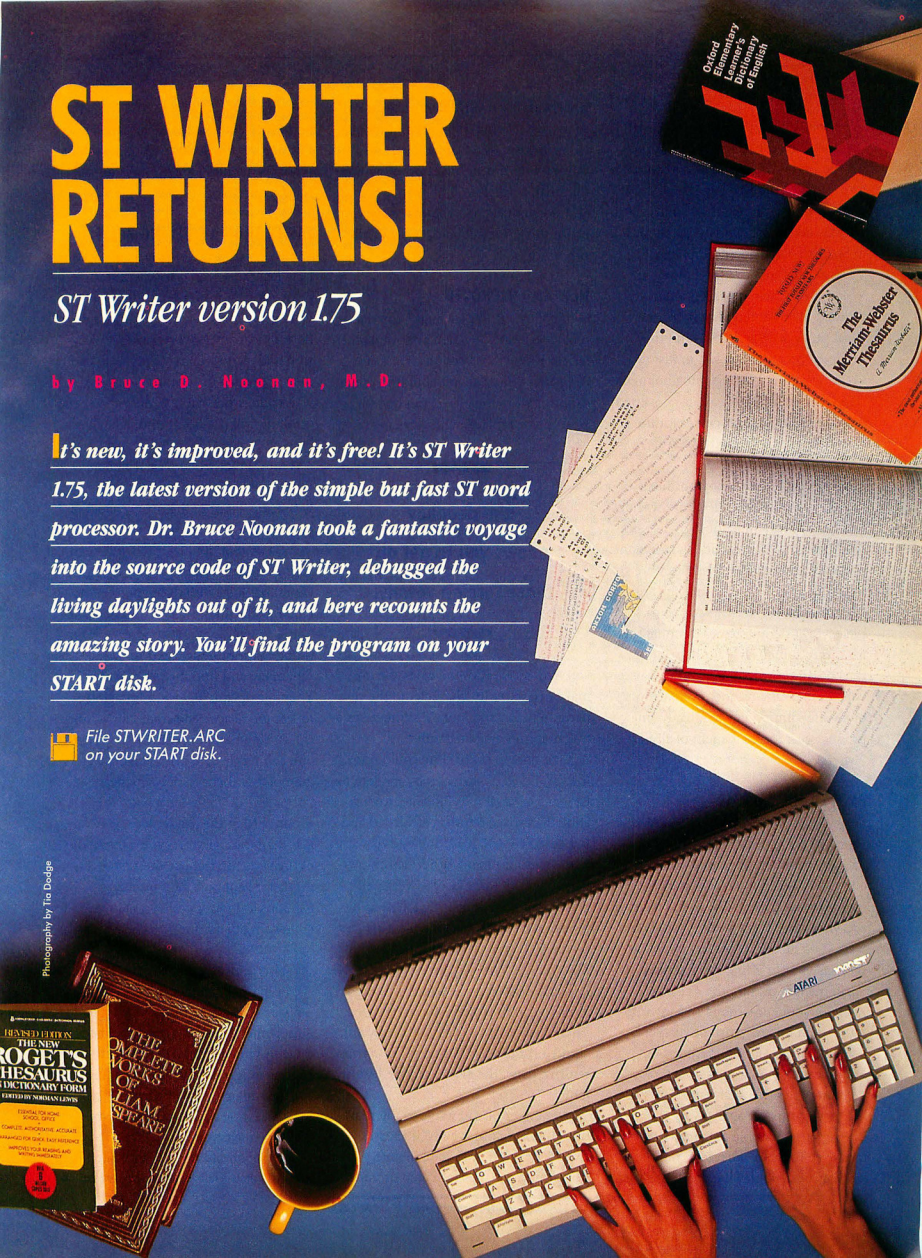
ST WRITER RETURNS!

ST Writer version 1.75

by Bruce D. Noonan, M.D.

It's new, it's improved, and it's free! It's ST Writer 1.75, the latest version of the simple but fast ST word processor. Dr. Bruce Noonan took a fantastic voyage into the source code of ST Writer, debugged the living daylights out of it, and here recounts the amazing story. You'll find the program on your START disk.

File STWRITER.ARC on your START disk.



Photography by Tia Dodge

ST WRITER...

In the Winter 1986 issue of START, I described the genesis of ST Writer, the fast, powerful non-GEM word processor for the ST. Now it's back, better than ever, with bugs fixed and new features added. There're even versions in Spanish, German and French.

Permit me to recap for a moment. When the ST first appeared, Atari decided they wanted to bundle a new word processor for the ST—and they needed a program quickly. In just *two weeks*, assembly language programmers Dan Oliver and John Feagans converted AtariWriter, a word processor for the Atari 800, to the ST—and ST Writer was born.

However, as with many products rushed to the market, ST Writer was not bug-free. In September of 1985 I spoke with Leonard Tramiel and Sig Hartmann and asked them when the bugs were going to be fixed. The discouraging answer was that ST Writer was "complete." I got permission to examine the ST Writer source code for bugs, and thus began one of the most time-consuming but educational challenges of my life—improving an already-fine product, just for the benefit of all ST owners.

BACK TO THE PRESENT

Since "ST Writer Secrets" and ST Writer version 1.50 appeared in START, I've had an overwhelming number of letters and electronic mail on CompuServe regarding the program. It seems many of you (like myself) prefer the "vanilla but fast" ST Writer to whatever else is out there as your first-line word processor. So, in the last six months, I've taken many of your suggestions and incorporated them into the current version, 1.75, which you'll find *free* on your START disk!

In my quest for aftermarket support, I've tried to answer as many of your questions as possible personally by mail, electronic or otherwise, but the task has been somewhat overwhelming, what with my involvement in Seattle's Atari Trek '87 and other commitments. Nevertheless, 1.75 is now here, and I think it's darn near bullet-proof by now! I hope this article will help answer any additional questions you may have about this great public-domain word processor.

NEW AND IMPROVED

Some of the ST Writer bugs I corrected included fixing up some annoyances left from previous versions. For example, in version 1.50 you couldn't enter a [Control M] in the command line for searches or replacement. As many of you may recall, [Control M] is the normal carriage return character to the rest of the ASCII world, but ST Writer uses a null to terminate paragraphs.

The deadkey allows you to get all those foreign vowels.

One person asked if he could transmit SAVEd ST Writer files by modem to UPI, since ASCII files PRINTed to disk contain carriage returns (ASCII 13) and line feeds (ASCII 10) at the end of every line. I told him that SAVEd files always have the "DO RUN RUN STWRITER .PRG" identification string followed by the tab data at the top of a file. Fortunately, the computer that received his file would ignore all data except that following a special code, which he entered at the beginning of the file to be saved. Then, just before saving the file, he substituted [Control M] for all those carriage returns, using the global replace feature [Shift F7].

A number of you wrote to say that the START disk files LONGREF and QUICKREF were mangled. Before you can print these files to screen or paper, they must be LOADed into ST Writer, and PRINTed from the master menu. Printing via the desktop option will not work, as the files contain nulls for carriage returns, and are *not* ASCII files.

FASTER THAN A SPEEDING BULLET

Some people wrote to complain about how fast the screen scrolled past in print preview. I agreed, and fixed it. Print preview still scrolls rapidly, but now almost any key except [Esc] will stop and start scrolling (I prefer to use the space bar). In addition, if a page wait code is present (a [Control W]), the scrolling will not occur until a key is pressed.

I found that when page numbers were double-wide, they did not appear with extra space in the print preview. I rewrote that portion of the code. I *tried* to fix it so that double- and triple-digit page numbers in headers and footers would be flush with the right margin when justification was on, but I couldn't find a way to do it. To work around the problem, print out pages 1 to 9 separately and find the page break. Then, just before the text for page 10, repeat the header line, including a [Control R] command to set the right margin one column less. (This will *not* affect the body of the text, only the header.) For pages 100 to 999, decrease the [Control R] in the header line by two less than the right margin for the body of the text. You can use the same technique for centering page numbers. (Thanks to John Woodley of Montgomery, Alabama, for the work-around.)

I also improved header and footer formatting. For example, if a header was wider than the selected margins, some of it would overflow (unpredictably) into a footer. I changed the routine to ignore any text extending past the right margin in a header or footer, but to observe any control functions that may have been placed there, such as a command to turn off an underline. This results in less calculation and al- ▶

ST WRITER Q & A

When a filename is already selected and I want to save to another file, do I have to back space to erase the path/filename?
No. Press [Control X] to delete it.

My Brother 60 typewriter is connected to my ST through its buffer interface. I have to print two first lines in order to get the first line to print, as the print head moved to the extreme right, center, then extreme right again, printing on the roller.
Try deleting the Epson printer reset command from the CONFIG.TXT file, replacing the 27, 64 with 255, 255, or check to see what a printer reset code should be for your printer.

I can only print 76 columns when using 12 print pitch with [Control R] set at 96.
Remember to set [Control G] to 8 when using elite (12 pitch) print. This will allow up to 96 columns on a normal width carriage.

How about a printer driver in Epson configuration to enable the use of the Atari ST character set as printed in the manual?
You can change the translation table in the CONFIG.TXT file to insert the ASCII code for the equivalent character in your printer's character set to match that in the Atari set. If the equivalent character does not exist in your printer's set, maybe you can download a font to your printer. However, this would require a separate program to design and download the font.

I am having trouble getting [Control O] to output a particular character at a specific point in my text.
[Control O] sends a string of printer commands to the printer immediately as it is read by the formatter in ST Writer. Unlike Atariwriter for the 8-bits, however, the bytes are sent *before* the text is formatted on its "page" in computer memory. Trying to preserve the byte on the formatted page in memory messes up the character count per line and word wrap. Sorry.

When I use [Control G] before a word, the first letter is omitted.
Correct! Suppose you want to bold the number 2. If you type [Control G][1] followed by 2, the program would interpret this as a 12, or italics elite! The proper way is to leave a space or some other character (such as a hyphen).

If I want to use carriage returns within a paragraph, the prior [Control P] always inserts a gratuitous line feed.
To avoid the line feed, simply change the paragraph spacing [Control D] from 4 to 2 prior to the paragraph in question.

Super and subscripts don't work properly.
Atari printers differ from Epson printers in that they use [ESC H] to terminate super- and subscripts, instead of [ESC T]. For dot matrix printers, no "half roll" is performed as might be required by a daisy wheel printer. Adjust the printer driver file accordingly! Also, remember, if ST Writer is in a folder, the printer driver file XYZZX.DAT *must* be in the same folder directory! The exception to this is AUTO folders, in which case place the XYZZX.DAT file *outside* the AUTO folder.

I can't see the second column on print preview when using a condensed font.
Try splitting the columns by using only the dimensions of the first column, and setting the [Control M] (second column, left margin) to zero temporarily. The second column will show up as page 2 on print to screen, but at least you will be able to see it intact.

Sometimes while typing, I find that the space bar deletes characters rather than inserting a space.
Perhaps you have inadvertently hit the [Insert] key, which toggles the typeover/insert modes on and off.

I think I have a defective copy of ST Writer. Sometimes when I load it I see a capital "C" in the lower right corner in the message window. Sometimes there is an "T".
No, your copy is not defective. *C* tells you the CapsLock key is active, *I* means you're in insert mode, and *T* means you're in typeover mode. [Alternate X] produces an *A*, showing you are using the alternate character set. Deadkey mode puts a *D* there. Since the [Alternate X] mode causes only alternate characters to come from the keyboard, *A* will appear on the menu screen to inform you that the keys you press to get menu items will not work unless you toggle out of [Alternate X] mode. ■

lows more flexibility when creating headers that extend the width of a page even though the page width is later altered.

BETTER DEAD, THEN READ

A further annoyance was that the letter flags (A,C,I or T) at the end of the middle line of the command box did not show up on every screen. This is troublesome if, for example, you're using special characters ([Alternate X] mode) and you are trying to type a menu command. Now, in [Alternate X] mode, an ***A*** is always present in the command box to alert you of this fact.

An additional flag has been added, too: ***D*** signals the ***deadkey*** mode. The deadkey allows you to get all those foreign vowels, such as umlauted ones, underlined **a** and **o**, and Scandinavian slashed **o**s—in fact, just about any character in the ST character set that resembles a combination of a vowel and some other mark (^ ,_, ' , " ,/,~ , ' ,–) can be produced. Toggle the deadkey function on and off with [Control Clr/Home]. For a **u** with an umlaut, for example, first type". Nothing will appear on the screen. Next, type **u**. An umlauted **u** (ü) appears. This is simpler than looking up the character in a table and going through the [Alternate X] toggle. While deadkey is turned on, to get regular quotation marks requires hitting " " twice in succession.

Tom Hudson, author of DEGAS Elite and CAD-3D, uses ST Writer as his first-choice word processor. Thanks to his suggestion, you can now select or de-select letter quality printing (provided, of course, that your printer supports it) without having to type in the [Control O] codes or pre-setting the printer configuration desk accessory.

I also could not leave the disk formatting feature alone. The new TOS ROMs in the Mega STs (coming with the blitter chip) support *skewing* of sector placement in disk tracks to enhance reading speed. This version of ST Writer will support that formatting system with the new ROMs. (Editor's note: *For an in-depth technical look at this procedure, see Dave Small and Dan Moore's article "Hard Disk Warfare" in the Spring 1987 issue of START.*)

In earlier versions, underlining more than one word while out-denting extended the underline all the way to the left margin; I've rectified that little problem. I've also corrected a bug in form insertion that caused an extra page to be printed while retrieving data from a database, such as in mail merge. Remember, a database containing six names and addresses must be printed to disk (ASCII format), and requires that copies be set to *1*, unless all six addressees are to receive more than one copy of the letter each.

ST Writer Version 1.75 is here, and it's darn near bullet-proof!

Finally, I've fixed one of the most annoying ST Writer bugs: You can now merge a non-ST Writer file into a file already in memory without scrambling things into an unreadable mess.

ST WRITER 2.0

Many of you are asking "What about the GEM version of ST Writer?" Well, I got tired of waiting for Atari, so I'm now in the process of doing it myself. No, it's not yet complete, and no, it won't be Thunder! compatible, but it will let you use dialog boxes for selecting printer options, file selection, and global formatting. Further, all menu functions can be selected with the mouse, and warning messages arrive in alert boxes.

It won't be Thunder! compatible because it must go through **event_multi**, a GEM function that handles input from the keyboard, mouse, timer, and message pipe. The function is also the reason such programs as 1ST Word are so slow. I had many pleas from ST users to produce a GEM version, while maintaining ST Writer's noted attribute—speed. I can't maintain this if using **event_multi**.

For those who *don't* want GEM, the program looks and runs as usual. But if you want to use the GEM features, clicking the left mouse button allows you to work in GEM. This is the only program I know of that allows this kind of toggle. Also, the GEM version will work in all three resolutions, making ST Writer the only word processor for the ST that can make that claim.

The final two features still waiting to be implemented are cursor positioning with the mouse and deselection of the GEM portion if the program is booted from an AUTO folder. John Feagans of Atari has promised to do this as soon as he can, but remember, he does this in his spare time—so if you want to prod him, prod gently, okay?

When and where can you get ST Writer 2.0? As of this writing (mid-June) John Feagans has said "several months," so it *might* be available on CompuServe and other online services by the time you read this. If not, be patient, and keep your eyes peeled. A future issue of START will probably include Version 2.0 of ST Writer on its disk. ■

Bruce Noonan, M.D., is the godfather of Atari's public domain word processor, ST Writer, and is currently debugging ST Writer version 2.0.

FLASH!

Just as we were going to press, Bruce Noonan called the START offices and told us ST Writer version 2.0 is finished. It's still being debugged right now, but we'll bring you the completed version on the Winter 1987 START disk. Future START disks will also feature the Spanish, German and French versions of ST Writer. ■

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CIRCLE 040 ON READER SERVICE CARD

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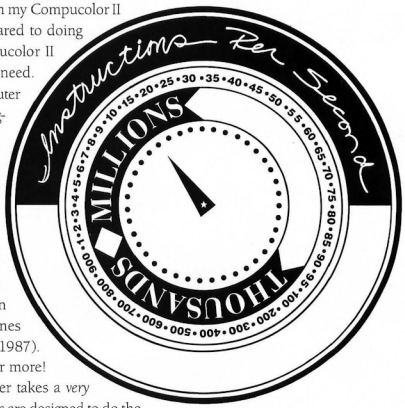
The Kuma K-MAX RISC Processor Development System

by TOM HUDSON
CONTRIBUTING EDITOR

Computer graphics take a lot of computing power. I found that out early on. It started with my Compucolor II and its 8080 microprocessor. Compared to doing math by hand or on a calculator, the Compucolor II seemed as if it were all the power I would ever need. However, when I tried to create complex computer graphics, it just didn't cut it—the machine bogged down to a crawl.



Along came the Atari 400 and 800, with their 6502 processors and special graphics chips. They ran much faster than my Compucolor, and had better graphics to boot. But I still wanted more: more power, more speed, better graphics. The ST, with high-resolution color graphics and a high-performance 68000 microprocessor, was fine for a while. But even the ST wasn't enough for doing complex scenes like my ray-tracing demo (START, Spring 1987). Creating a single image could take an hour or more!

Simulating complex scenes on a computer takes a *very* high-speed machine. Whole computer systems are designed to do the number-crunching—like the Pixar computer developed by Lucasfilm (for the Genesis Planet sequence in *Star Trek II*) and the Cray X-MP (it did the animation in *The Last Starfighter*). But a super-high-speed processor costs a lot of money, and most of us don't have tens of thousands of dollars sitting around for a Pixar.

Jim Warner

File TRANSPUT.ARC on your START disk.

ENTER THE TRANSPUTER

Fortunately, there's another way. Kuma Computer's K-MAX is an add-on box for the ST that lets your computer run at spectacular speeds—up to 15 million instructions per second (MIPS). It's *not* a consumer product but a serious development tool, requiring a solid knowledge of computers to use. For the experimenter, though, K-MAX is a fantastic experience—it gives a taste of what computers are really capable of.

Physically, the K-MAX unit is a simple, off-white box with about a foot of ribbon cable that plugs into the ST's cartridge port. There is no power supply necessary; the K-MAX takes all power from the ST, and it connects in just seconds.

Once you've connected the K-MAX, you simply run the XPA program from the disk provided, and you're off. XPA contains a built-in screen editor, line editor, cross-assembler and symbolic debugger; according to Kuma, you can compile up to 50,000 lines of code per minute with XPA, and it supports multiple transputers as well.

But, like any assembler, XPA does you no good if you don't already know the processor's instruction set. To program the K-MAX, you've got to know something about *how* this powerhouse works its magic. It all depends on a specialized microprocessor called the Inmos T414 transputer—a 7.5 MIPS processor that outruns the ST's 68000 because it's designed for speed, using two advanced features: RISC design and parallel processing.

RISC-Y BUSINESS AND PARALLEL LINES

RISC stands for *Reduced Instruction Set Computer.* A general-purpose processor like the 68000 has a fairly complex, powerful instruction set—for example, it can multiply or divide two numbers with a single instruction. But that power has a price: each instruction takes time, sometimes a (relatively) long time, 150 clock cycles or more. By contrast, a RISC processor's instructions are much simpler and less powerful—but each one is performed in a single clock cycle.

Case in point: The 68000 can divide two numbers with one instruction in about 160 clock cycles. A RISC processor doesn't have a divide instruction—it has to perform a whole subroutine to divide the two numbers—but as long as the subroutine is less than 160 instructions long, the RISC machine will outperform the 68000. And for some simple operations, such as moving data around in memory, the RISC processor *does* have individual instructions—making it *much* faster than the 68000. (You can read up on the current thinking on RISC in the April 1987 issue of *Byte* magazine.)

Parallel processing is the technique of dividing computing tasks between processors running at the same time. It's used by some of the expensive high-speed computers available today. With several processors number-crunching at the same time, the work can get done several times faster than by one processor alone.

Say we want to create a low-resolution ray-traced scene for the ST. Normally, the scene would take an hour to create. But suppose we use two 68000 processors—one to create the top half of the image and the other to create the bottom half. That would cut the time in half, to 30 minutes. Now imagine we have *200* 68000s, one for each scan line of the image; the scene will now take only 18 seconds to create! Then there's the ultimate setup: 64,000 processors, one for every pixel on the screen. The picture would take less than 1/16th of a second to finish. Now *that's* computing power!

By using several processors, we can perform several times faster than if the operations were performed by one processor alone.

The Inmos transputer is designed for both RISC operation and parallel processing. K-MAX comes with one or two transputers, and you can add even more. But with just a single transputer, K-MAX is still blisteringly fast.

K-MAX PERFORMANCE

Just how fast is it? I set out to compare the K-MAX's speed to that of the ST's 68000. I programmed both in assembly language to get the best performance possible, with maximum use of registers in the ST so that its highest speeds could be reached. The K-MAX code was written to utilize its odd, stack-like, three-register architecture and the fast on-chip RAM.

The K-MAX unit I used for these tests is a single-transputer unit; the performance of a two-transputer unit will probably be a little less than twice as fast with proper programming. In order to get maximum performance out of a multiple-transputer configuration, the program task must be divided up carefully between the transputers by the programmer or compiler—a tricky operation.

You'll find the benchmark programs on your START disk under the name TRANSPUT.ARC. BENCH.XPA is the trans- ▶

15 Million Instructions...

puter version of the benchmark; it requires a K-MAX unit and the XPA assembler, of course, but I've included it so you can compare the K-MAX code and the 68000 code. BENCH.C and BENCHASM.S are the ST versions of the benchmark; the C source handling general user-interface details and the assembly source performing the actual benchmark routines. The K-MAX has its own timer conveniently built-in, and I used the ST's system timer for the ST version.

In the first benchmark test, both processors perform ten million additions in a simple loop. As *Table 1* shows, the K-MAX easily outran the ST, clocking in at just over four times as fast. (All times shown are in seconds.) The transputer can

TABLE 1

Benchmark #1 (10,000,000 additions in fast RAM)

68000	K-MAX (1)	SPEED (X)
46.12	11.34	4.067

use two different kinds of RAM—2K of fast on-chip RAM or 256K of regular RAM. Just to see what effect the fast RAM has on program execution, I moved the entire program and data area out of the fast RAM area and into the main RAM workspace. The times for this run are shown in *Table 2*. As you can see, the use of the slower main RAM in the K-MAX resulted in a time that is still faster than the 68000, but only slightly. Clearly, using the on-chip fast RAM gives the K-MAX a big advantage.

TABLE 2

Benchmark #1a (10,000,000 additions in normal RAM)

68000	K-MAX (1)	SPEED (X)
46.12	38.56	1.196

The second benchmark test examines the effect of more complex operations on the processing speed of the K-MAX. Here, each processor executes ten million multiply operations ($ABCD * $1234). As shown in *Table 3*, the K-MAX wins again, but by a narrower margin. Remember, the K-MAX was

TABLE 3

Benchmark #2 (10,000,000 multiplies in fast RAM)

68000	K-MAX (1)	SPEED (X)
122.99	40.02	3.073

performing a subroutine to manage what the 68000 could do in a single instruction—but it was still three times as fast as a 68000. Even using slow RAM *(Table 4)*, the K-MAX was still almost twice as fast as a top-speed 68000 operation.

As these benchmark demonstrations show, a single transputer can run rings around even a 68000 microprocessor, thanks to its streamlined design. And while these times are impressive, remember that the transputers may be teamed up to provide exceptional performance far beyond that of the 68000. A single transputer runs three or four times as fast as a 68000; a two-transputer configuration could potentially run up to eight times faster, and even more transputers could make the system run faster still!

TABLE 4

Benchmark #2a (10,000,000 multiplies in normal RAM)

68000	K-MAX (1)	SPEED (X)
122.99	65.98	1.864

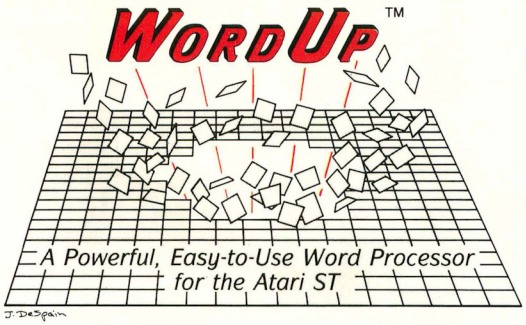
TECHNICAL DETAILS

The standard K-MAX, which I tested, comes with a single Inmos T414 transputer RISC processor. Each transputer has 2K bytes of on-chip, high-speed RAM, an external block of 256K RAM and a few support chips. There's also a set of empty sockets for a second processor chip/RAM set in the K-MAX box; to upgrade to a two-transputer system, you simply return the unit to Kuma for them to add the appropriate chips. You can add even more transputers to the system if you like.

In a two-transputer setup, the transputers are connected via the standard transputer link, a 10 million bit-per-second serial link (an optional 20 megabit per second link is also available). This allows the transputers to communicate with each other, an essential part of parallel processing. For example, transputer 1 can work on the first part of a process, feeding output to transputer 2 through the link. After the data is relayed to transputer 2, transputer 2 can perform the second part of the process, while transputer 1 performs the first part of the process on the next piece of data.

Theoretically, links can be set up among hundreds or thousands of transputer chips in many configurations, creating a complex network of serial and parallel processing. In practice, it doesn't take hundreds of transputers to outperform almost anything else around. If you're seriously interested in parallel processing, Inmos makes a computer called the ITEM-400, with 40 10-MIPS transputers linked together for 400 million instructions per second capability!

The K-MAX comes with a manual describing system setup, the transputer and its instruction set, and instructions for the XPA cross-assembler. XPA allows the ST to be used as a front-end for the K-MAX; code is entered via the ST's keyboard, and saved and loaded using the ST's disk drives. When the code is assembled, it is loaded into the K-MAX automatically. You can then have the K-MAX run the program, with messages printed to the ST's screen. The K-MAX XPA disk contains routines which allow the K-MAX to access the ST key-▶



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CIRCLE 036 ON READER SERVICE CARD

15 Million Instructions...

board, screen, printer and serial port. The manual also gives details of the transputer memory map, cartridge port connections used and how to access the K-MAX from 68000 assembly language.

Through my testing of the K-MAX unit, I suffered no system crashes at all, even with some serious syntax errors—the system seems very solid and dependable. But remember that the K-MAX is *not* a consumer product. Don't buy it thinking you'll be able to program it unless you have the time and expertise to master the transputer's instruction set.

WHAT'S AHEAD?

According to Tim Moore of Kuma, several new languages are on their way for the K-MAX. These include a special parallel-processing language compiler known as Occam-1, a C compiler, and a Modula 2 compiler, due late this year. These will certainly open up the possibilities of the K-MAX beyond the experimenter who is accustomed to working in assembly language.

The K-MAX is not a product you'll see in every home, but its potential is virtually unlimited. It's a well-done, solid product, but to use it you'll have to do some additional research (see the References sidebar). But if you're a serious user, it can take you as far in the pursuit of speed and power as you desire. ■

Tom Hudson is the author of the DEGAS and CAD-3D series of ST programs and is a sysop on CompuServe's Atari SIG.

Kuma Computers Ltd., 12 Horseshoe Park, Pangbourne, Berkshire RG87JW, England. Distributed in the U.S. by: Megabyte Computers & Electronics, 109 West Bay Area, Webster, TX 77598, (713) 338-2231, $1995 (Single transputer cost—price may vary due to the exchange rate between the U.S. dollar and the British pound.)

CIRCLE 191 ON READER SERVICE CARD

REFERENCES

For more information on the Inmos transputer, and other RISC processors, check out the information in these books and articles:

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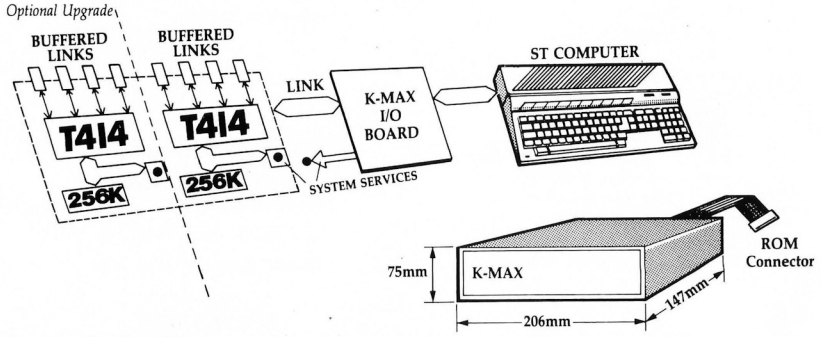
- *Transputer Reference Manual.* Publication number 72 TRN 006 01. Inmos Corporation (see address above).
- *T2/T4 Instruction Set Manual.* Publication number 72 TRN 106 00. Inmos Corporation (see address above).

Kuma K-Max Transputer development system



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THREE HARD DISK DRIVES

Massive storage without massive prices

by Howard Root

A hard disk drive is a bit like an electric can opener. Basically, either it works or it doesn't. Some can openers are slightly faster than others, but unless you run a restaurant and open hundreds of cans a day, the speed difference doesn't matter very much. You can mount can openers in different ways—on a counter, on a wall or under a cabinet. Some can openers are more convenient to use than others. And some can openers are built better and will last longer than others.

Likewise, some hard disk drives are faster than others (though unless you are doing an extraordinary number of disk accesses, the differences are negligible). They come in different shapes, sizes and levels of convenience. And the quality can vary, too—unfortunately, this is not something that may be readily apparent when you buy a hard disk.

Here I review three hard disk drives for the Atari ST: the Astra System HD+, the SupraDrive, and the Atari HD204. In many ways they are different, and your personal preferences may lead you to choose one over the others. But they all have the same essential characteristic: They store and retrieve large amounts of data quickly and reliably.

THE ASTRA SYSTEM HD+

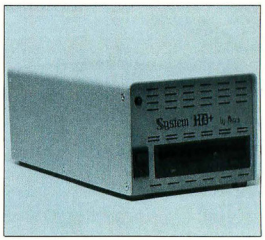
The Astra System HD+ is a combination unit consisting of a hard disk drive with 20.8 megabyte (Mb) capacity and a double-sided 3-1/2-inch floppy disk drive. It measures a compact 5-1/2 inches wide by 4-1/4 inches high by 12 inches deep and has some convenient extras, such as a lighted power switch on the front of the unit, built-in power supply, and 36-inch hard drive cable.

Setting up the HD+ is quite simple with a 1040ST, but somewhat more complicated with a 520ST due to the boot disk software being supplied on a double-sided disk. Thus, while doing the initial setup, you must disconnect the SF354 floppy disk drive and use the one built into the HD+. After completing this procedure, you can reconnect the SF354 into the chain as Drive A and copy the boot program onto a single-sided disk if you wish. Alternatively, you can designate the double-sided drive in the HD+ as drive A and make your SF354 drive B.

When the HD+ comes out of the box, it is already formatted and partitioned into two 10.4 Mb logical drives (C and D). The autoboot program shows icons for floppy disk drives A and B, and hard disk drives C and D, along with directory menus for drives A, C, and D. If you are happy with that arrangement, you need do absolutely nothing except start using the system.

On the other hand, you may wish to partition your disk differently. Your constraints basically are: two to four logical drives, each with a capacity of 2 to 15 Mbs, for a grand total of 20.8 Mbs. It is important to think out your partitioning scheme when you first install your hard disk, since repartitioning involves reformatting which means destruction of all your files. Sure, you can back them up on a set of floppy disks, but your life will be a great deal easier if you think things out in advance.

An interesting section of the Astra manual is devoted to file maintenance. It contains an excellent discussion of



Astra System HD+

file tree structures, noting that "the directory structure of a properly developed hard disk resembles a tree. That is, it has a root from which grow branches, limbs, and twigs." An illustration of such a structure is included, along with further discussion on how to best organize your own hard disk files. I agree strongly with Astra that "it may take a few minutes (or more) to set up such a system, but it will pay handsome dividends in the time you'll save tracking down files, and keeping things neat and available."

USING THE HD+

After this initial setup, you are ready to use the system. To do so, you turn on the HD+ and wait about ten seconds for it to come up to speed. You then turn on the computer with the Astra boot disk in floppy drive A (you *can* boot directly from the hard drive, although Astra doesn't recommend it). Actually, with the hard drive connected, about the only thing the boot disk does is say to the computer, "Nope, nothing here. Look over on hard drive C for your instructions." Three menus will appear on the screen for drives A, C and D, from which you can select any program you want.

Just what does a data transfer rate of 7500K bits per second (bps) and an average seek time of 8.5 milliseconds mean to you? Well, a double-sided floppy disk has a data transfer rate of 250K bps so you might expect the hard disk to be 30 times as fast as a floppy. Sorry, but that's wishful thinking; in most real world applications, a hard disk will be three to ten times as fast as a floppy disk. On disk-intensive applications, the hard disk will be somewhat faster, for example, loading color images. That is why at computer shows, hard drive manufacturers like to display color images in rapid succession. What more dramatic (if somewhat unrealistic) way to show off the speed of a hard drive?

Astra advises against trying to copy protected software onto the HD+ unless the publisher has provided a means for "installing" the software onto a hard drive. Some computer programs have a form of copy protection called a "worm" which slowly and inexorably destroys all of the software on the copied disk—a diabolical device which could play absolute havoc with a 20 Mb hard drive.

It's advisable when shutting down a hard drive to "park" the read/write head over an unused part of the disk so when the disk comes to a stop, the head will not land on live data and possibly destroy it. Astra has provided a park program for just this purpose; it takes about three seconds to run and is a cheap insurance policy against the risk of lost programs or data.

SOFTWARE AND OTHER EXTRAS

With the HD+, Astra includes an excellent backup and restore program (BRS) created by RIK Software that will work on single files, root directories, or entire partitions (logical drives). BRS formats floppy disks in a different way than TOS, a process that increases the storage capacity of a double-sided floppy disk by about 150K. BRS is a flexible and valuable utility, but, of course, for it to be of benefit, you must use it regularly.

I mentioned some features at the beginning of the review that deserve further comment. Putting a lighted power switch on the front is so logical and

continued on page 78

MARK WILLIAMS C 2.0

The most complete development system for the ST now works with floppy-based systems, too!

by Arick Anderson

Mark Williams Company has released a new version of the Mark Williams C compiler for the Atari ST. Version 2.0 adds some very nice features to a solid, mature package. The company seems to have examined those areas where previous versions were weak and listened to suggestions from customers.

The biggest improvement for many buyers is that the compiler can be used on a floppy disk-based system. You can now compile small to medium-sized programs with only one drive and a RAMdisk (though with single-sided drives it's a cumbersome process—I would recommend two drives). A hard drive is still optimal, but it is no longer absolutely required.

The package includes an Install program that will have anyone—novice, student or developer—up and running with minimal problems. The Install program asks you what your environment is and then builds either the disks or directories you need; all you do is swap disks periodically. If you are using single-sided disks, you can copy the compiler and utilities directly off the distribution disks.

THE COMPILER

I originally chose Mark Williams C rather reluctantly. It wasn't the fastest

continued on page 82

THE MUSICAL ST, PART II

MIDI patch editors

by Jim Pierson-Perry

Last issue (Summer 1987) I covered three different categories of MIDI software—player, sequencer and librarian programs. This time I'll look at patch editors, with a mini-review of each program, and I'll highlight some of their specific features in the summary chart.

As I said last issue, many consumer MIDI programs are equally suited for the professional musician, and if you make your living (or at least try to) by performing music, then you should definitely examine the software covered here. To use most of these products, you need only your ST and a MIDI-compatible synthesizer such as the popular Casio CZ-101, Yamaha DX-7 or Ensoniq ESQ-1. Also, I'm assuming that if you're reading this, you're already somewhat familiar with the world of MIDI and music software, but if not, I've listed several good references at the end of this article to get you up-to-date.

PATCH EDITORS

If a music sequencer is the musical equivalent of a word processor, then patch editors are the printer drivers that make sure the translation from idea to performance gives the desired final result. If the powerhouse heavy metal synth lead you wanted comes out sounding like a duck being run over by a school bus, your audience may be nonplussed, to say the least.

At its most basic, a patch editor should provide an easy way to enter values for a synthesizer's various instrument parameters, which shape its musical tones. Some instruments, such as the Yamaha FB-01 synthesizer, have little or no way to manipulate the parameters with hardware; for these machines, an editor is the only effective way to create desired sounds.

Beyond simple parameter input, graphic display of sound envelopes can help you visualize how different components, such as pitch, volume and frequency filtering, will change with time. Some of the better programs extend this to let you directly edit each voice by manipulating the envelope graphs. Other useful editing features include the ability to copy envelopes between components, insert or delete segments into envelopes, and compare modified patches to the originals. Some programs even use internal artificial intelligence to generate new sounds.

Since most synthesizers contain banks of multiple voices (such as the 16 presets on the CZ-101), most patch editors contain integrated librarian functions. These serve to upload and download patch data between the synthesizers and the ST, select individual patches for editing, and combine various voices to form new banks.

CZ PATCH

CZ Patch ($99, Dr. T) was the first patch editor program released for the ST. It's a reworking of the original Commodore 64 version, which has achieved industry standard status. CZ Patch works with Casio CZ-101/1000/5000 synthesizers but does not support the new CZ-1 or CZ-230S. It is extremely easy to use and can hold up to four banks of sounds in memory at once. You can use either function keys or the mouse to select program options. The edit screen shows the three Casio envelopes (pitch, filter, volume) simultaneously for a single voice. Although you can't edit the graphs, they dynamically follow changes to the parameter data to give visual editing feedback.

One unique feature of CZ Patch is the option to see parameter data in a time-based format; another is the ability to scale entire envelopes to change duration or amplitude. The program allows you to input parameter data by clicking on a location and then typing the value or moving an on-screen slider. You can also make printouts of patch data, though they may look cluttered. CZ Patch uses some GEM features, but doesn't support desk accessories and has no provision for formatting a data

disk from within the program. It comes with 15 banks of preprogrammed patches to get your sound collection started. I have used this program for several months and am quite satisfied with its dependability and features.

CZ-ANDROID

The CZ-Android ($99.95, Hybrid Arts) offers an alternative patch editing program for Casio synthesizers; it's the only one that fully supports the new CZ-1 and CZ-230S. You can choose between entering parameter data by clicking the mouse buttons (left to increase values, right to decrease them) or by editing graphs of the envelopes. Unfortunately, only one graph can be displayed at a time, which makes it difficult to visualize an entire voice. The program uses a full GEM implementation, including desk accessories and options to rename and delete files and format disks. Patch data printouts are clear and well organized.

CZ-Android is designed to use artificial intelligence to either modify existing patches or create new ones. It's fun to play with, but this particular AI implementation does not often come up with startling new sounds. Two banks of patches are included on the disk, many of which are fairly good. The program is easy to use and I can recommend it. Whether you should use CZ-Android or CZ Patch will depend on whether you prefer graphical editing and AI patch generation or more extensive envelope editing capabilities and faster data input. I cheat and use both, but you should try each program to see which style best fits your needs.

DX HEAVEN

DX Heaven ($99, Dr. T) is a patch editor for the Yamaha DX-7/TX series of synthesizers and, like CZ Patch, is a rework of the original Commodore 64 program. Patches for the DX/TX synthesizers are much more complex than those for Casio synthesizers; each patch consists of up to 6 independent sub-voices (operators), each with its own envelope, and a host of additional parameters. DX Heaven is an easy-to-use program which offers both librarian and patch editing functions. Numeric data can be entered using an on-screen slider via the mouse or by graphical editing of the operator envelopes.

MIDI Thru with channelization is supported, which allows you to test-play a patch from a master keyboard, with the MIDI data sent through the ST and back out on a different MIDI channel to the target synthesizer/expander. This is especially useful in programming a TX-816 which can sound different patches on each of 8 channels at once!

Although some GEM features are implemented, desk accessories are not supported. You can format a data disk

continued on page 74

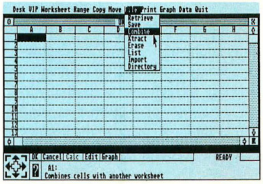
VIP PROFESSIONAL

The Lotus 1-2-3-compatible GEM spreadsheet

By Matt G. Loveless
START Consulting Editor

In the world of IBM spreadsheets, Lotus 1-2-3 is the name of the game. It makes sense, then, that 1-2-3 compatibility would earn high marks for an ST

FIGURE 1



spreadsheet. But to ST owners, mere emulation of an IBM program is like a slap in the face—with the ST's mouse-based GEM interface, a simple conversion of a text-and-keyboard program seems not only archaic but counterproductive.

VIP Technologies learned this when they released the first version of their Lotus-compatible ST speadsheet, VIP Professional. The reviews were clear: It was a solid program and closely matched the Lotus standard, but it needed a GEM interface. Like any good company interested in improving its market position, VIP revised the program to use GEM. The result: the same high-quality spreadsheet with a greatly improved user interface. ▶

VIP Professional...

LOTUS LAND

If you're familiar with Lotus 1-2-3, you will immediately feel at home with Professional. You can type in any Lotus slash-command (as they are called because each command is preceded with a slash character) and it will perform exactly as it would on 1-2-3. But Professional also allows access to all spreadsheet functions through the mouse and drop-down menus.

Unfortunately, Professional's mouse-and-menu interface is just another way of performing Lotus commands—it's still just a GEM veneer. On the plus side, this lets Professional maintain much of the Lotus "look and feel." But personally, I never thought much of the Lotus command structure in the first place. An interface that uses it, mouse-driven or not, doesn't impress me greatly.

The Professional spreadsheet appears inside a GEM window (see *Figure 1*). Below the window is the spreadsheet Control Panel, which gives you status information—the contents of the current cell, cursor location, CapsLock status and entry mode. You may also move around the spreadsheet using the arrows in the lower left corner, recalculate, get help, or start drawing a graph from the Control Panel.

Although the Control Panel is very useful and time-saving, it takes up approximately one-sixth of the screen. That, combined with the space needed for the window's controls and the GEM menu bar, reduces the visible portion of the spreadsheet to 13 rows on a color system (15 rows in monochrome). This isn't crippling, but it can be frustrating when you are porting spreadsheets from Lotus 1-2-3 that are designed assuming you have a full-screen display.

SPREADSHEET FEATURES

VIP Professional sports the full complement of Lotus 1-2-3's calculation facilities. These include the standard math operations, of course, as well as sophisticated financial calculations, trigonometric functions, lookup tables, constants (such as Pi), and time/date variables. It also supports a wide range of logical operations such as and, or, not, greater than, less than, and related items.

Built into both Lotus 1-2-3 and VIP Professional is the ability to create two-dimensional graphs such as bar charts, line charts and pie charts. The graphing facility is flexible and sophisticated, yet it can be as simple to use as specifying a range of data to graph. Professional also lets you print graphs on your printer, but it only works with printers supported from the GEM Desktop. This limits you to Epson-compatible printers, unless you have a special printer driver for your printer (like the ones you can generate with Tom Hudson's printer-driver program from the Summer 1986 START).

VIP Professional allows access to all spreadsheet functions through the mouse and drop-down menus.

Professional also duplicates 1-2-3's macro facility. These spreadsheet macros allow you to automate multi-step functions. The macro facility is fairly sophisticated, approaching the complexity of a high-level programming language. Its high level of flexibility lets you create spreadsheets that can, for example, duplicate many of the features of complete accounting and inventory packages. There are many public-domain and commercial spreadsheet templates for Lotus 1-2-3 that will actually walk you through your data entry and, at a keypress, graph the data, do simple analysis or massage the numbers into some more useful form—and Professional's Lotus compatibility lets you use them all.

LOTUS 1-2-3 AND VIP PROFESSIONAL

Because VIP Professional is completely file- and function-compatible with the IBM PC version of Lotus 1-2-3, you can also use spreadsheets you create with Professional with Lotus. In fact, if you have an IBM-compatible with a 3-1/2-inch drive, or an ST with a 5-1/4-inch drive connected to it, you can use the same disk in both machines. This file compatibility also allows you to download .WKS (Lotus worksheet files) from bulletin boards and online services. On CompuServe, for example, you can join the Lotus SIG (type GO LOTUS) and download spreadsheets that do everything from manage a small business's accounting to calculating the pressure capacity of pneumatic valves.

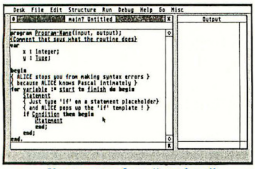
There are also many books on using Lotus 1-2-3, building Lotus spreadsheets and programming Lotus macros—you'll find them in the computer books section of most well-stocked bookstores. Almost anything you read in such books will work with VIP Professional; Professional's manual even offers a bibliography.

PROBLEMS AND CAVEATS

But, alas, Professional is not perfect. In compromising between keyboard and mouse, VIP made some sacrifices and some less-than-desirable design decisions. Scrolling, in particular, is slow. According to the manual, this is because of the ST's bit-mapped display, but I don't buy that; scrolling is only this slow if you don't optimize screen updates. In a $250 product such as Professional, I would hope for at least this

continued on page 76

We were going to tell you all about



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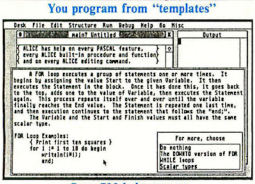

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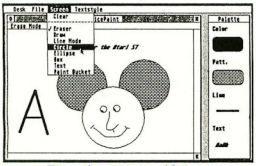

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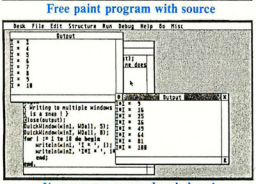
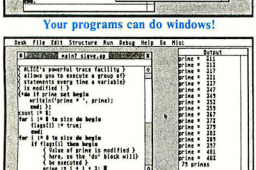


Your programs can do windows!



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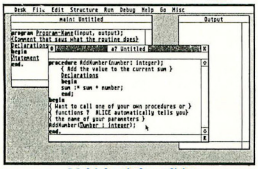

Multiple window editing

Programming Made Easy

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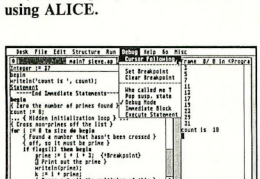
Even if you're an expert, ALICE makes it easier to write, test and especially *debug* programs. ALICE's extensive Pascal improvements include a GEM interface even beginners can use and most of the extensions of Turbo Pascal. The surrounding examples just give a glimpse at how easy it is to put programs together using ALICE.



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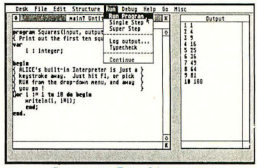

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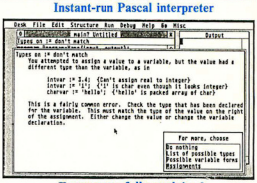

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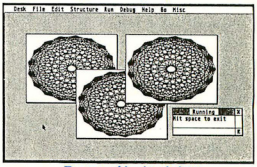
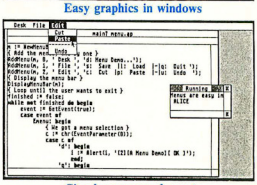
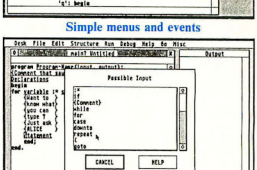


Easy graphics in windows



Simple menus and events



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Musical ST...

from within the program in either single- or double-sided format. Printout options are for listing patches within a bank and all parameter data for a single patch. For those "occasional" boo-boos, an Undo function is available. Computer-generated patches can be created using a randomization function which works on all patch parameters or just selected ones which you specify.

In using DX Heaven, my only criticism is with the mouse-driven slider to enter numeric data; I would prefer to be able to simply click on the parameter and type in its value. It would also be nice to include the function parameters on the same display with the operator parameters and to go with a full GEM implementation. The documentation is clear and complete, with the maddening exception that no screen displays are shown for reference. Despite this, the program is a good workhorse patch editor and can be recommended.

PERFECT PATCH

Perfect Patch ($59, Aegix) is a patch editor program for the Yamaha DX-7/TX series of synthesizers. The program is well named; put simply, this is the finest patch editor I have ever seen for any computer and/or synthesizer. All patch parameters are accessible from a single screen, with simultaneous display of all envelope and scaling graphs. With the touch of a button, you can change all graphs to display their numeric values. You may edit graphically or by numeric values. Keyboard scalings, envelopes and even entire operators can be copied from a source to multiple destinations in a single pass.

The program is fully GEM-based and holds up to three banks of 32 patches in memory at once. MIDI Thru with channelization is supported. The documentation is thorough, well-written, and includes descriptions for various instrument configurations with which the program can be used. My only complaints: There is no provision ▶

PATCH EDITOR COMPARISON CHART

GENERAL FEATURES	CZ PATCH	CZ-ANDROID	PERFECT PATCH	DX HEAVEN
Version reviewed	1.0	9/24/86	2.0	1.0
Cost ($)	99.00	99.00	59.00	99.00
# banks stored/SS disk	87	146	74	43
# sample patch banks supplied	15	2	1	24
Need TOS in ROM	yes	yes	yes	yes
Copy protected	yes	yes	yes	yes
GEM utilization	some	full	full	some
Allow desk accessories	no	yes	yes	no
Keyboard equivalents to mouse	yes	yes	no	some
SET-UP				
Assign MIDI channel	no	yes	yes	yes
Synths supported	CZa,b	CZa,b	DX-7/TX	DX-7/TX
# displayed patch banks	4	2	3	4
MIDI thru/channelization	no	no	yes	yes
LIBRARY FUNCTIONS				
Display file name for bank	yes	no	yes	yes
Store patch/envelope files	yes/yes	yes/no	yes/no	yes/no
Move single patch/bank	yes/yes	yes/yes	yes/yes	yes/no
Patch name length	8	16	10	10
Hardcopy bank patch names	yes	yes	yes	yes
File edit options	no	D,F,R	D,R	F
EDIT FUNCTIONS				
Smart editor	yes	yes	yes	yes
Graphical envelope editing	no	yes	yes	yes
# simultaneous graphs	3	1	12	1
Voice edit options	C,SW	C,SW	C	C
Envelope edit options	C,SW,ID	C,SW	C	C
Envelope scaling	yes	no	no	no
Compare edit to original	yes	yes	yes	yes
Unedit	no	yes	yes	yes
AI patch generation	no	yes	no	yes
Test sound from keyboard	yes	no	yes	yes
OVERALL IMPRESSIONS (0-5)				
Ease of use	4	5	5	4
Program features	4	4	5	4
Documentation completeness	5	5	5	4
Documentation clarity	4	5	5	4
Quality of patch hardcopy	3	5	5	4

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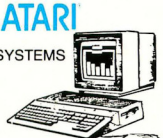

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Musical ST...

for formatting a data disk (though it could be done through an appropriate desk accessory), and the only way to get a printout of patch parameters is by using the built-in ST screen dump routine. I strongly endorse this program; it's worth looking at even if you don't own a DX-7, just to admire its design features.

SIDE BY SIDE

The accompanying chart compares the features of these four programs side by side. Whenever possible I have tested and verified the features myself, rather than just listing the manufacturers' claims.

Consumer MIDI programs often prove to be high-powered bargains for musicians. If you own a MIDI keyboard and you're just interested in seeing what your ST can do with it, you'll probably find the programs I've covered in this issue and the last to be more than adequate. If you're a professional musician, consumer programs are worth a careful look, though they may not be quite enough. You'll find a survey of professional MIDI software in an upcoming issue of START. ■

Jim Pierson-Perry is a research chemist for DuPont, who leads a double life as a programmer, musician and START's MIDI expert.

LIST OF MANUFACTURERS

Perfect Patch, Aegix, P.O. Box 9488, Reno, NV 89507, (702) 329-1943
CIRCLE 195 ON READER SERVICE CARD

CZ Patch, DX Heaven, Dr. T's Music Software, 66 Louise Road, Chestnut Hill, MA 02167, (617) 244-6954
CIRCLE 196 ON READER SERVICE CARD

CZ-Android, Hybrid Arts, Inc., 11920 West Olympic Blvd., Los Angeles, CA 90064, (213) 826-3777
CIRCLE 198 ON READER SERVICE CARD

REFERENCES

- "The Ins, Outs, And Thrus Of MIDI." Tom Jeffries, START, Spring 1987.
- "The Musical ST." Jim Pierson Perry, START, Summer 1987.
  "Save Your Synthesizer Sounds." Tom Bajoras, START, Summer 1987.
- *MIDI For Musicians.* Craig Anderton, AMSCO Music Publications, 24 E. 22nd St. New York, NY 10010, (212) 254-2100. $14.95.
  CIRCLE 199 ON READER SERVICE CARD
- *Introduction to MIDI Programming.* Abacus Software, Inc., P.O. Box 7219, Grand Rapids, MI 49510, (616) 241-5510. $19.95.
  CIRCLE 200 ON READER SERVICE CARD
- Keyboard Magazine, 20085 Stevens Creek, Cupertino, CA 95014, (408) 446-1105. $23.95 per year.
  CIRCLE 201 ON READER SERVICE CARD
- Electronic Musician Magazine, 2608 Ninth St., Berkeley, CA 94710, (415) 843-7901. $22 per year.
  CIRCLE 202 ON READER SERVICE CARD

VIP Professional...

much. Fortunately, moving around the spreadsheet using the scroll bars and the express icon is straightforward and simple.

Another problem: scattered throughout Professional are the annoying vestiges of Lotus's IBM heritage. For example, to select a file in Professional you don't use the standard GEM item selector box; instead, you must actually type in the name of the file manually.

VIP Professional also has a few bugs, though fortunately most of them are not serious. However, Professional did crash more than once for me. It is best to play it safe by saving your spreadsheet often, especially when you're doing very large copy operations.

The manual is thorough, but it's a bit dry and wordy, making it hard to look up specific information quickly. Fortunately, there is a quick-reference sheet included. Finally, on an unexpanded 520ST, Professional doesn't leave much room for you to work with. VIP recommends at least one megabyte of RAM—an expanded 520, a 1040, or a Mega ST.

To ST owners, mere emulation of an IBM program is like a slap in the face.

CONCLUSION

Bugs and problems aside, VIP Professional is a solid program. It comes on single-sided disks with help files and sample macros and spreadsheets. It's not copy protected and it easily installs on a hard disk.

All in all, Professional is a good spreadsheet that does what it claims, bringing Lotus compatibility to the ST. Its only major drawback is the $249 price tag. That's about what you'd pay for Lotus 1-2-3 on an IBM, but it may be a bit steep for most ST owners. If all you need is a spreadsheet, you should carefully examine the other programs on the market.

But if you need a full-featured Lotus-compatible spreadsheet, VIP is the only way to go. ■

VIP Professional, GEM version 1.2. VIP Technologies, 132 Aero Camino, Santa Barbara, CA 93117. (805) 962-8815. Available from ISD Marketing, Inc., P.O. Box 3070, Markham Industrial Park, Markham, Ontario, Canada L3R 6G4. (416) 479-1880. $249.95

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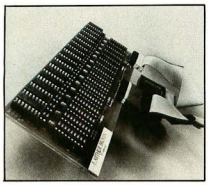

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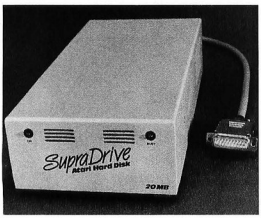
Three Hard Disk Drives...

sensible that I find it inconceivable that so many manufacturers refuse to do it. Hurray for Astra! A 36-inch cable between the drive and the computer is only 12 inches longer than the Atari cable, but makes a vast difference in flexibility of where to place the drive. I have a low shelf behind the computer; the Atari drive won't reach it, but the Astra drive will. Very nice! And, of course, the built-in floppy disk drive is a big help; I just leave the boot disk in the floppy drive on the side of the computer and use drive B in the HD+ for my floppy disk operations.

Do I have any complaints about the HD+? Sure, *the fan is* a bit loud, but if it keeps the drive cool (read: reliable), I'm willing to live with that. And apparently Astra does think the unit is reliable since they are providing a one-year limited warranty, four times longer than the usual. I'd be picking nits if I complained that the manual was not typeset; against that is the fact that it contains more thorough information than any of its competitors.

All in all, the System HD+ by Astra is an outstanding 20 Mb hard disk drive, made better than its competition by the inclusion of a built-in floppy



SupraDrive

disk drive, lighted front panel switch, one-year warranty, versatile software, and several other thoughtful features.

THE SUPRADRIVE

The first thing that strikes you on seeing the SupraDrive is its diminutive size. From the front, it's only 1/4-inch higher than a floppy disk drive. If you consider the power supply part of the floppy drive, the SupraDrive is actually one inch shorter from front to rear. The difference is even more striking when compared to the Atari SH204 hard drive; although the SupraDrive has less than one-half of the bulk (cubic volume) of the SH204, it boasts the same 20 Mb capacity.

Like most ST components, the power switch is on the back, although a small green light on the front indicates when power is on. When turned on, the fan of the SupraDrive produces an unobtrusive whir.

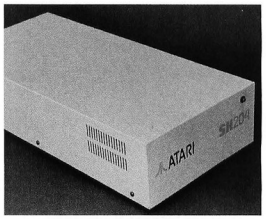
Setting up the SupraDrive with either a 520ST or 1040ST is equally easy. You simply plug in the SupraDrive cable into the hard disk port, turn on the drive and wait 15 seconds until it comes up to speed, pop in the boot disk into floppy Drive A, turn on the computer, and you are set to go. Since the boot software is not protected, you can copy the Auto folder from the SupraDrive disk to any other disks with which you may want to start up.

GETTING STARTED

As it comes out of the box, the SupraDrive is pre-formatted and partitioned into two 10.2 Mb logical drives (C and D). If you like this arrangement, you need do nothing. If you don't, you can re-format the disk into two to four logical drives, each of which may have a capacity between 0.13 and 16.25 Mbs. A utility program leads you by the hand through this process, and it is difficult to go wrong.

Whether you use the preformatted set-up or one of your own, upon subsequent power up, the screen will show icons for each disk drive on the system, along with the menu for hard drive C. From then on, using the SupraDrive is exactly the same as a normal ST floppy disk drive.

The SupraDrive manual contains some good tips, notes, and warnings. For example, it reminds you to never copy a file to itself because of a bug in the TOS operating system that may wipe out the entire hard disk if you do so. It also notes that the SupraDrive will work best if TOS is in ROM because the disk-based TOS has some bugs that may adversely affect the use of the drive. The manual also reminds you to



Atari SH204

backup files periodically, critical files at least daily. Speaking as one who just recently lost the entire contents of a hard disk and *did not* have it backed up, I am living testimony that a hard disk mishap can make a grown man cry, and that making backups is worth however much time it takes.

The SupraDrive utilities disk also contains a program to park the heads, a procedure that Supra recommends if the drive is to be moved or shipped.

Complaints about SupraDrive? Well, I'd like a longer cable, a front panel power switch, and a slightly more comprehensive manual. But these are nits. Overall, the SupraDrive is an excellent performer, admirably compact, and a welcome addition to any ST system.

THE ATARI SH204

The Atari SH204 hard disk drive consists of a 20.3 Mb hard disk, controller, interface, and power supply in one box—a rather hefty box measuring 7 inches by 15 inches by 3 ¼ inches. Where do you put a box that big? Although it's not quite the right size, I find it serves nicely as a monitor stand if you turn it sideways. ▶

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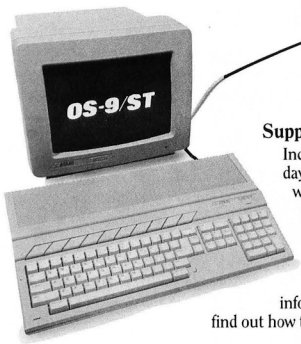

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Three Hard Disk Drives...

Like other Atari components, the power switch is on the back so you must either locate it so the back is accessible or use it in conjunction with a switchable power strip. Actually, I prefer the power strip arrangement, since the hard disk must be fired up for about 15 seconds before the CPU is turned on. A red LED on the front of the SH204 indicates when disk accesses are being made; there is no "Power On" indicator.

Setting up the SH204 is equally easy with a 520ST or 1040ST. It is connected to the computer with an interface cable that plugs in to the high-speed DMA channel. Once connected, you simply turn it on for 15 seconds to let it come up to speed, put the boot disk into floppy drive A, load the HDX program, and follow a fairly simple procedure to format and partition the disk.

The HDX menu contains four programs to format, partition, zero (erase), and mark bad sectors on the hard disk. Before you can do anything, you must format the hard disk and partition it. Partitioning means dividing the disk into separate logical disks. As the largest permissible logical disk size is 16 Mbs, you must partition the SH204 into at least two logical disks—but no more than four. The partitioning program provides eight preselected partitioning schemes (4-6-10, 10-10, 16-4, etc.) or you can design your own. Chances are you will find one of the preselected schemes satisfactory.

In order to access any logical drive other than the first (C), you must install the drives from the GEM desktop. The procedure for doing this is described in detail in the manual. After you install the partitions and save the desktop with the necessary drive icons (and menus, if you wish) showing, the hard disk will then boot up as you have specified whenever you turn on the system. As the boot software is not protected, you can copy it onto any floppy disk with which you wish to boot up. Unlike MS-DOS systems, you cannot boot up directly from the hard disk, but you must have the autoboot program in floppy drive A.

The boot disk also comes with a program called "Ship" which parks the disk drive heads in a safe place for secure shipping and handling. This program must be run from a floppy disk.

A COMPREHENSIVE MANUAL

The manual contains a page of helpful notes and warnings. Here you learn that you must have TOS in ROM to run a hard disk, that you cannot have more than 40 directories (folders) and subdirectories in total on your ST, that you cannot copy one entire partition to another, and that a hard drive main directory can hold a maximum of 256 items.

A hard disk drive is a bit like an electric can opener.

The manual also describes how to set the DIP switches to address multiple hard disk drives. Unfortunately, it gives no clue as to how to hook up multiple drives other than to say, "additional hardware and software are required." Systems software enthusiasts will be pleased to note that Atari has included a 10-page appendix describing the command structure, operation codes, status structure, and several other items incomprehensible to normal human beings.

What didn't I like? Well, the 24-inch cable severely restricts where the disk can be located. Forget about a shelf or the floor—it won't reach. Also, I'd like the power switch on the front along with a Power On indicator. And why is the box so large? Both Astra and Supra have proved it could be one-half the size. And while partitioning the disk is relatively easy, I would've preferred it to be shipped preformatted and partitioned along with a program to alter it if you want a different partitioning scheme.

But all in all, the HD204 is a physically solid unit, admirably fast, well documented, and, if months of heavy daily use are an indication, dependably reliable.

CONCLUSION

I've tried to make some comparisons here and in the accompanying chart that I hope will help you decide which of three excellent hard disk drives currently available for the ST will best suit your preferences. The really important thing to remember, however, is that when it comes to floppy drives, there is no comparison. You have heard and read it before, and believe me, it is true—once you have used a hard disk drive, you will never want to rely on floppies again. ■

Howard Root is a travel writer who's been working with microcomputers for more than ten years.

Astra System HD+, Astra Systems, 2500 South Fairview, Unit L, Santa Ana, CA 92704, (714) 549-2141, under $1000; call for dealer nearest you.
CIRCLE 185 ON READER SERVICE CARD

SupraDrive, Supra Corporation, 1133 Commercial Way, Albany, CA 97321, (503) 967-9075, 20 Mb $699, 30 Mb $995, 60 Mb $1995.
CIRCLE 186 ON READER SERVICE CARD

Atari SH204, Atari Corporation, 1196 Borregas Avenue, P.O. Box 3427, Sunnyvale, CA 94088, (408) 745-2367, $699.95.
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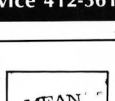

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CIRCLE 042 ON READER SERVICE CARD

Mark Williams C 2.0...

compiler available; the compile times were significantly slower than the competition. In fact, I used to run my previous compiler from within the Mark Williams shell just so I could use the environment and utilities without sacrificing speed. I liked the Mark Williams compiler's error checking, which can be set to different sensitivities. A real Unix-style "make" utility was also a plus.

Version 2.0 goes after this from two directions. First, it compiles about 25 percent faster than version 1.0. To speed things up even more, version 2.0 includes a RAMdisk program that survives resets and most crashes. Using the RAMdisk for temporary files cuts compile times in half, and puts Mark Williams version 2.0 in the same ball park as the fastest compiler currently available for the Atari ST.

The timings in *Figure 1* are for the Dhampstone benchmark, a set of routines more fully described in the Fall 1986 START, and for compiling Doodle, the public domain GEM drawing program. All times are in seconds.

One new feature is the -A option on the compiler; if a fatal error causes your compile to halt, you automatically return to your source code in the editor at the location of the first error. A single command moves you to the next error. When you leave the editor you can either return to the shell or resume compiling. This makes the compile/edit/compile cycle a lot smoother.

The editor is a reasonably robust RAM-based version of MicroEMACS, an adequate editor that more or less by default has become my editor of choice on the ST. With this version you can suspend an editing session and temporarily return to the shell, examine files or whatever, then return to your editing session with a simple command. It's not mouse-based, and the keyboard commands are fairly standard, using control keys and escape sequences. As with previous releases, the source code to the editor is included with the package.

THE SHELL

For a Unix user, the Mark Williams shell will be familiar. The new version adds some delightful features, including "aliasing," which allows the user to give more familiar names to the rather cryptic operating system commands by changing the profile file. (The profile file contains the shell commands that you want executed every time you enter the shell.)

The shell also incorporates "environmental variables," which let you specify paths for temporary and Include files while compiling (complete with multiple pathways and directories to be searched). There's a command history capability, but it's quite primitive; your previous commands can be re-executed but not edited.

From the shell you can archive, change the cursor, run a symbolic debugger, check free RAM and disk space, run either TOS or GEM programs, manipulate the mouse, add and delete files and directories, show and save screens in any of the major graphic formats, reset an entire directory's file modification dates with a single command, count the words/lines in a file and a host of other things. In short, the shell has utilities and features that in many packages you would expect to pay extra for. No other compiler package currently available on the ST offers anywhere near the utility support that Mark Williams does.

There is a gap in the utilities, though: the lack of a resource construction set. Mark Williams has one in development, but it probably won't be available until the next release.

THE RAMDISK

Mark Williams made the RAMdisk "permanent" – if you crash your system, you can reboot and retrieve any source code left there. You can also make a bootable image of the RAMdisk so you don't have to reload your RAMdisk each time by hand. The system can also boot off the RAMdisk.

That, at least, is how it's supposed to work. In practice, I have never been able to get the Mark Williams RAMdisk to work. In fairness to Mark Williams, I have an unusual hardware/software environment: a one-meg 520 ST with two double-sided floppies, a Z-Time internal clock chip, the Beckemeyer Hard Disk Cache program and a 20-megabyte ▶

File MWC2.ARC on your START disk.

C VIEW

By the time you read this, Megamax should have released the second version of their C compiler. They promise new documentation, a smoother interface and even faster compile and link times. Also, the new compiler and linker will use absolute code generation. This will remove the 32K limitation on your data and code segments. The new linker will use and produce the DRI format. This will allow your object modules to be linked in with Pascal, assembly or object modules from other languages who use the same format.

A new version of the Lattice C package is almost complete. However, there's a new address for all sales, upgrades, and technical support:

Metacomco PLC
26 Portland Square
Bristol, BS2 8RZ
UK

The new phone number is 011 44 (272) 428781. If you try to call the California phone number, you'll just be referred to the English address.

And Manx is now beta-testing an Atari ST version of their Aztec C compiler. At press time there was no projected release date or price; when the package is available, it will have the full assortment of utility and library routines that are available on other Aztec development systems. ■

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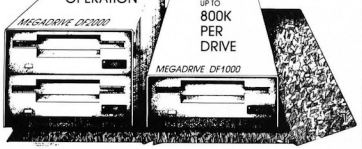

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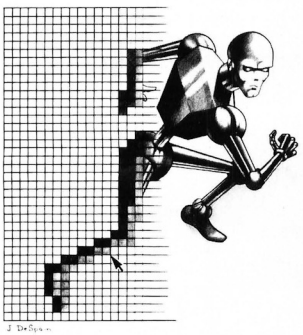
CIRCLE 009 ON READER SERVICE CARD

ST SPRITE FACTORY



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— ***INSERT*** *Copies frames from another file.*
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— ***PASTE*** *All of the above editing options are available with the paste buffer so that you can cut out small sections of a frame and move them around inside the paste buffer and "PASTE" them where you want them on the current frame.*
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**Degas is a product of Electronic Arts.*

CIRCLE 016 ON READER SERVICE CARD

Mark Williams C 2.0...
Supra hard drive partitioned into drives 'C' through 'K' with drive 'M' drive set aside as a RAMdisk. (The 'C' drive doesn't show up on the desktop—it's set as a system/boot disk.) This is obviously not the ideal environment to try out what appears to be one of the niftier RAMdisk programs available.

I talked with Mark Williams' customer support about the problem, and they gave me a program fix over the phone. Since the source code to the RAMdisk is also included with compiler, recompiling the RAMdisk was easy. Unfortunately, my problems with this RAMdisk program just wouldn't go away. Mark Williams Company knows for sure that the Beckemeyer cache program is incompatible, and the Supra Bootstrap program may also be colliding with the program.

Though other developers reported favorably on the RAMdisk, I simply wasn't able to get it going. However, using the same idea, the TMPDIR environmental variable, and a public domain RAMdisk, I *was* able to perform the benchmarks for this article.

DOCUMENTATION AND SUPPORT

The documentation for earlier versions of the Mark Williams compiler was innovative, but it had some significant shortcomings: AES/VDI documentation was not included and the editing was very poor. The current manual is much improved, with GEM documentation and additional example programs. In order to fit the additional information, they made the manual wider (8-1/2 by 7 inches) and reduced the print size (though most users won't have any trouble reading the text).

Overall, the editing is much better, with only an occasional typographical error instead of the content errors I found in the original manual. The style is very readable; it's easy to simply start reading the manual, one entry after another. Like the original version, the manual uses a lexicon format, very similar to an encyclopedia. It's very easy to locate information on how to use the compiler, operating system, GEM or anything else covered in this manual.

However, it's difficult to learn about functions, features and utilities if you don't already know they exist. There is no "function library" section or "Xbios" section to turn to in order to see what is available; you are more or less left to stumble across little gems and treasures as you peruse the manual. Thus, those who don't have the time to read the manual all the way through won't be able to make optimum use of the excellent library support routines available.

The manual *is* loaded with examples. They are generally very good and demonstrate not only the specific application, but often some of the more esoteric features of C, such as unions. The examples are short, concise and do a better job of illustrating the material presented than many of the books written on the subjects.

Some significant gaps do show up. The symbolic debugger has inadequate documentation, even with two example sessions in the manual. I also had trouble with documentation on the linker when I tried to get separate compile and link times for the benchmarks. I finally had to call Mark Williams for clarification, since all my attempts to use the linker directly for an independent link were unsuccessful. (The final answer was not to call the linker itself but to do all linking through the "cc" command. This is a standard Unix technique, but I didn't find it mentioned in the manual.)

Mark Williams' support has improved since I first called them; they now have a toll-free number you can call to get help. The support personnel are quick, and when the phone lines are tied up the receptionist will take your name and number; usually they get back to you the same day. The toll-free number and the call-back procedures are a real relief when you're calling from across the country. Without question, Mark Williams' concern for support is exceptional.

CONCLUSION

With the exception of the resource construction set, the Mark Williams compiler environment is the most complete development system currently available in one package on the market for the Atari ST. In terms of its phone support, utilities, libraries functions and overall environment, it is in a class by itself. If you have a hard disk and prefer the traditional DOS shell environment with its variety of tools, Mark Williams 2.0 is without equal on the ST. Even if you're

FIGURE 1

	Dhampstone		Doodle	
	compile	link	compile	link
Hard disk with RAMdisk	0:28	0:22	1:23	0:25
Hard disk without RAMdisk	0:40	0:22	2:00	0:25
Floppy with RAMdisk	1:19	1:12	3:00	1:30
Floppy without RAMdisk	2:05	1:12	5:48	1:30
object code in bytes				
without symbol table*	12,889 bytes		15,587 bytes	
with symbol table	15,749 bytes		19,965 bytes	

*the utility "strip" removes the symbol table used by the debugger.

Dhampstone times

strings	integers	longs	unsigned	double	disk I/O
7.53	2.22	.28	1.88	.58	14.88–16.45

working with a floppy system, Mark Williams is a development system that warrants consideration.

(If portability to other systems is important to you, you may also be interested in the Mark Williams C compiler for the IBM PC. The new PC version contains both the compiler package and C source level debugger for only $75.) ■

Arick Anderson is technical leader with the Curriculum Enhancement department at WICAT (World International Computer-Assisted Training) in Orem, UT.

Mark Williams C Version 2.0, Mark Williams Company, 1430 West Wrightwood, Chicago, IL 60614, 1-800-692-1700 or (312) 472-6659, $179.95

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CIRCLE 026 ON READER SERVICE CARD

THE START CALCULATOR

A fully programmable scientific calculator

by Alex Leavens

I needed a calculator for my computer. It was frustrating—here I was with an incredibly powerful microprocessor, hundreds of K of RAM, a machine that could blister its way through almost any benchmark. And every time I wanted to perform a calculation in the middle of another program I had to turn on my old Texas Instruments TI-35 calculator.

I didn't want a little four-function adding machine, either. I wanted one with fancy features like the ones I saw in stores, calculators costing hundreds of dollars. I wanted extended math functions, multiple levels of parentheses, and, to top it all off, *programmability*—but no matter where I looked, I couldn't find an ST calculator desk accessory that did what I wanted.

So I stopped looking and started programming. The result is START Calc, START's desktop scientific calculator. It may well be the only calculator you'll ever need. Just look at the features you get:

- full floating point math, including 10 levels of nested parentheses
- log, trig and power functions
- 100 data memories
- 1000 steps of program memory
- full program control, including nested subroutines, label addressing, and much, much more.

You say you want your computer to work like a calculator? You want to use extended math functions, complex expressions, and programmability? That's what Alex Leavens wanted, so he created a feature-packed desk accessory program called START Calc. You'll find this programmable desktop calculator on your START disk!

File CALC.ARC on your START disk.

GETTING STARTED

To use the calculator, first copy STRTCALC.ARC to a fresh disk, along with ARCX.TTP. Run ARCX, and type in the filename STRTCALC.ARC. ARCX will un-archive the files, and in a few minutes you'll be ready to go.

START Calc is a desk accessory, so you'll next need to reboot your ST. Then, when the desktop reappears, point at "Desk" to drop down the menu, and click on "START Calc." and the START Desktop Scientific Calculator will appear (see *Figure 1*).

You can, of course, copy the calculator to any other disk you boot from, including your hard disk. Just copy STRTCALC.ACC (the desk accessory program) and STRTCALC.RSC (the re-

source file) to the disk; when you boot from that disk, you'll have the calculator immediately available.

USING THE CALCULATOR

Before we get into how to *program* the calculator, let's just get acquainted with how to *use* it. At its simplest level, it's a standard mathematical calculator—you type in an equation just as it appears, and the calculator solves it. Thus, for example, you can type in the equation
2 + 3 * (5 + 9 / 6 * (3 + 8)) ENTER
on the numeric keypad on the right side of your ST keyboard, at which point the calculator will evaluate the entire expression, and give the answer, 66.5. Or, instead of typing, you can click on the equivalent keys on the screen's keypad:
2 + 3 X (5 + 9 ÷ 6 X (3 + 8)) =
and you'll get the same answer. Note that, either way, the calculator does not evaluate intermediate steps of the problem, with the exception of parts of the expression that are entirely enclosed in parentheses.

(Speaking of parentheses, you should also note that you can have up to 9 parentheses open before you must close one. That is, you could enter:
2 X (((((((((3 + 5))))))))) =
and still be safe. If you *do* exceed the parentheses level, there is no warning—but the results are guaranteed to be wrong.)

The calculator understands algebraic precedence—that is, it will evaluate multiplication and division before addition and subtraction. It will also evaluate any expression completely enclosed by parentheses first, before evaluating other parts of an expression. Thus the expression
(2 + 3) X (4 + 5)
will be correctly evaluated as 45, and not 19, as would be the case if the parentheses were ignored. For a complete breakdown of the ordering of expression precedence, see *Table 2*.

The highest priority functions in the table are the *immediate mode* functions, which are processed immediately and affect only the contents of the display register. For example, 1/x always changes the displayed number to its reciprocal, but affects nothing else.

THE KEYS

OFF Turn the calculator off and exit. Clicking on the close box in the upper left corner of the window does the same thing.

CLR Clear the calculator of any equations or results, and reset the display to 0.

CE Clear the current entry in the display. If you enter a number incorrectly (for example, you type a 3 but you wanted a 2), press this button to clear only the currently displayed number. This key does not affect calculations in progress, nor will it clear the result of a previous calculation. For example, keying
2 X 3 CE 4 =
results in the answer 8.

2nd Activate the secondary function of a key. These secondary functions are displayed immediately above the main function of a key. For example, the secondary function of the key *SIN* is *Sinh*.

INV Activate the inverse of a function. For example, *lnx* takes the natural logarithm of a number, so INV lnx takes the inverse natural log of a number (that is, e^x). INV does not work with all keys—see the list below for those it does work with.

Note: Some functions require both the 2nd and INV keys. In those cases, you may press either key first—2nd INV and INV 2nd are equivalent.

Every time I wanted to perform a calculation in the middle of a program I had to turn on my old Texas Instruments TI-35 calculator.

MATH FUNCTIONS

+, −, X, ÷ Add, subtract, multiply or divide two numbers.

• Insert a decimal point.

SIN Take the sine of the number in the display. **INV SIN** takes the arcsine, **2nd SIN** takes the hyperbolic sine, and **INV 2nd SIN** takes the hyperbolic arcsine.

COS Take the cosine of the number in the display. **INV COS** takes the arccosine, **2nd COS** takes the hyperbolic cosine, and **INV 2nd COS** takes the hyperbolic arccosine.

TAN Take the tangent of the number in the display. **INV TAN** takes the arctangent, **2nd TAN** takes the hyperbolic tangent, and **INV 2nd TAN** takes the hyperbolic arctangent.

lnx Take the natural logarithm (base e) of the number in the display. **INV lnx** finds e to the value in the display.

log Take the common logarithm (base 10) of the number in the display. **INV log** finds 10 to the value in the display.

$\mathbf{x^2}$ Take the square of the number in the display, that is, x times x.

$\sqrt{x}$ Take the square root of the number in the display.

1/x Take the reciprocal of the number in the display.

$\mathbf{y^x}$ Take the number in the display and raise it to the power of the next number entered. For example, to raise 2 to the third power, you would type 2 y^x 3 =. **INV** $\mathbf{y^x}$ takes the displayed value to the root of the next number entered; to find the cube root of 8, type 8 INV y^x 3 =.

|x| (**2nd ÷**) Take the absolute value of the number in the display.

DEG (**2nd X**) Switch the calculator to Degrees mode, and convert the number ▶

START CALCULATOR...

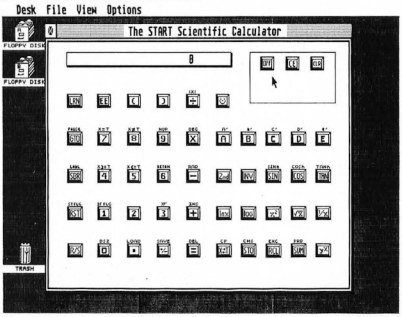

FIGURE 1

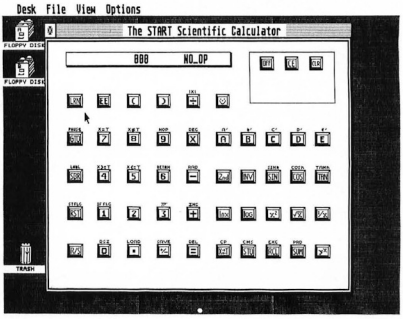

FIGURE 3

in the display from radians to degrees. DEG affects only the trig functions (SIN, COS, TAN and variants). The calculator starts out in Degrees mode.

RAD (**2nd −**) Switch the calculator to Radians mode, and convert the number in the display from degrees to radians. RAD affects only the trig functions.

π (**2nd 3**) Enter the value of π to 10 significant places.

CONTROL FUNCTIONS

+/− Change the sign of the number in the display. If a number is positive, pressing this key makes it negative. If the number is negative, pressing this key makes it positive. When entering an exponent, this key is used to make the exponent positive or negative as well.

EE Enter the exponent of a very large or very small number.

X<−>T Exchange the contents of the display with the test register. The test register is used mostly when programming the calculator, although it can act as a simple "temporary memory" area.

STO Store the displayed number to one of the calculator's data memories. After pressing this key, you must enter two digits to specify which memory the number is to be stored into. The memory addresses range from 00 to 99. This function does not affect the displayed number, other than to store it. **CMS** (**2nd STO**) will clear all data memories.

RCL Recall a number from one of the data memories into the display. Like STO, this key must be followed by two digits to specify the memory number. The current contents of the display are lost. **EXC** (**2nd RCL**) will exchange the current display register with the specified data memory; that is, the currently displayed number is saved in the specified data memory, and the number originally in the memory is displayed.

SUM Add the contents of the display to one of the data memories. This key must be followed by a two digit address (00 to 99), specifying which memory to use. **INV SUM** subtracts the contents of the display from the specified data memory. **PRD** (**2nd SUM**) multiplies the contents of the specified memory by the number in the display; **INV PRD** (**INV 2nd SUM**) divides the contents of the specified memory by the number in the display.

I couldn't find an ST calculator desk accessory that did what I wanted, so I stopped looking and started programming START Calc.

IT'S PROGRAMMABLE, TOO

In addition to being a powerful scientific calculator, START Calc is programmable as well. It can load and save programs, perform tests on numbers and branch to different locations as a result of those tests. Each function is explained in detail below. (Note, however, that it is beyond the scope of this article to teach you programming *per se*. If you've never programmed anything before, I wouldn't recommend this as the place to start.)

LRN Enter or exit programming mode. If you are in calculator mode, LRN will put you in programming mode; in programming mode, it will put you back in calculator mode.

LOAD (**2nd .**) Load a previously saved program from disk. This will erase any current program and labels that you have stored in memory.

SAVE (**2nd +/−**) Save program to disk. This saves the entire contents of the program area (1000 steps and all labels and locations) to a file you specify. This function leaves the contents of the memories unchanged once it has finished.

R/S Run or stop a program. If program

is running, R/S stops it. If no program is running, R/S starts it.

RST Return to the start of the program. RST is used in calculator mode only.

CP (**2nd X<–>T**) Clear out the entire contents of program memory.

When you first click on LRN after starting the calculator, you'll see the display in *Figure 3*.

Each program address has three fields: a label, address and an operation. In *Figure 3* you can see the address (000) and the operation (NO_OP). No label is currently set to program address 000, so there's nothing in the label field. There are 1000 program addresses, so you can create a calculator program up to 1000 steps long. When you first begin programming the calculator, all addresses are set to NO_OP, which means "no operation," or "do nothing." You can move forward and backward through your program by using the arrow keys on your ST's keyboard.

Almost any operation or series of operations that the calculator can perform when in calculation mode it can also perform in program mode. Thus, if we have the equation

$22 + 3^4 =$

we could enter it into the calculator in calculation mode:

$22 + 3\ y^x\ 4 =$

and get the answer, 103. However, we could enter the following instead:

2nd X<–>T LRN 2 2 + 3 y^x 4 = R/S LRN

This sequence will clear the program memory, then enter the program and return to calculator mode. Now, if you click on RST and then R/S to run the program, the calculator screen will go blank briefly, then display the result, 103.

This is not particularly exciting–after all, we had to enter a lot of extra keystrokes and do some fancy gyrations to get an answer we could find more easily just by using the calculator normally. However, when combined with the other programming capabilities of the calculator, we can get much more interesting results.

LABELS

A label is a way for a program to tell the calculator to remember a particular program step. To use a label, you must first set it, using the LABL function (2nd SBR). For example, to set label A at program step 000, you'd type

2nd SBR A

and the display would change to read:

LB: A 000 NO_OP

TABLE 2

Precedence	Function
0 (Highest)	Sin, inverse sin, sinh, inverse sinh
0	Cos, inverse cos, cosh, inverse cosh
0	Tan, inverse tan, tanh, inverse tanh
0	Lnx, e ^ x
0	Log, 10 ^ x
0	x ^ 2
0	root(x)
0	1/x
0	+/–
0	|x|
1	(
1	)
2	y ^ x
2	y root x
3	× (multiplication)
3	/ (division)
4 (lowest)	+
4	–

You can add a label to any program step whenever you're in program mode. Then, when you're in calculator mode, you can start the program beginning with the step at label A by clicking on the A button on your screen. The buttons A through E and 2nd A through 2nd E can all be used as labels that you can execute from the calculator mode.

For example, suppose you want to multiply several numbers by 2/3. You can write a short program to do this using the A key:

2nd x<–>t	Clear program memory
LRN	Enter learn mode
2nd SBR A	Set label
X	Multiply by. . .
2	Two
÷	Divide by. . .
3	Three
=	Compute the answer. . .
R/S	Stop
LRN	Return to calculator mode

Now, whenever you press the A key, whatever number is in the display will be multiplied by 2/3.

There are also a number of spare labels available that can't be called from calculator mode; they're listed under LABL in the programming functions.

PROGRAMMING FUNCTIONS

INS (**2nd +**) Insert space for another program step. When you insert, all instructions below the current program step move down, and if there is an instruction in program step 999, it is lost.

DEL (**2nd =**) Delete the current program step. When you delete, all instructions below the deleted program step move up, and the instruction in program step 999 becomes a NO_OP.

LABL (**2nd SBR**) Set a label to the current program step. Follow this command by clicking on a valid label key to set that label to the current program step. If the label was previously set, its old setting is lost. If more than one label is set to the same program step, only the highest priority label will be displayed.

You can perform the program at an executable label directly from calculator mode. The executable labels are A through E and 2nd A through 2nd E. Spare labels, which will function only from within program mode, include SIN, COS, TAN, lnx, log, X^2, $\sqrt{x}$, 1/x, y^x, SUM, RCL, STO, X<–>T, =, +, –, ▶

X, ÷, +/−, ., 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, EE, (, and).

GTO Go to a label or the address of a program step. In a program, GTO is followed by a label or address, and jumps to the program step at that label or address. If GTO is followed by a label name and the label has not been set, the GTO instruction is ignored.

Because the numbers 0 through 9 can be labels, you must be careful in using them with GTO. For example, if label 1 has been set, the instruction GTO 123 will *not* jump to program step 123, but instead to the program step pointed to by label 1.

In calculator mode, GTO simply changes the current program step, without performing the program.

SBR Execute a subroutine beginning at a label or the address of a program step. SBR must be followed by a label or address. If SBR is followed by a label name and the label has not been set, it is ignored. You may nest up to 30 subroutine calls. A subroutine must end with a RETRN instruction.

RETRN (2nd 6) Return from a subroutine. If the instruction is not part of a subroutine that has been called with the SBR instruction, the RETRN instruction is ignored.

X<−>T Exchange the current contents of the display with the test register.

X = T, X NOT = T, X<= T, X>= T Test the current contents of the display against the contents of the test register. If the condition being tested for is met, then jump to the label or program step specified; otherwise execute the next instruction. Like a GTO instruction, each test instruction must be followed by a label or address of a program step; if the label has not been set, the test is ignored.

The X>= T and X<= T functions can also be used with INV. INV X>= T provides the test X< T, and INV X<= T provides the test X> T.

STFLG (2nd RST) Set a flag to the *on* position. There are ten available flags, numbered 0 through 9. The STFLG instruction must be followed by a number from 0 through 9, specifying which flag to set. **INV STFLG** sets the specified flag to the *off* position; it appears as CRFLG is the program display.

IFFLG (2nd 1) Test a flag to see if it is *on*; if so, jump to the label specified; execute the next instruction. IFFLG must be followed by a number from 0 through 9, specifying which flag to set, and a valid label. **INV IFFLG** tests whether a flag is *off*; it appears as IFNOT in the program display.

DSZ (2nd 0) Decrement a memory register; if the result is zero, then branch to the label specified; otherwise execute the next instruction. DSZ must be followed by a number from 0 through 9 (only these ten memory registers will work with this instruction) and a valid label. **INV DSZ** decrements a register, but jumps only if the result is *not* zero; it appears as DSNZ in the program display.

PAUSE (2nd GTO) Update the display in the course of program execution. PAUSE makes it possible to see the progress of calculations in a program, but it does not change any values in the calculator.

NOP (2nd 9) Do nothing, and proceed to the next program step. This instruction appears in the program display as NO_OP; it performs no operation, and changes no values in the calculator.

I wanted a calculator with fancy features, like extended math functions, multiple levels of parentheses and *programmability*.

PRACTICE, PRACTICE, PRACTICE. . .

And that's it! You now know about every function in this calculator. I've touched only briefly on many of the functions, but as I said before, it's far beyond the scope of this article to give detailed examples of all the features. The best way to understand each feature is to experiment with the calculator.

There wasn't room for the source code for the calculator desk accessory on this month's START disk. However, you'll find it in Antic Online, the Atari online magazine on CompuServe. Just log on to CompuServe and type GO ANTIC, then check the "What's New" menu to find the STRTCALC source code.

I've tried, with my routine names, to keep things in the source code as clear as possible, but several of the routines are worth special note:

do_everything() processes 90 percent of the keystrokes; when you press one of the keys on the calculator, you almost always end up here. **run_calc()** is responsible for executing calculator programs. **evaluate_it()** sifts through the stack to evaluate the equation it finds there; it calls itself recursively as needed. (It also caused me to lose many nights of sleep—unless you're *really* interested in how to build a complex algebraic calculator, you can skip this routine and never worry about it.)

I had a lot of fun writing the calculator, and I find new uses for it every day. I hope you do, too. And if you come up with particularly useful calculator programs, send them to START—you might see them appear in a future issue! ■

Alex Leavens, author of The START Desktop Icon Editor (Spring 1987) is a games designer with Activision Software.

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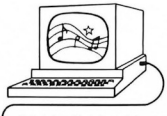

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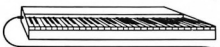

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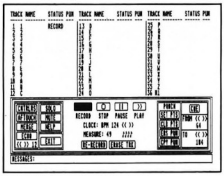

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ST Hints For Hackers, Novices and In-between

Compiled by **Patrick Bass** *START Technical Editor*

Monitor Mania

The ST's color monitor is one of the clearest and sharpest in the industry. It does a dandy job displaying ST graphics, but—in case you've been wondering—it *won't* plug into the Atari PC. However, it *will* work fine with any of the new Mega series ST computers.

Blitter Update

By the time you read this, Atari should have released the Mega STs, and ST graphics will be faster than ever with the new blitter chip. Late word is that there are actually *two* blitters—a square one (like the MMU in 520 and 1040 STs) and a rectangular "aircraft carrier" blitter for upgrading existing ST computers. With any program that uses TOS for displaying graphics, the blitter speeds things up by as much as ten times.

Inside The New 520 ST

If you just bought your 520 ST, you know it looks a lot like a 1040—complete with built-in disk drive. The big differences: The disk drive is single-sided (the 1040 has a double-sided drive) and, of course, there's only half as much memory in the 520. The motherboard is identical to the 1040 motherboard, though, and the traces for installing more RAM are already there—so upgrading your 520 to one megabyte of memory may be easier on the new machines.

The Ultimate Thinking Machine

Your ST is one of the most compatible computers available. Not only will it run all software written for it, it can also run nearly anything written for the IBM PC using a program called PC-Ditto—it emulates a PC with monochrome, color, serial and parallel ports. PC-Ditto has been tested with every flavor of IBM DOS (including GEM), SideKick, Microsoft Word, MultiPlan, WordPerfect, dBase II and III, and Flight Simulator—slower than a real PC, but still usable. It's $89.95 from Avant-Garde Systems, 381 Pablo Drive, Jacksonville, FL 32225—phone (904) 221-2904 or circle 222 on the START Reader Service Card. Meanwhile, the new version of Magic Sac, the ST Macintosh emulator, runs more Mac software than ever—95 percent, it's claimed—and the Magic Drive will soon let you plug an external Mac-compatible drive into the ST. Magic Sac, version 4.2, is $149.95 from Data Pacific, 609 E. Speer Blvd., Denver, CO 80203—phone (303) 733-8158 or circle 225 on the Reader Service Card. Finally, there's a *free* CP/M emulator available on CompuServe that runs thousands of programs from the CP/M 2.2 world. Maybe—just maybe—the ST can run more software than any other computer.

AtariFests Forever

This year was a big time for AtariFests around the country—almost two a month—but Atari's decided to hold fewer (but bigger) expositions. If you're looking for new ST hardware and software, the new AtariFests are a good place to go; the first one (in June in San Jose) featured everything from Atari's new laser printer, Mega STs and PC clone to MIDI-Maze, a multi-player game that connects up to 16 STs through their MIDI ports. Upcoming AtariFests include fests in Los Angeles on September 19 and 20 (sponsored by ACENET; phone (818) 760-1831); Boston on October 10 and 11 (sponsored by the Boston Computer Society; phone (617) 296-8286); and Washington D.C. on October 24 and 25 (sponsored by NOVATARI; phone (703) 938-4829).

E-Z Directory Updates

There you are, searching through your disks, looking for KREINHLD.DR or SWDHUD.JAB. After a while you start thinking that there must be a better way than closing the window, swapping disks, and then re-opening the window. There is! With the file directory showing in a window, just change disks and tap the Escape key. The window will refresh to show the contents of the new disk. Easy!

Snoopy's Dilemma

It's a dark and stormy night, and your older 520 ST starts acting crazy! Disks you *know* are good start showing up as "damaged," and all programs now show the dreaded TOS #35 error. Your ST may be suffering from the "loose chips" syndrome. Get thee directly to thy local ST Service Station and have them "clip" the chips. This means they'll simply

place a special metal clip across each IC chip to securely hold the chip inside its socket. You *don't* need to do this to a 1040 ST, or one of the newer 520 ST's which come inside the 1040 casing. Newer ST's are already "clipped" and don't exhibit loose chips.

Mickey Deceased?

This isn't your day. There's a big report due tomorrow and your mouse just bit the dust. Can you still get your report out? Sure! Just hold down the Alternate key, and your cursor keys will now move the mouse pointer around the screen in character-wide jumps. Hold down [Shift] too, and the mouse pointer moves a pixel at a time. Also, with [Alternate] down, tapping the Insert key is the same as tapping the left mouse button.

Breakfast Serial

A short 'un – if you want to switch the printer output to the serial port instead of the parallel port, just click on the "serial" selection on the "Install Printer" Desk Accessory.

Mouse Extension Formula; Shack Saves Mouse

It's amazing. Atari spent a great amount of time designing the ST series computer to be convenient and easy to use, and then on the 1040ST they put the mouse/joystick connector *underneath* the computer! What to do? Either lift the entire unit up every time you need to plug/unplug a joystick (major hassle), *or* hop on down to your local Radio Shack store and buy their Joystick Extension Cord (part #276-1978, $3.99). Plug one end into the joystick port, and lead the other end wherever you desire. Now when you need to plug a joystick in, you can simply use the extension, without having to lift the entire computer.

Physician, Trace Thyself

Holy smokes! You just typed in *War And Peace* in C, saved the file, then accidentally *deleted* it. Short of typing it in again, can you recover the file? Sure. When you "delete" a file, the entire file isn't erased – the computer just changes the first letter of the deleted filename to a special character, and "forgets" where the file was saved on the disk, thereby freeing up the room the old file took up. If you write another file to the disk, it may be written to some of the space the original file took up. If this happens, the file really *is* unrecoverable. But if not, you can use one of the disk repair programs available, such as Disk Doctor (The Catalog, $29.95), which allow you to correct information directly on the disk. Find the filename, replace the first letter of the filename with the correct character, and then run the "trace" function so the ST can recover all the different parts of your file.

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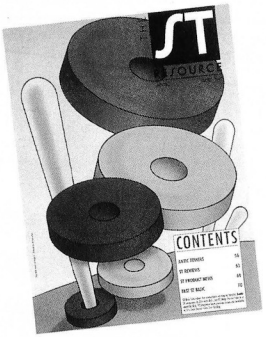

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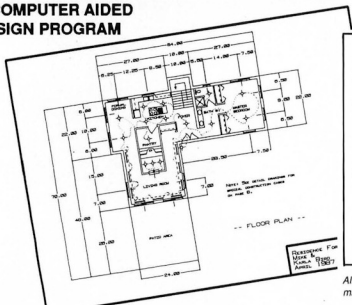

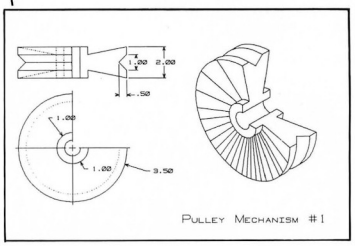

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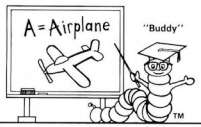

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Brickyard...

The top eight lines comprise the title, copyright, and version information for the program. The next four program lines comprise the entire main program. All we need to do is initialize, then handle the menu (which will call the gameplay if desired), terminate when the game is finished, then end the game. That's not too hard, right? The rest of the program is all in the subroutines.

INITIAL-EYES

To get the program up and running, it needs to be told a few things. First we set default values for soft switches, tell the computer where the boundaries of the video screen are, and then determine the default sizes for the paddle, the blocks, and the ball. The first For-Next loop gets the default color palette from the ST and saves it in an array, so we can fool around with the colors all we want inside the game and then restore the default colors when we eventually leave the program. This function calls the Atari XBIOS function **Setcolor**.

PLAY BRICKYARD

Here we just build the playfield, meaning we clear the screen and draw the blocks and boundary, then call **Bounce It**, which is the subroutine that actually plays Brickyard.

TERMINATE

In here we do two things. First, we restore the screen pointer to point at the original screen we had when the game started up, and then we restore the original color palette. Remember when we saved it? Here's where we put it back down.

BUILD PLAYFIELD

This subroutine draws the game playfield on the ST screen. First it hides the mouse, clears the screen, and sets the background color to black. Then it creates a single brick onscreen, grabs it and saves it in **BLOCK$**, and repeats the create/grab/save process with the ball and paddle. Now it's time to draw the border around the edges of the playfield, made up of a single yellow and a single green line. Finally, it draws the field of blocks: For each column and row coordinate, it places a single block down in the color specified by the current row we happen to be on.

When that is finished, it grabs a copy of the complete field of bricks and places it into **Zz$**, which will be used to quickly restore the field when the last brick has been knocked out. Finally it places the paddle at the bottom of the screen, and refreshes the pointers for the paddle position.

BOUNCE IT

This is the largest subroutine in the program; in here we actually play the game. At the top, it resets game-length variables to their standard starting value. The subroutines **Text_report** and **Init_ball** initialize the text along the top of the screen and the default starting values for the ball. Next the routine hides the mouse and falls into a Repeat loop, which will continue playing the game until the exit condition has been satisfied. In our case, the game will stop only if all the balls have drained out the bottom, or if you hold *both* mouse buttons down during game play.

The first thing to do is refresh the position of the ball to the ball's last known. Now it calculates where the ball will be placed next. There's a check to see if the ball will hit the left or right wall. If so, it will reverse the ball's direction, make a sound (if allowed), and then recalculate the extra-new position of the ball. Next it performs the same tests to determine if the ball has struck the top wall. When the two tests are complete, it grabs the current horizontal position of the mouse and captures the state of the mouse buttons.

I had written Breakout-type games before, and I was sure GFA BASIC was powerful enough to give a reasonably good showing.

Next, it determines if the ball is about to drain off the bottom of the screen. If you have the Never Miss switch on, it will simply bounce the ball back up and make a sound if it's allowed. However, if it is possible to miss the ball, it will check to see if the ball is anywhere within the boundary of the paddle. If it is not, the ball just drained, so it counts it, makes an obnoxious noise, and re-initializes the ball parameters.

But if the ball is at the bottom of the screen, and is somewhere between the left and right edge of the paddle, the ball must be about to hit the paddle, eh? So we reverse the vertical direction of the ball, and then test to see if English is allowed on the ball. If it is, then we generate a new ball direction based on where the ball struck the paddle; if not, we let the ball bounce back up. The next test determines whether you have the Automatic switch turned on. If it is, the paddle position is computed to follow the ball back and forth across the screen. It's a much better player than you are, I assure you.

So much for all those tests – now let's start doing some-

thing onscreen. First we **Vsync** to make sure you draw at a stable time on the screen, then **Put** the ball image down at the old position of the ball, which erases it, and then **Put** the ball image down at the newly computed ball position. Next we compare the old position of the paddle to the new position. If they haven't changed, we don't redraw the paddle; otherwise we erase the old image and redraw it at the new paddle position.

Before we actually move the ball, we check the location on the screen where the ball will eventually wind up. If the color there is greater than color one, then we must be about to place the ball down on a block, which means we're about to hit the block. The blocks use colors 2 through 11; the background of the screen is drawn with colors 0 and 1. If we do indeed detect that the ball is about to enter the block, we make a noise if we can, then quickly erase the ball, Fill the block with the background color zero, which effectively erases it, and redraw the ball. We decrement the count of the total number of blocks onscreen, and increment the number of hits we've made. These two numbers are not just reciprocals of each other—remember, we can have more than one field of blocks. Now we calculate a new vertical velocity for the ball based loosely on the total number of blocks which have been hit and erased so far.

If the number of blocks left onscreen at this point is less than one, then all the blocks have been erased, so we increment the Wave count and replace the field of blocks onscreen. One of the last things to do at this point is update the text line at the top of the screen. Then we loop back to perform the entire ball placement loop again.

INIT THE BALL

This is a very short routine whose sole purpose is to select a random place onscreen to place the ball initially. The subroutine that follows, TEXT REPORT, will update the text line at the top of the screen to reflect the current values for the Wave, number of Hits, the Score, and how many balls are left to play.

HANDLE MENU

This routine starts by grabbing the address of the screen buffers we'll keep pictures in, like the picture that makes up the Menu Screen. With that address, it **Bloads** the menu image into the buffer, and then falls into the menu Repeat loop.

In the loop, we first copy the menu image over to the screen buffer we'll actually wind up looking at, then use the GFA call that corresponds to the GEM **Setscreen** function to place the internal image pointer to show the picture onscreen. Next, we place the button text in the center of the menu, then fall into the Repeat loop that does the color shifting that gives the menu screen its "moving lightbulb" look. Once every loop, we look to see if you've pressed either mouse button; if you have, we try to determine which menu item you are pointing at and handle it accordingly. Otherwise, we continue in this loop until both buttons on the mouse have been pressed, and continue the outer loop until the game is actually finished.

HANDLE MOUSEPRESS

When you press either mouse button on the menu screen, you must be trying to handle one of the selections on the screen, right? So this subroutine goes down the list, trying to find which section of the screen the mouse was in when the button was pressed. For example, look at the first selection, which tests to see if the mouse was near the **Handle_ Beeping** area. If it was, then it calls the routine that toggles the beeping flag, and puts the results onscreen. The rest of the buttons are handled in exactly the same way.

SHOW BUTTON TEXT

This is a generic routine that calls each of the possible button handling routines in turn, thus showing them all onscreen. We call this routine right after we've drawn the initial menu screen, which comes without any buttons actually drawn.

SUPER END-O-GAME

The rest of the subroutines to the end of the program handle the different areas of the menu screen. Some are simple toggles, which write the proper string to the screen. If the subroutine calls for a value to change up or down, then it determines which button was pressed when you pointed at it and clicked. If the left button was pressed, then it decreases the value there, and if the right button was pressed it increases the value, checking for the limits that apply for that particular subroutine.

UNDERTURE

As you can see, it's not that hard to do this in GFA BASIC. I am constantly struck by how the leading edge of technology a decade ago is now a simple programming exercise.

At that rate, within ten years we should have fifth-graders programming CAD-3D 12.0 in BASIC! ■

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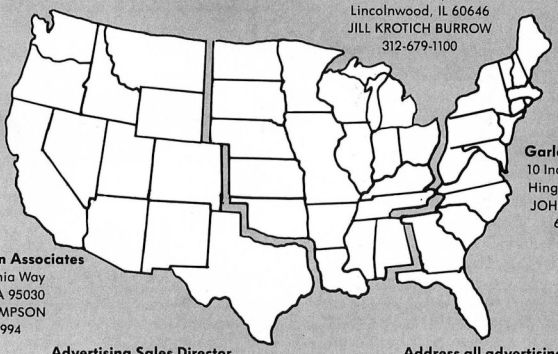

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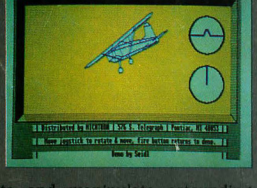

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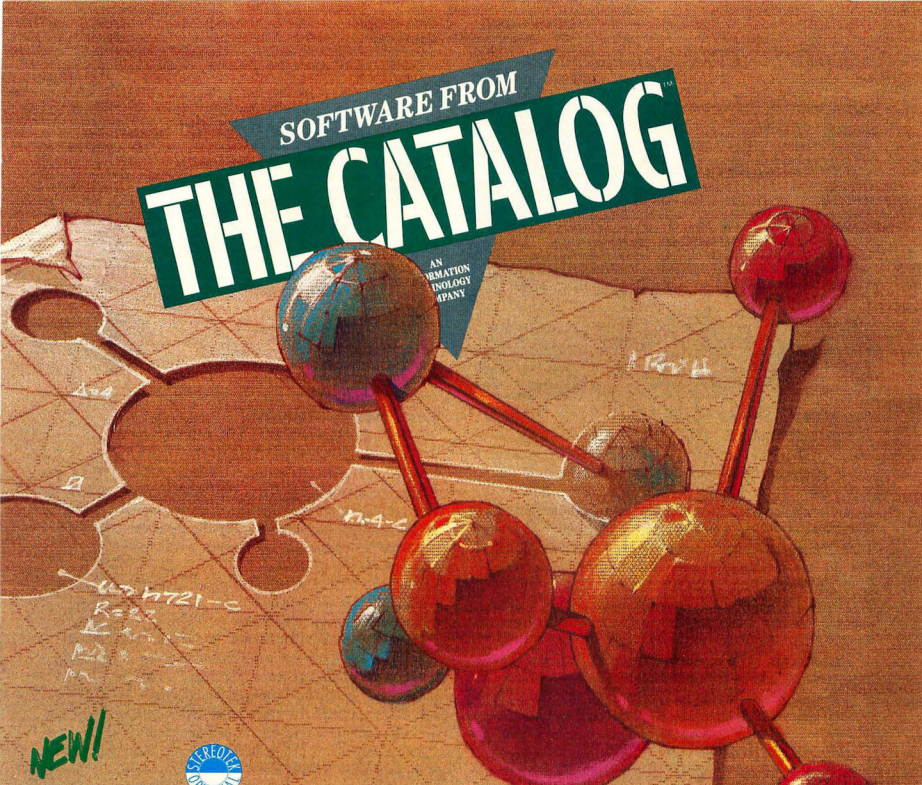

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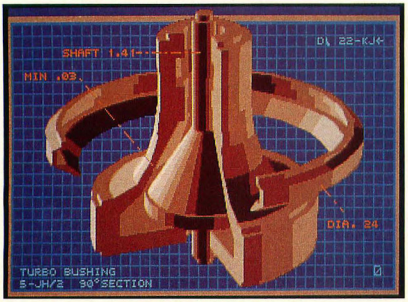

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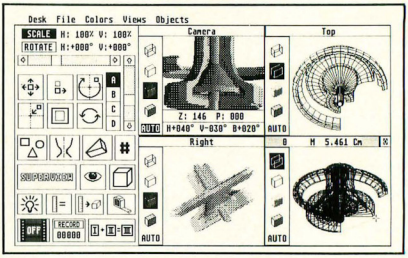

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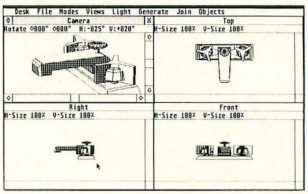

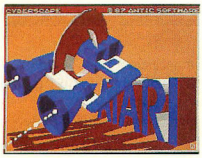

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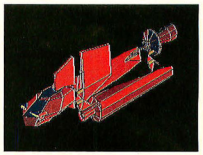

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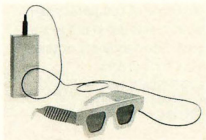
Put on the STEREOTEK glasses and jump into a new universe. Discover a magical world that you always knew existed. That *extra* dimension—DEPTH. Now you can add depth to your computer graphics with the STEREOTEK Liquid Crystal glasses. Solid, realistic, 3D images you want to reach out and touch. STEREOTEK glasses plug into your ATARI ST cartridge port to provide absolutely realistic 3D graphics in full color or hi-res monochrome.

Your STEREOTEK depth-view system includes:

- One pair electronic Liquid Crystal Shutter glasses with four-foot cable (can be comfortably worn over eyeglasses).
- ST cartridge interface unit—supports two sets of glasses (second set optional).
- DEGAS Elite Stereo Desk Accessory.
- Stereo CAD-3D animation and stereo slide show by Tom Hudson.
- For programmers: Complete developer's instructions plus sourcecode for adding stereo to your own programs. (C or GFA BASIC)

The secret to full-color stereo images on a computer screen is electronic Liquid Crystal Shutter (LCS) glasses. Two optical shutters in eyeglass frames are connected electronically to the ST. Every time the ST screen refreshes (60hz/color, 70hz/mono), one shutter closes and the other opens. The monitor displays alternating right and left eye views synchronized with the shutters. The alternating views appear faster than the eye can see, and your brain translates the normally flat monitor image into one of startlingly realistic depth.

STEREOTEK 3D SYSTEM
TH9020 $149.95
ADD-ON GLASSES ONLY
TH9021 $99.95
STEREOTEK 3D SYSTEM
Manufacturer's Sugg. List: $189.95
Catalog Price: You pay only $149.95



LC Technologies is a venture of Tektronix, Inc.

NOW! AVAILABLE FOR USE WITH STEREOTEK GLASSES

NEW!

LCS WANDERER™

by Pyramide Software

Deep space has never been so real!

LCS WANDERER is the first ST game designed for full-depth stereo. Written in France, but set in outer space, this stunning arcade adventure transports you through galactic Space sectors, Black holes, and Limbo. Startlingly realistic, stereo point-of-view animation puts you in the cockpit as you swoop and dive through star fields while dodging enemy craft.

This is no ordinary space shoot-em-up. The bizarre, complex plot involves the ruthless kidnapping of every cat on earth. As you wander through space, collecting purloined pussycats, you run across the Heads of State of the Planetary sectors with whom you must play interstellar poker. LCS WANDERER is a complex, multimodular program—really several games in one. Journey from the dogfights in the Space sectors to the interstellar poker strategies, from the Battlezone-style of the Planetary sectors to the stereo tunnel of the Black holes, and Limbo . . . well, there's always Limbo.

The liquid-crystal clarity of the StereoTek glasses transforms LCS WANDERER into a multi-colored micro universe within your monitor. Includes a completely redesigned solid-surface cockpit, full 16-color displays, and reduced eye-fatigue compared to the original red/blue version.

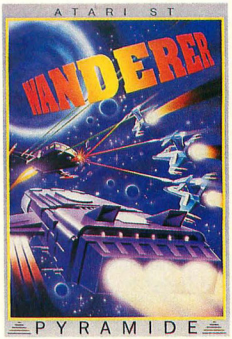
(Requires color monitor and StereoTek glasses)
LCS WANDERER
ST0238 $39.95

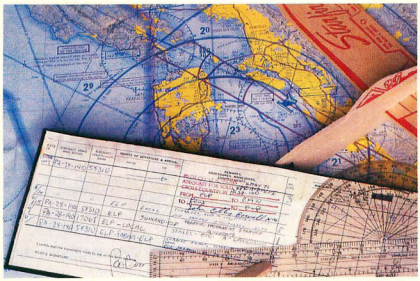
Battlezone™ Atari Corp.

$5,000 CONTEST

Antic and LC Technologies are co-sponsoring a competition to search for the MOST INNOVATIVE STEREO APPLICATION PROGRAM. We're going to pay $5,000 in cash (advance against royalties) for the winner, plus a continuing royalty upon publication here in The Catalog.

For an official entry blank and competition details, write to: STEREO COMPETITION; The Catalog, 544 Second St., San Francisco, CA 94107, or call (415) 957-0886.





NOW! A PROFESSIONAL FLIGHT PLANNER FOR THE ST!

THE NAVIGATOR™

by Scott D. Stephenson

NEW!

• Works with MAPS AND LEGENDS

Sometimes, you really need to know *exactly* where you're going. Have you ever wondered, while boarding your plane, how the pilot will find his way to your destination? The answer is navigation. The pilot follows a detailed flight plan created by his navigator.

Now, accurate computerized navigational planning is available on the Atari ST. THE NAVIGATOR is a professional, automated flight planner created specifically for the ST by professional navigator Scott D. Stephenson. Private pilots, military pilots, navigators (ocean-going as well as air), and commercial operators can use this amazing program to create accurate, detailed flight plans.

Amateurs, arm-chair flyers, teachers and students of navigational theory can discover how the professional navigator plans his flight, compensates for wind direction, establishes waypoints, and calculates times and distances. And we've included a special MAPS AND LEGENDS overlay function which creates custom map overlays, graphically displaying your flight paths.

- PRIVATE PILOTS: You'll love THE NAVIGATOR'S printed flight plan and extensive ICAO waypoint database.
- ARMCHAIR PILOTS: Generate your own flight plans for sub-Logic's FLIGHT SIMULATOR II.
- TEACHERS: Show your students the rudiments of navigation. Use THE NAVIGATOR plus MAPS AND LEGENDS to measure the earth!
- SAILERS: Plan for currents or winds—taking fuel flows and times into consideration.
- THE NAVIGATOR comes complete with these databases: European ICAO, Asian ICAO, and US ICAO.

TWO PROGRAMS IN ONE!

Included with THE NAVIGATOR is THE NAVIGATION TOOLKIT a bonus program of computer navigation tools which performs sophisticated data management operations on your waypoint databases. Create new data files or modify existing files using its advanced random-search technique.

THE NAVIGATOR
ST0245 $49.95

THE WORLD ON A DISK.
MAPS FOR EVERYBODY!

MAPS AND LEGENDS™— The Cartographer

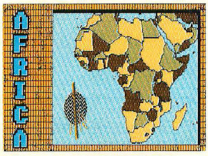
STEREOTEK OPTIONAL

Enhanced Version
Supports (optional) StereoTek Glasses
by Harry Koons and David Chenette

Hold on a second. Now that you've word-processed, spreadsheeted, databased and telecommunicated with your Atari ST, aren't you looking for **something different?**

How about Cartography? Until now, mapmaking has been a unique art mastered by only a few talented people. Not anymore. With MAPS AND LEGENDS, your Atari ST becomes a personal desktop cartography system.

Show your children exactly what the world looks like—with or without political boundaries. And in STEREO, the world globes appear



to be floating **in front** of your monitor. Or print an impressive custom map to go with your travel itinerary. We use MAPS AND LEGENDS all the time at the office for sales and marketing maps. And since it's based on the GEM interface, it's GEM-easy to use!

MAPS AND LEGENDS 3.0
ST0202 $34.95
(upgrade is $15)

800-443-0100, ext. 133

(Continental U.S. and Hawaii) Visa/MC Only

ORDER TOLL FREE

LET'S-GET-TECHNICAL BOX

Packed with features, including: STEREO COMPATIBILITY, BUILT-IN 9000-COORDINATE DATABASE, 11 DIFFERENT MAP PERSPECTIVES, PLOTTING FROM ANY ALTITUDE, WORKS IN ALL 3 SCREEN MODES, BUILT-IN PAINT SYSTEM (and compatible with DEGAS and NEO), MULTI-FONT LABELLER, CUSTOM OVERLAY PLOTTER (create your own maps—build your own map databases), AUTO-LOCATE MODE (reads coordinates, distance and bearing from maps) and so many more that we don't have room to list them all.

DATAMAP COLLECTION I

Expand Your Maps and Legends Database!

NATIONAL POLITICAL BOUNDARIES
Europe, Latin America, S. America, Asia, Africa

PROVINCIAL BOUNDARIES
Australia, Canada, China, U.S.S.R.

(requires Maps and Legends 2.0 or greater)
DATAMAPS
ST0227 $24.95

PLUS HISTORICAL MAPS AND MORE!

BASETWO™

The GEM Database by the Authors of DBMASTER ONE

THE NEXT STEP IN DATABASES, BY THE AUTHORS OF DB MASTER ONE™!

BASE-TWO™

Dan Matejka
and Stanley Crane

It's no fun re-learning your database commands every time you boot it up. And those simplistic "filecard" databases just don't have the power to do the job. Or, maybe you've just created your custom database, entered 5,000 records, and now you want to print a report. . . Good luck. You need a degree in programming just to get some decently formatted hardcopy!

Dan Matejka and Stanley Crane have eight combined years of experience writing databases on computers ranging from the IBM PC to the Apple Macintosh. And their databases range in complexity from the extremely powerful and complex IBM PC DB MASTER to the familiar, introductory DB MASTER ONE on the Atari ST. They've watched the ST database market grow—and they've spotted a gap: Until now, ST databases have been either too simple, or too complex. Until now, ST owners were limited to easy-to-use, inflexible "mailing lists," or involved, programmable "throw-backs" to the CP/M or MS-DOS world. Until now, there was no intuitive, yet powerful database featuring an adaptable report generator. *Until now.*

BASE-TWO fills the gap. Entirely GEM-operated, DB MASTER-ONE owners will find it familiar, yet far more powerful. Look over some of the features and see if it solves your problem:

- Variable field types:
  - Implicit (default)
  - Alpha
  - Numeric
  - Date (calculable)
  - Formula
- Formula fields automatically calculate results from several fields in same record
- Adjustable numeric decimal placement
- Re-edit database at any time without loosing data
- User-definable .DIF file creation for software compatibility (with A-CHART, for example)
- DB MASTER-ONE conversion program
- On-line Help screens
- Optional mouse or keyboard control
- 64 character label length
- 100 fields per record
- Multi-level Search and Sort
- Totally RAM-based for instant action
- Format disks from within program

The intuitive BASE-TWO **Report generator** includes:

- Multi-line field word-wrap; screen and printer
- Completely adustable label or column-format report
- Place "comment" text anywhere
- Customize with printer control codes
- 'Soft" field borders for auto-field truncation

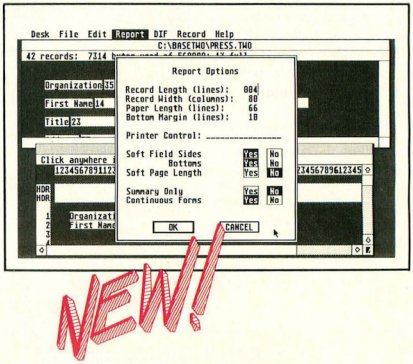
INSTANTANEOUS SORTING!

size	# records	sort time
512K	5,000	5.1 sec
1 Meg	10,000	9.7 sec
2 Meg	20,000	19.2 sec
4 Meg	50,000	46.1 sec

Using a sample eight-field mailing list.

- Optional, automatic date, time, and page numbering
- Print reports to screen, printer, or ASCII disk file for word-processor editing
- Optional subtotal printout
- Adjust number of records per page
- Double-line report headers
- Single-sheet or continuous feed option
- Store 10 custom reports for each file
- Up to 100 unique fields per report

BASE-TWO
ST0246 $59.95



800-443-0100, ext. 133
(Continental U.S. and Hawaii)
Visa/MC Only
ORDER TOLL FREE
24 hours-a-day

PHA$AR IS THE STANDARD BY WHICH OTHER FINANCIAL PACKAGES WILL BE MEASURED

IBM AND AMIGA USERS SAY:

"The first home accounting package I have found in five years that is actually usable."
—Mark Baldwin, Littleton, CO

"I am enjoying your tutorial almost as much as I admire the power and versatility of the software itself."
—Joe Joyce, Huntington, VT

PHA$AR

Professional Home Accounting System and Register
by Marksman Technology

WHAT PHA$AR IS: A friendly, GEM-based, single-entry accounting system that will make your life easier. PHA$AR is fast, sophisticated and contains the best interface programming design we've seen in any ST applications program.

GENERAL FEATURES

- 130 expense/income categories
- 40 accounts (VISA, checking, etc.)
- Up to 500 transactions per month
- Custom check printing
- A.I. parser predicts input, minimizes typing
- Instant help messages with right mouse button
- Relational design integrates financial data

TRANSACTIONS

- Automatic transfers between accounts
- Split-category transactions
- Create transaction macros for repetitive entries
- Point-and-type spreadsheet-style relational summary update

FINANCIAL ANALYSIS

- Easy budget setup and maintenance
- Analyze loan/savings plans
- Display multiple loans simultaneously for easy comparison

DATE/ADDRESS ORGANIZER

- Store up to 250 names, addresses and phone numbers
- Integrated scheduler stores special occasions
- Display calendar with highlighted special occasions
- Optional auto-alert reminds you of important events

RECONCILIATION

- Display outstanding transactions for any account
- Confirm transactions with single keystroke

REPORTS

- Clearly formatted printed reports include:
  - Account Summaries
  - Category Summaries
  - Net Worth Statement
  - Tax Calculations
  - And more . . .
- Display or print total income/expenses, monthly or year-to-date
- Sort categories in any order
- Built in data graphing
- Compatible with A-CHART

TAX

- Design your own tax forms—never out of date
- Calculate tax liability in less than one minute
- Project tax liability at any time

PHA$AR
ST0237 $89.95

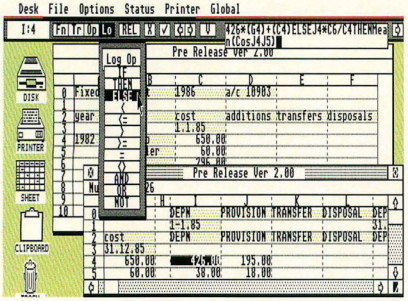
BYTE TESTS SHOW A-CALC ALMOST **TWICE** *AS FAST AS MICROSOFT MULTIPLAN ON THE MAC PLUS!*

A-CALC PRIME™ by Kuma

Kuma Computers, Ltd. UK

That's right! In the February 1987 review of the Atari 1040ST, BYTE magazine selected A-CALC 1.0 to test the Atari against the Amiga and the Macintosh Plus. On recalculation of a 25×25 cell spreadsheet, A-CALC was the clear winner at 4.7 seconds, compared to 7.5 on the Mac Plus, and 6.5 on the Amiga (using Lattice Unicalc).

And now, you can have all the speed of the original GEM-based spreadsheet plus the powerhouse features of the next generation: A-CALC PRIME—it blows away the competition.



Features that made the original A-CALC 1.0 the easiest-to-use spreadsheet ever:

- Up to five windows open at once
- WIDE-VIEW option to see 50 percent more of your worksheet at once
- SEARCH for character strings
- Powerful PRINTER FORMATTING commands

"This is the easiest to use spreadsheet that I've ever seen."
—W. Krieger
Computer Shopper Magazine

- .DIF file compatibility
- Exclusive A-CHART compatibility
- Sparse-matrix design maximizes available RAM

And now, PRIME adds dozens of special features:

- Row and column lock.
- Conditional expressions (IF, THEN, ELSE, etc.)
- MACROS
- Labels
- 8192 rows×256 columns
- Color/pattern coding of formula, text, value, etc.
- SORT and FIND
- Trig functions
- **Sideways** printing (for Epson compatibles)
- High-speed SMOOTH screen updating
- Complete printer control from **within** the spreadsheet
- Password-protected cells (hide and unhide)
- Additional ease-of-use features:
  - **Off-screen** scrolling with the mouse
  - **Out-of-the-way** convenient edit window
  - Cell and range reference by **pointing with the mouse** (even reference cells in inactive windows!)
  - **Ten** clipboards
- Illustrated manual and on-disk examples

In short, PRIME gives you premium spreadsheet power for the rock-bottom price of $59.95. And, for A-CALC 1.0 owners, the upgrade is only $20.00 (plus $5.00 shipping. Enclose your original ver. 1 disk).

A-CALC PRIME
ST0235 $59.95

Make your next presentation the one they **remember.**

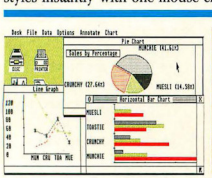
A-CHART™ by Kuma

Kuma Computers, Ltd. UK

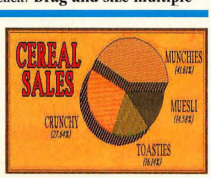
When was the last time you were excited about your spreadsheet? A-CHART makes working with figures **fun and intuitive**.

A-CHART automatically turns your A-CALC (or A-CALC PRIME) spreadsheets into beautiful graphs that are DEGAS-compatible. And, if you don't have a spreadsheet, A-CHART's **built-in editor** will help you organize those numbers into a super-sharp presentation.

View your data in **eight different chart styles**—change styles instantly with one mouse click. **Drag and size multiple**



A-CHART



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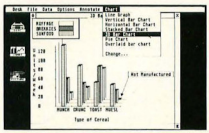
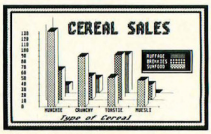


A-CHART



DEGAS ENHANCED

charts in each window, **define your own fill patterns and line styles**. The flexibility of the graphic presentation of your numbers will give you **an entirely new perspective on your business or home budget**. And A-CHART grows as you do, with the capability of storing up to 50,000 data points in a 512K machine and 150,000 datapoint in a 1 meg machine. **Full statistics menu** for detailed analysis includes Mean, Median, Variance, Standard Deviation, Skewness, T-test, F-test, and much more.

A-CHART
ST0230 $39.95
Epson-compatible from A-CHART.
Multi-printer compatible from DEGAS.
File compatible with BASE-TWO, PHASAR, and A-CALC PRIME

"FLASH is my #1 choice on the Atari ST."

—Ron Luks, Founder of CompuServe's SIG*Atari and Atari Developers Forum.

THE MOST POPULAR TERMINAL PROGRAM FOR THE ATARI ST.

FLASH™

Version 1.1
by Joe Chiazzese and Alan Page

If you own a modem, you should be using FLASH. Why? Because FLASH is the best. It will simplify your online time and make telecommunicating more enjoyable and less expensive.

TOTALLY PROGRAMMABLE PLUS BUILT-IN WORD PROCESSING

Imagine turning on your ST and, with **one click** from the GEM Desktop, beginning an online session on your favorite BBS. Watch FLASH dial the number, log on, and **automatically** browse through the most recent messages or files. Then, edit some email in the **built-in message editor,** and upload it right from the capture buffer. Instantly! It's your personal telecom droid. So programmable that you have **total control,** and so GEM-intuitive that you feel right at home the first day you use it. No wonder FLASH is the most popular Atari terminal program of all time.

TERMINAL EMULATION PLUS BULLETPROOF FILE TRANSFERS

Of course, FLASH has a barrel full of terminal-emulation features, such as DEC VT100/VT52 and CompuServe Vidtex graphics, so you can use it with **every** mini or mainframe editor. And talk about bulletproof file transfers! It's got the most **reliable** Xmodem around—never lose a file during transmission again!

PACKED WITH FEATURES!

Here are just a few of the most useful features. Shop around and see if any other terminal program can even come close!

- Built-in GEM word processor with cut & paste
- Programmable "script" language (70 commands)
- Mainframe terminal emulation
- Xmodem (CRC), ASCII and DC2/DC4 file transfers
- Totally configurable to **your** needs!
- $15 online time and CIS membership

Ask your local telecom guru's opinion. FLASH is the winner... **hands down!**

FLASH
ST0220 **$39.95**

FLASH COMMAND CARDS **FLASH-CARDS** **TH9025** **$7.95**

"FLASH is to the Atari ST what Lotus 1-2-3 is to the IBM PC."
—Ken Wolburn ***Microtimes Magazine***

FREE! Try FLASH now and get $15.00 of CompuServe access time, FREE.

Order now and you'll receive a CompuServe Intro-Pak; your free introductory subscription to the CompuServe Information Service with a 46-page CompuServe mini-manual. Plus $15.00 worth of CompuServe access time, free.

*DOUBLE THE POWER OF YOUR **FLASH!** TRANSFORM IT INTO A BBS! ADD KERMIT!*

REMOTE CONTROL ACCESSORY & KERMIT PROTOCOL™

by Joe Chiazzese and Alan Page

One mouse-click tranforms FLASH into a password-protected BBS. You can send and receive files while you're in another room or even away from home!

Plus, you can now use the powerful KERMIT protocol with FLASH. **With KERMIT, you can transfer up to 128 different files without touching your keyboard!** More powerful than the version shipped with the Atari Developer's Kit—total automation for less than $25!

Works with any Hayes-compatible modem.

(Remote/Kermit requires FLASH™)
ST0226 **$24.95**

SOUP UP YOUR MODEM. . . IN SOFTWARE!

NEW!

QUICKTRAN™

The Modem Accelerator
Adrian Jovanovich

Your 1200-baud modem can now transfer files at over 2000 baud. . . 2400 baud now flies at 4000 baud. . . The telephone company can't stop you. It's totally legal!

The Buddy System

QUICKTRAN comes to you as two identical disks. Each contains a desk accessory that works by itself (as a VT52 emulator), or with FLASH. The QUICKTRAN accessory automatically shrinks a file when you're sending it—in real time, smaller than ARC.TTP. And on the receiving end, the file is expanded back into it's original size as it's coming in over the phone lines.

Why spend hundreds of dollars on a faster modem when you can transfer files in almost half the time with QUICKTRAN? Get together with a friend and start a modem conspiracy!

QUICKTRAN
ST0247 **$34.95**
(2-disk set)

800-443-0100, ext. 133
(Continental U.S. and Hawaii)
Visa/MC Only
ORDER TOLL FREE

ARTIFICIAL INTELLIGENCE
Teach your ST, then let it teach you!

EXPERT OPINION™

by Mind Soft

Curious about expert systems and artificial intelligence? Discouraged because most expert systems tools are either for the IBM PC or Macintosh? And usually cost over $700?

Transform your ST into an expert on any subject. EXPERT OPINION creates production-rule knowledge bases with more power than the average university system. And you don't need to know a programming language like Prolog or LISP—EXPERT OPINION is totally GEM-based... so you already know how it works.

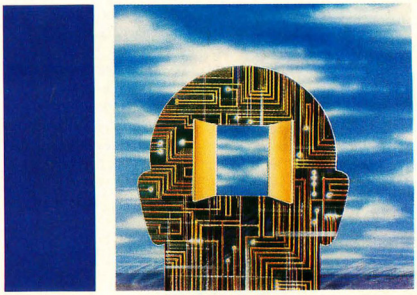
Create your own expert systems for classification of Horticulture, Animal Husbandry, Gemology, Medical diagnosis, Economics—any subject you want. Be a part of the first wave of knowledge engineers!

EXPERT OPINION's "Inference Engine" solves problems three ways: **DEDUCTION** (forward chaining); **VERIFICATION OF A HYPOTHESIS** (backward chaining); or a unique combination of both modes. **CERTAINTY LEVELS** allow you to fine-tune your knowledge base with heuristic control. Plus, the clear, well-written documentation includes a tutorial by Harvard expert and START contributing editor Christopher Chabris.

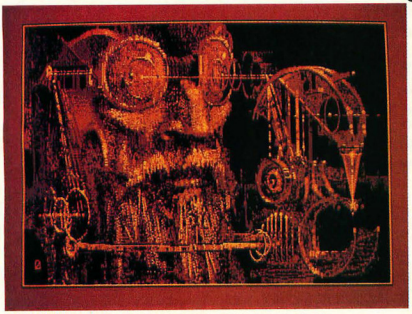
FREE BONUS! To get you started, we've included a disk packed with knowledge bases about a typical application ... Gemology. The six linked knowledge bases will guide you through the classification of over eighty kinds of rocks and minerals. Perfect for studying how an expert system is built.

EXPERT OPINION
(2-disk set)
ST0219 $99.95

WARNING: This is a sophisticated computer science tool requiring study to use it effectively.



BATTERIES INCLUDED



ANYTHING THIS MUCH FUN IS USUALLY ILLEGAL.

D.E.G.A.S. ELITE™

by Tom Hudson

STEREO/TV OPTIONAL

The best-selling graphics software on the Atari ST just got **ten times better!** D.E.G.A.S. ELITE has all the power of the original, **plus:**

1) Multi-color fill patterns
2) Special effects like scaling, perspective distort, rotating, outlining, and color animation
3) Multiple screens in RAM at once (up to 8)—cut and paste between them
4) Color search and replace

DEGAS ELITE
TH9036 $79.95

INTEGRATED FINANCIAL SOFTWARE FROM BATTERIES INCLUDED

THE ISGUR PORTFOLIO™

THE ISGUR PORTFOLIO is three programs in one: Portfolio manager, telecommunications, and calendar/memo pad. Receive Dow Jones stock quotes, CompuServe, The Source, and InfoGlobe financial information, automatically. Consolidate multiple stock portfolios. Hands on management of stocks, bonds, options, commodities, mutual funds—your key to financial success.

A real value for your investment. Plus, **THE ISGUR PORTFOLIO** includes **I•S TALK.** Invest in your future... today.

TH9009 $199.95

A SPELLING CHECKER THAT IS LIGHTNING FAST!

THUNDER™

THUNDER gives you a powerful spelling checker accessible from within your favorite application program. Your accuracy will skyrocket, so the time spent proofing will plummet.

It's so simple. Here's how it works. Example: you're happily writing away and you make a "mstake" and BEEP (**THUNDER** picks up the error with lightning-fast speed). Now **THUNDER** will display a list of similarly spelled words (stake, mistake, etc.).

TH9011 $39.95

TAKE A SECOND FOR TIME MANAGEMENT

TIMELINK™

TIMELINK is a great GEM-based scheduling and time-keeping tool for home and business. Your day, week, month and year appointments are only a mouse-click away. Useful for messages, reminders and much more. There are many incredible uses for this handy elegant, time-saving tool.

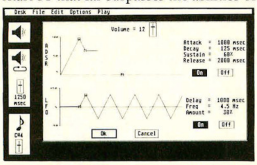
TH9010 $49.95

CREATE NEAR-SYNTHESIZER-QUALITY SOUND EFFECTS WITH OUR ***SOUND LABORATORY.***

G.I. Sound Tool
G.I.S.T.™

by Lee Actor & Gary Levenberg for Synthetic Software

If **sound** has always fascinated you . . . or if you're a programmer or developer. . . take a look at G.I.S.T., the sound editor. G.I.S.T. was created to establish a standard of sound generation on the Atari ST that far surpasses the abilities of the built-in sound chip.



G.I.S.T. is really two programs:
1) GEM-based editor
2) Sound Driver

As you can see from the screen display, the G.I.S.T. editor gives you real-time mouse control over any sound shape. The key to G.I.S.T.'s power is dynamic control of the GI chip. Each voice has three ADSR (envelope) controls and three LFO's (low frequency oscillators). You'll be creating sounds like a professional engineer—Near Synthesizer Quality (NSQ) sound.

For programmers, the Sound Driver is linkable object code that can be used in your own software. Adding superior sound effects to **any** program . . . It's interrupt-driven, so it won't impact the speed of your software. In fact, it's already built into CYBERMATE for CAD-3D—just one of many useful applications.

LET'S-GET-TECHNICAL BOX

- Volume ADSR to shape attack, decay, sustain, release
- Volume LFO for Tremolo effects and AM (Amplitude Modulation)
- Frequency ADSR—frequency shifts up to ± 3 octaves!
- Frequency LFO for Vibrato effects and FM (Frequency Modulation)
- LFO delay lets you add effects at any point in the sound
- MIDI-compatible! Use your keyboard to play the GI chip
- Three sound windows may be open at once

G.I.S.T. is also compatible with CYBERMATE. **Add sound effects to your CAD-3D animations!**

Source-compatible with Alcyon C, Megamax C, and Lattice C.
G.I.S.T.
ST0233 $34.95

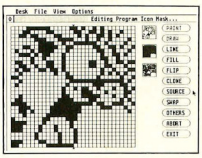
START ICON EDITOR HITS

P.I.E.™ NEW!

Professional Icon Editor
Alex Leavens

It began as a hot little desk accessory in START, The ST Quarterly—you know, "Customize Your Desktop Icons!" or so the copy read. And it was a lot of fun. You could redesign your Trash can to look like a paper shredder. But the programmer, Alex Leavens, just couldn't leave it alone. He kept *adding* things. . .

Now, the Desktop Icon Editor has graduated. P.I.E. is the *Professional* Icon Editor—for programmers as well as desktop artists. Alex has added



icon code generation so you can now design icons for your own programs. And while he was at it, he added a bunch of graphics improvements to delight the artist in you.

New features include:

- Generates Resource Construction Set code for icon images; P.I.E. can be used from within the Resource Construction Set to create and edit icons for the resources you're currently working on!
- Improved Editing Features:
- Faster Paint and Line modes
- New Image Cut & Paste functions
- Selectable Fill Patterns
- Horizontal and Vertical Image Flip
- Multiple Sub-function Menus added
- Nine-level Bi-directional Undo buffer
- In-program Desktop Icon Preview mode
- Improved Keyboard Response

P.I.E.
ST0248 $29.95

CRYSTAL™

(It makes GEM shine. . .)
by Jim Thompson

These are the DOS Icons Digital Research forgot when they wrote GEM. It's too bad Atari didn't put **CRYSTAL** into the TOS ROM's, because for about 30K of code, **CRYSTAL** gives TOS the most powerful features of MS-DOS. Plus, you never lose the look and feel of GEM. And since **CRYSTAL** is a desk accessory, it's always available.

In fact, these eight icons will eliminate all the frustration you feel from not having powerful DOS functions available from within your favorite GEM program (or the desktop)...

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Make your personal version of GEM shine—for $24.95.

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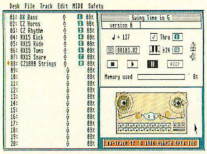

The 20-track polyphonic MIDI recorder for the Atari ST.

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This is the finest, moderately-priced MIDI software we've seen—and by an experienced firm with a strong music background. Easy to use, but no toy! With EZ-Track, you can make multitrack recordings in real time or step time, save them to disk, then play them back in perfect sync. Professional features include: Real-time solo and muting of tracks, quantizing (auto-correcting) of timing, instant transposition of entire song and much more. Memory capacity is over 27,000 notes on the 520ST and over 63,000 on the 1040ST—very flexible MIDI control.

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The patch librarian, editor and sound generator for the CASIO CZ synthesizer series and Atari ST.

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Completely professional MIDI software designed specifically for your CASIO CZ synthesizer. CZ-Android actually **helps you program** your CASIO CZ synthesizer. Then save thousands of your lush new patches with the 20,000-patches-per-disk librarian. Plus, you can edit all CZ parameters either **graphically** or numerically. The unique **Android programmer** lets you listen to thousands of new, original sounds and select the ones you like: to use right away, for graphical editing, or to save for later use. Get the most out of your instrument!

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by Stanley Crane and Daniel Matejka

What if you could view a game of SUPER MISSILE COMMAND from space? You'd be playing RED ALERT! Your cities are under attack. Russian ICBM's and MIRV's are coming in—both over the pole and from subs. **You** make the decisions about where to locate your Antiballistic Missile Silos, Ground-based Lasers, and when to use your space-based Particle Beam Weapon. The **twist** is that you may also place your cities anywhere you want... from your hometown to Havana. Or use the European scenario and defend London, Paris and Rome from the Red Menace! **The perfect blend of strategy and arcade excitement.**

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by Harry Koons

Sure, you can cross that palm with silver, but can you **trust** the results? Your ST, on the other hand, won't leave you in the gutter with empty pockets. And it's accurate! This GEM-based celestial workhorse **instantly** creates charts using formulas for the 9 most popular historical house systems (Placidus, Morinus, Porphory, and 6 more). And if you don't know the coordinates of your birthplace, just **point and click** on the US or world maps! Of course, you can save charts in DEGAS format and create your own **astro-masterpieces.** STAR STRUCK works in color or monochrome and comes with loads of extra fonts. Now you've got something to talk about at the local singles bar.

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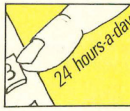

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Fly a Cessna prop plane, soar in a Lear jet, or dogfight with other planes in a World War I scenario. **Completely mouse controlled!** Multiple windows for multiple viewpoints: cockpit, spotter plane, tower, zoom-map—set up as many as you like, drag them, size them and put them where you want. Special custom-graphics routines permit multi-tasking windows. Explore accurate, solid, three-dimensional geographical scenarios which sweep by at update rates as high as 10 frames-per-second. Supplied scenarios include San Francisco, New York to Boston, Chicago to Champaign, Los Angeles, and Seattle.

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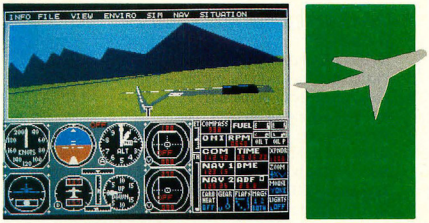
Two experienced pilots on our staff took FLIGHT SIMULATOR II up for a spin and pronounced it a complete success—detailed, accurate, in many ways far better than professional flight simulators. You can preset your position and altitude and adjust your seasonal and weather conditions—including wind direction and



multiple cloud layers. Nine directional views are available from the cockpit **plus** a zoom and a pan. "Instant Replay" feature lets you redo your most successful moments—which you can then watch from any vantage point!

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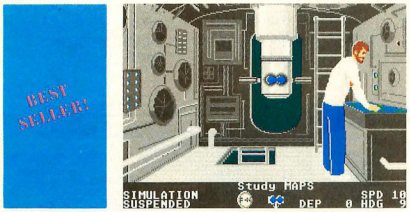

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TURN YOUR ST INTO TWO COMPUTERS!

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by Kuma Computers, Ltd.

Picture this: You're in the middle of hyperwarp to an endangered sector of the Star Raiders™ galaxy when you hear the approaching footsteps of your boss. No problem. You press three keys and your ST **instantly** switches to 1ST WORD™ where you continue working on a letter to the Accounting Director. The boss's steps recede in the corridor . . . press three keys and—WHAMO! Right back in the middle of hyperwarp.

If you have a megabyte of RAM in your ST you can now **load two programs at the same time.** K-SWITCH splits your ST into two isolated 400K blocks, with a shared RAMdisk. You can toggle between two programs instantly—at any time. The inactive program will be frozen in progress, ready to continue right where you left off.

Now you can use your favorite word processor and database **together.** And for the ultimate in financial software, mate A-CALC PRIME and A-CHART, transferring data instantly with the RAMdisk. Even run low res. programs in one half, and medium res. in the other—it's a marvel to see it switch.

If you own a megabyte ST, K-SWITCH will transform the way you use it. Today.

(1 megabyte RAM required)
K-SWITCH
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Can your RAMdisk **accelerate** your **floppy** write speed?
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A RAMdisk is an area of memory set aside as a buffer that responds like a disk drive—only **much faster.** Everybody needs a great RAMdisk, and A-RAM is powerful, simple, and flexible enough for every application.

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Construct GEM resources without spending $300 for the Atari Developers Kit.

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Now you can write professional GEM programs with custom icons and dialog boxes—without spending an arm and a leg. K-RESOURCE makes creating menus, icons, and screen dialogs easy. More powerful than the original DRI Resource Construction Set, K-RESOURCE is also compatible with all other .RSC files.

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GST

Here is the compiler that 1ST WORD™ was written in.

GSTC COMPILER™

by GST, Ltd.

If you've recently begun programming in C, this is the compiler you're looking for. Its GEM Superstructure Library™ will make your very first program run with GEM windows—**automatically.** Write GEM applications without the complex learning curve associated with GEM AES and VDI. **Plus,** you don't have to remember any arcane commands. The compiler and editor use GEM **everywhere**—it couldn't be easier!

The package includes a special programmers version of the GEM-intuitive 1ST WORD™ editor, Linker, C Compiler, 68K Assembler, GEM bindings (including XBIOS) and a comprehensive user manual.

GSTC
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A high-level Macro Assembler with an unbeatable combination of price, performance, and features.

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When you want to squeeze that last drop of performance out of your ST, GST-ASM is the macro assembler that will get the job done. It's got everything . . . high-powered macro facilities and toolkit, extended macro functions, 100% Motorola compatibility, plus the built-in exclusive GEM editor and GEM "shell" operating environment. In fact, it's probably the most elegant and sophisticated assembler available for **any** microcomputer. Naturally, it also creates cross-reference listings, symbol tables, supports include files, generates relocatable code, and produces object files compatible with every high-level language.

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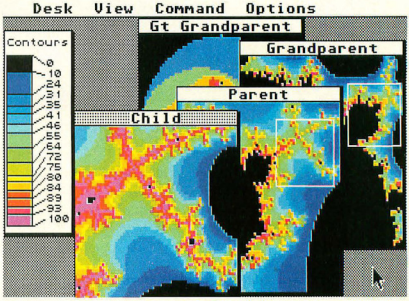

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INCLUDES: **EDITOR, LINKER, MENU+.**

Compatible with G.I.S.T. (page 10)
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MCC MACRO ASSEMBLER

by Metacomco

The MCC MACRO ASSEMBLER is the companion assembler for Lattice C and MCC Pascal. This full-specification assembler was specifically designed to complement those languages. Features include: linker, editor, GEM libraries, macros, MENU+ and 100-page manual.

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by Dan Matejka

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UNITERM, written by Simon Poole, is a public domain GEM-based terminal emulator supporting complete VT100 and Tektronix 4010/4014 modes (with zoom), as well as ASCII file-transfers and other features. Also included on the disk, both with full C source code, are WTERM II, a GEM-based Tektronix 4010 emulator.

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ADVSYS, written by David Betz, is a complete Lisp-like language for creating text adventure games. It offers special facilities for giving descriptions, parsing user-input sentences, and handling objects and actors. Includes complete docs on disk, as well as "Starship Columbus," a completely documented sample adventure that's also fun to play!

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SPELL, written by Eric Bergman-Terell in Personal Pascal, is a simple spelling-checker for ASCII or 1st-Word files. It scans your document, reporting incorrect words and allowing you to add them to the program's unlimited-size dictionary.

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(requires CAD-3D ST0214)

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