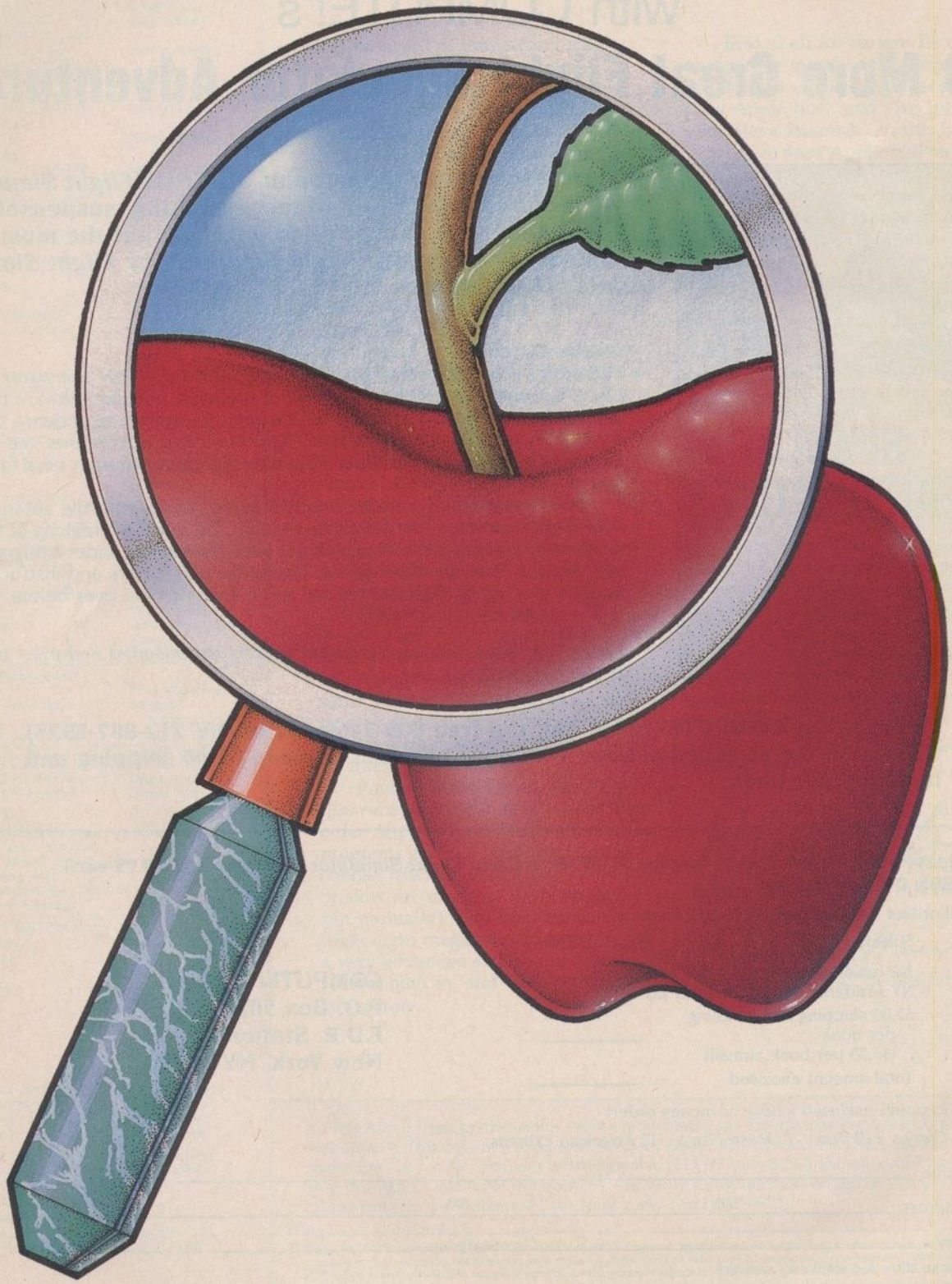

The New Apple IIGS Computer:

A Hands-On Look

David D. Thornburg, Associate Editor

Apple's new IIGS computer is the latest—and strongest—addition to the company's "Apple II Forever" campaign. Completely compatible with earlier Apple IIs, the IIGS offers exceptional advances in both graphics and sound (hence, GS). With a new 16-bit microprocessor (see "The Brains Behind the Brains" in this issue), 256K of RAM, and plenty of peripheral ports, the IIGS redefines the Apple II series in some amazing ways—and IIe owners can easily upgrade their machines to the IIGS.

No wonder it's Apple cofounder Steve Wozniak's favorite machine. Steve's comments accompany this article.

It happens whenever a new computer hits the market. In a matter of weeks, sometimes days, you start to hear two criticisms.

It doesn't use the latest technology. That means the computer is compatible with earlier, similar machines. You heard this when computers like the Apple IIc, Commodore 128, and IBM PCjr were released.

There's no software for the computer. A bit harder to decipher, this means the machine uses some or all of the latest technology. The Macintosh, Commodore Amiga, and Atari ST fit this one.

Seems like a no-win situation, doesn't it? It was, until now.

Apple's recent announcement of the Apple IIGS, the latest addition to its original line, puts both those criticisms to rest. The IIGS is first and foremost an Apple II, and as such it runs nearly *all* of the Apple II software on the market today. Yet it's also a new computer that has its own advanced modes of operation—some of which eclipse the Macintosh in performance.

In short, the Apple IIGS is two machines in one—a product that bridges the gap between the Macintosh and Apple IIe, and in so doing poses what may be a deadly threat to the Commodore Amiga and the Atari ST series.

The Newest Apple

GS stands for *Graphics* and *Sound*—areas where this computer is most noticeably different from its other Apple II namesakes.

Anyone who's worked with the older II-series machines has had to contend with relatively primitive graphics and sound—capabilities that are a nostalgic remnant of 1970's technology. For instance, if two areas of the hi-res graphics screen were to be shaded with different colors, you had to be careful that the colors didn't "bleed." This further restricted an already small palette of colors, and made the Apple II pale in comparison to the eight-bit Atari and Commodore computers.

The built-in sound of the original II was even worse. There was only a speaker which could be "clicked" on and off by addressing a memory location. That some developers were able to create speech synthesis as well as music through this primitive port is miraculous. More modern designs, like those in the Atari and Commodore machines, provide dedicated sound processors that offer users control over the

waveforms and envelopes of multivoice music.

In graphics and sound, Apple had a lot to overcome.

A Tremendous Choice Of Colors

The gap between the original Apple II and the competition grew wider and wider. Apple, after all, has sold the II in one permutation or another for nearly ten years.

The release of the IIGS does nothing to narrow the gap—it's just as wide as it ever was. Now, though, it's the competition that's lagging behind Apple.

The IIGS graphics capabilities offer all the original Apple II modes (to retain compatibility with existing software), as well as two new modes that promise to dominate the time and enthusiasm of software developers. These include a 320 × 200–pixel display mode that supports up to 16 different colors per scan line and a 640 × 200–pixel mode that supports 4 colors per scan line.

Courtesy of Apple Computer, Inc.

The Apple IIGS computer, shown here with the AppleColor RGB monitor and 5¼-inch drive, features 256K of RAM, high-resolution graphics, high-quality sound synthesis capabilities, and complete compatibility with existing Apple II software.

While these modes may not appear to be that much different from the original Apple II hi-res and double-hi-res modes, they are as different as night and day. The difference comes not so much

Infocom introduces four new gam

Infocom,™ the crazy people who brought you "Zork"® and "The Hitchhiker's Guide to the Galaxy,"™ has a habit of coming up with games that add a new dimension to interactive fiction. And the best keeps getting better. Case in point: "Leather Goddesses of Phobos."™ It has a scratch n' sniff card and a 3-d comic book to excite all your senses. Once your interest is piqued, you'll embark on a rowdy romp through the solar system. This hilarious spoof of 1930's pulp science fiction has 3 "naughtiness levels," for the prude to the lewd. "Leather Goddesses" is sure to amuse members of either sex.

One's really warped.

Then there's "Trinity."™ It answers the question of whether a game can be both light-hearted and profound. You journey through a time warp into a mischievous fantasy world where all atomic explosions are mysteriously connected. "Trinity" takes you back to the dawn of the atomic age and puts the course of history in your hands.

One's a real circus.

It has been said that the circus is the only really mysterious thing left in civilization. One thing's for sure, there is plenty of mystery in "Ballyhoo."™ While trying to locate the circus owner's kidnapped daughter, you are somersaulted into a three-ring world of deception and crime. To solve the crime

from resolution (although that has improved) as from the fact that the color choices are picked from a palette of 256 hues, each of which has 16 luminance (or brightness) levels. This gives you access to 4096 colors in all—a tremendous choice.

Apple also announced an analog RGB monitor that shows these colors in their best light. There are no restrictions on color placement. Color bleeding is gone forever.

The purity of the IIGS color display has to be seen to be appreciated. Apple chose to use a noninterlaced screen and the resultant picture is very easy on the eyes.

One side effect of the 16 luminance levels is the ability of the IIGS to display monochrome pictures with a true grey scale, rather than using halftoning techniques that trade off grey levels for resolution. As a result, digitized photographs look much better on the IIGS screen than they do on the Macintosh, where each pixel is either "on" or "off," black or white.

Courtesy of Apple Computer, Inc.

The AppleColor RGB monitor has a 12-inch screen with a resolution of 640 × 200 pixels. When used with the Apple IIGS computer, the monitor is capable of displaying graphics and text in as many as 4096 colors.

Of course, the independent control of hue and luminance is not new to the personal computer industry—Atari was (to my knowledge) the first to introduce this scheme to personal computers.

An Ensoniq Sound Chip

If the IIGS graphics capabilities are good, the machine's sound capabilities are in a class by themselves. Rather than work with the (by now) ho-hum sound chips that provide simple ADSR (Attack, Decay, Sustain, Release) envelopes on sounds made from a small set of basic waveforms, the IIGS uses a custom 32-oscillator chip from Ensoniq similar to the one used in the $1700 Mirage synthesizer. This chip is capable of generating 15 voices of music, allows excellent speech synthesis, accurately reproduces sampled sounds, and is provided with its own 64K of RAM so that music can be played in a background mode while other programs are running.

This chip alone justifies the price of the IIGS to many music fans and fanatics.

es. One really smells.

Every package includes an integral set of props to excite your senses and enhance the game.

and save your hide from a permanent spot in the freak show, you'll need to stretch your puzzle-solving skills to the limit.

One's really haunting.

Wrapping up this new quartet is a classic gothic mystery set in a haunted castle on the mist-shrouded seacoast of Cornwall. In "Moonmist"™ you'll explore the darkest reaches of Tresyllian Castle and get involved with an eccentric cast of characters, including British nobility, while trying to save your best friend from a vengeful ghost. "Moonmist" offers four distinctly different sets of clues, problems, solutions and hidden treasures. So you'll die to replay it again and again.

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Simply follow your nose to your local software store today.

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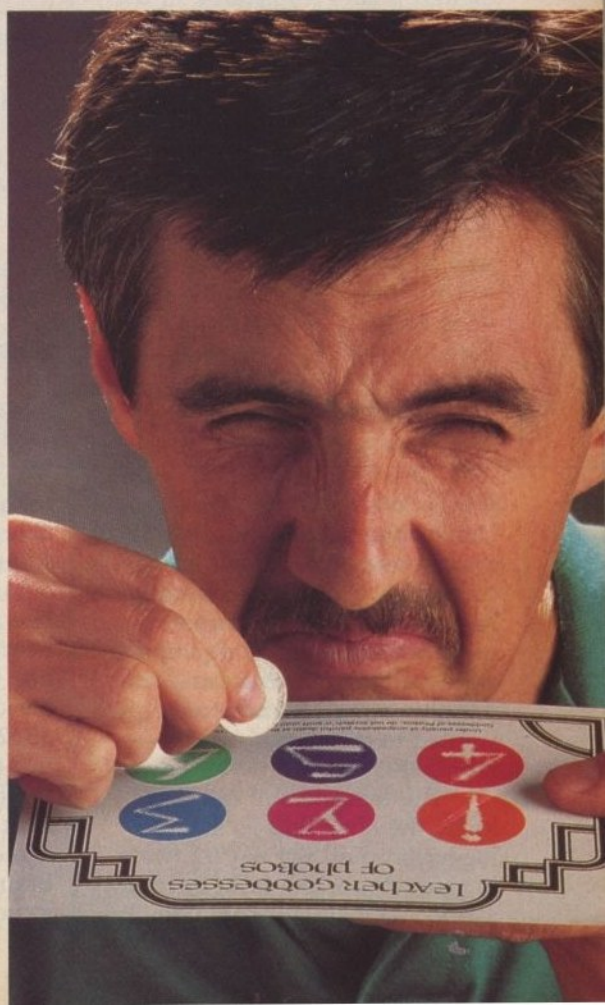

An Interview With Steve Wozniak

Steve Wozniak, one of the cofounders of Apple Computer, Inc., now heads his own company, Cloud9. While at Apple, he started the project that became the Apple IIGS. Thornburg recently had a chance to talk with Wozniak about the new II.

Thornburg: How did you get involved with this project?

Wozniak: We were looking for a project for some good people who weren't needed on existing Apple II and III projects in late 1983. I started thinking about some things and a small group of us started on a new project.

Thornburg: What led you to the 65C816?

Wozniak: In the beginning, a bunch of us sat down with a basic concept—to build a very simple, very fast machine with this new processor. There were some things about the 65C816 we liked, although it isn't everything in the world.

The major concern for me at the time was that the Apple II was constrained to the 64K address space of the 6502 (microprocessor). To have direct addressing to 24 bits of address was the key that would allow the new processor to let Apple II applications move up another level without having switched banks of memory. When we talked to the chip developer we saw that speed could be increased as well.

Our early ideas for the computer had it running at 8 MHz. Soon we found we had to back off to about 5.5 MHz, and then to 2 MHz for that version of the processor. In the end, the product came out at about 3 MHz, which is a good compromise.

Thornburg: Did you stay involved after leaving Apple?

Wozniak: The original project started in late 1983 and I was quite active in it at the time. By 1984, I was so involved with other activities in the company that I couldn't spend the time on this project that I would have liked. I was able to attend meetings to keep up with the progress of the new machine. I've continued to be a strong supporter of this project.

Thornburg: How did the project evolve?

Wozniak: The original project was to make a better Apple II—the ideal *AppleWorks* machine. There were pressures to change the machine—to make it a completely new product. These changes would have been very costly to implement and I was getting disillusioned with the project at that time.

Finally the idea for the IIGS developed in its present form. I love the way the IIGS came out.

Thornburg: Is it your favorite Apple?

Wozniak: Yes—no question! I still use the Apple II a lot—the slots are important to me for burning PROMs and doing other things.

Thornburg: What about user interfaces?

Wozniak: From the very beginning I was a supporter of the idea that we should support the Macintosh user interface because it was better than what we had. We needed to put it on the II. At that time there wasn't much interest in that, so I am very happy that it finally appeared.

The Apple II is the accepted machine, and now it is striving for the state of the art—to be as good as it can be.

Thornburg: What do you think about Apple's upgrade policy?

Wozniak: To tell the truth, I'm glad they did it. When we went from the Apple II to the II+ we said that the II+ was a better machine for the same price and we knew that people would go to it, but we let the change take place slowly over a year. That way nobody got mad. We also offered a board that made the II into a II+, and a board that made the II+ into a II. We acted like we at Apple were owners of the machines ourselves. I was very happy to see that the Mac upgrades were handled that way.

Eventually I think the IIGS will take over [from] the IIe, but it is good that Apple isn't forcing the change.

Thornburg: Will it be the Apple II forever?

Wozniak: For the home, I still usually recommend the II over the Mac. If you are an *AppleWorks* person, the II is all you need. And, as I said, I love the IIGS.

All This With A 6502?

One of the reasons that the 68000-based computers like the Macintosh, Atari ST, and Amiga have become so popular is because the older eight-bit chips were running out of steam—especially when programmers wanted to create new user interfaces.

The designers of the IIGS knew the 6502 and its slightly bigger brother, the 65C02, were inadequate for the task, but they wanted to maintain compatibility with the massive amount of available software on the market. The solution was to use the 65C816—a 16-bit processor that can emulate a 6502. The 65C816 forms the heart and brains of the IIGS and, like the Roman god, Janus, looks backward—to the days of the 6502—and forward—to capabilities that go beyond the limits of the 8-bit world. (For an in-depth look at the 65C816 and its designer, William Mensch, see "The Brains Behind the Brains" in this issue—Ed.)

As a result, IIGS not only runs existing Apple II software, but it is also capable of supporting the various user-interface tools (like menus, windows, and icons) that have made the Macintosh so popular.

Easily Upgrade Your IIe

Lift the hood on the IIGS and you're treated to a view of a circuit board identical in size to the one inside the Apple IIe. This lets Apple offer a special upgrade for IIe owners. For a modest price

you can take your IIe to your dealer and upgrade to a IIGS. Only the power supply, case, and keyboard are retained—the circuit board and basepan are replaced.

A closer look at the circuit board reveals a familiar set of seven peripheral card slots that accept the same plug-in cards used by the Apple IIe. But unless you have a lot of old cards lying around, you probably won't have to use any of these slots.

That's because the back panel already features a game/joystick port, a disk drive port (which accommodates up to six drives in either the 5¼-inch or 3½-inch format), two serial ports (including support for the AppleTalk network), composite video out, audio out, and the analog RGB video output. The remaining back panel port is the Apple DeskTop Bus—up to 16 keyboards and mice may be connected via this bus. (The IIGS is the first computer in the II line to be shipped with a mouse.) Expect to see a lot of interesting peripherals on the market that take advantage of this DeskTop Bus.

The circuit board contains 256K of RAM that can be expanded (through a built-in connector) to eight megabytes. The on-board 128K ROM can be expanded to one megabyte, another indication of the possible third-party support for this computer.

Several custom chips fill out most of the remaining real estate on the IIGS's circuit board. One of the most interesting is the "Mega II"—a chip effectively duplicating an entire Apple IIe or IIc. Don't be surprised to see this chip used to create a three- or four-chip Apple IIc someday soon.

Sound, graphics, and the Apple DeskTop Bus are each controlled with dedicated chips, shifting the burden from the microprocessor. The result is a computer that provides tremendous room for software development.

Turbo II

The IIGS clock runs at 2.8 MHz, almost three times the speed of the Apple IIe. As a result, programs designed for the older II-series machines run at close to three times their normal speed. This is an advantage for some programs, but not for others. Most players would be truly hard-pressed to set new records if games ran at three times their normal speed. To compensate, you can set the computer's speed to the "old" value with the IIGS's onscreen control panel. Games written for the IIe or IIc will then play at the correct speed.

The control panel also lets you set the color of the text and the background, as well as the pitch and volume of the internal "beep." Again, while this kind of control is familiar to owners of Atari and Commodore computers, it's a welcome addition to the Apple II line.

What About Software?

At the time of this writing well over one hundred outside developers were actively engaged in creating software for the IIGS. By the time you read this, the number is probably triple that, with new entries being announced every day.

Apple itself, however, is conspicuous in its absence from these announcements. The company appears to be content to provide support for outside developers rather than dedicating its resources in aggressively developing its own programs for the IIGS.

There's good reason for this approach. Unlike the Macintosh—a computer released with no immediate third-party software support—the IIGS runs the vast library of Apple II programs. The IIGS is a machine that you can use from the moment you unpack it and set it up. As new products are developed to take advantage of the IIGS, people will move away from the pure Apple II software and toward the newer titles with their improved performance. aa

The GS At A Glance

Memory

256K RAM
- Expandable to 8 megabytes

128K ROM
- Expandable to 1 megabyte

Graphics Modes

40 × 48 (Apple IIe/c low-res)
- 16 colors per scan line

280 × 192 (Apple IIe/c hi-res)
- 6 colors per scan line

560 × 192 (Apple IIe/c double-hi-res)
- 16 colors per scan line

320 × 200 pixels
- 16 colors per scan line

640 × 200 pixels
- 4 colors per scan line

Colors

40 × 48 (Apple IIe/c low-res)
- 16 colors

280 × 192 (Apple IIe/c hi-res)
- 6 colors

320 × 200
- 4096 (256 hues, 16 luminances)

640 × 200
- 4096 (256 hues, 16 luminances)

Sound

32-oscillator Ensoniq chip
- 15 voices
- Speech synthesis
- Reproduces sample sound
- Dedicated 64K of RAM

Microprocessor

65C816
- 16-bit processor
- Clock speed—2.8 megahertz
- Emulates 6502 for Apple IIe/c compatibility

Ports

Game/joystick port

Disk drive port
- Accomodates up to six 5¼-inch or 3½-inch drives

Two serial ports
- Support for AppleTalk

Composite video out

Audio out

Analog RGB video out

Apple DeskTop Bus
- Connects up to 16 keyboards and mice

Slots

Seven peripheral card slots

David Thornburg is an associate editor with COMPUTE! *magazine, a frequent contributor to other publications, and the designer of* Calliope*—an idea processor for the Apple IIe, IIc, the Macintosh, and now the IIGS. He may be reached in care of this publication.*