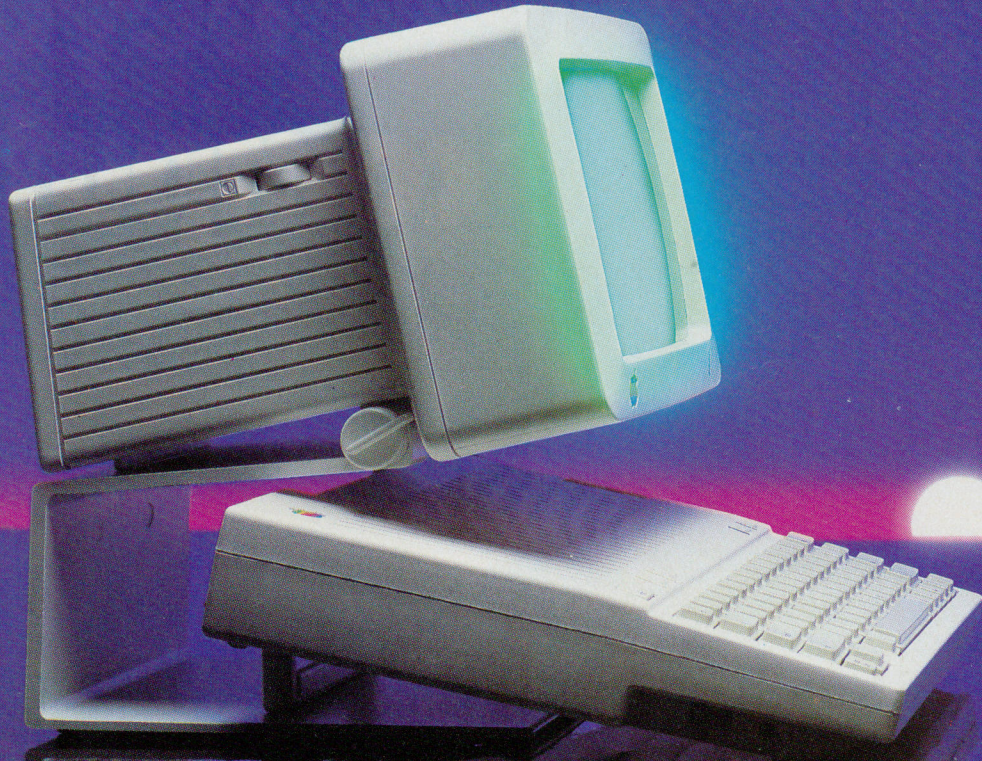


# FACE



## THE APPLE IIc VS

*Which of these midpriced computers is right for you?*

**BY PETER COSTA & JOSEF BERNARD**

**I**BM and Apple are fighting for the hearts and minds of future computer buyers with aggressive advertising campaigns to promote their two hot "little" machines, the IBM PCjr and the

Apple IIc. Both micros appeal to the vast middle market of potential computer users who are looking for full-featured personal computers, but ones priced below the heavy desktop models.

The race has quickened with IBM's revamping of the *jr*. Because of disappointing initial sales and much loud criticism of the *jr*'s "Chiclet" keyboard, IBM has retrofitted the *jr* with a new typewriter-style keyboard (see below) and increased the *jr*'s memory capacity. These enhancements may help the *jr* claim some of the territory that is sought by the Apple IIc.

But few analysts are willing to predict who will win the contest for this lucrative middle ground. Microcomputers, like automobiles, succeed or fail in the marketplace for reasons that often are based on emotion rather than logic. Tell a sports car owner that his dream machine is a multi-thousand-dollar mistake because it is hard to repair and expensive to maintain, and he'll counter with a catalog of features about handling, acceleration and personal style.

So it is with most micro owners. Even Osborne 1 users will find something positive to say to vindicate their purchase of

# OFF:



## IBM'S NEW PCjr

the mini-screen, now-extinct portable. Apple lovers and IBM devotees are the same: They're emotionally involved. With that in mind, let's examine the IIc and the *jr* and try to compare their features.

Perhaps most striking is the difference in appearances. The IIc, designed by a European firm, has rounded corners and smooth lines and looks as if it could pass a wind tunnel test for aerodynamic flow. The *jr* looks like a boxy Model T, with the rectangle as its basic aesthetic building block. This look is reinforced by add-on units and ROM cartridges that are

also rectangular. The IBM design philosophy seems to favor function over form and few of their machines break with tradition: They are nearly all uninteresting boxes with keyboards.

In a comparison of monitors, the IIc appears to be the clear aesthetic winner, with its monochrome unit, perched on a swivel stand. Our monitor mounting bolt, though, had the unnerving tendency to loosen up with use, causing the monitor to drop downward in a gravity-loving Newtonian arc.

The color monitor for the *jr* is apparently intended to sit on top of the com-

puter (as you see it here and in the IBM ads) but using it in this manner may not be feasible. The *jr* manual cautions against using a video display closer than 6" to the computer, stating that doing so may cause the computer to function erratically. And, in our tests we found it did—we experienced repeated disk errors until we removed the monitor and set it to one side of the computer. That solved the difficulty, but also wasted a lot of desktop real estate.

*Peter Costa is Executive Editor and Josef Bernard is a Technical Editor of COMPUTERS & ELECTRONICS.*

# CHIP FOR CHIP

BY MARK MOERDLER

**A**t the heart of the PCjr and the Apple IIc are, respectively, the 8088 and the 65C02 microprocessors. Because the architectures and capabilities of these microprocessors influence the construction and performance of the two computers, we will attempt to point out the major differences between them.

Key aspects of the design of any microprocessor include word size, maximum addressable memory size, and processor speed. Other, less important, issues we will not consider: interrupt-handling mechanisms, stack mechanisms, number and kinds of registers, instruction sets, and available coprocessors.

The 65C02 is classified as an 8-bit mi-

croprocessor because both the data bus and the microprocessor work with only 8 bits at one time. The 8088 also has an 8-bit data bus. However, internally, the registers, arithmetic-logic unit (ALU), and control logic handle 16-bit data. Due to this difference in data width, the 8088 is called a hybrid, or an 8/16, machine. The ability of the 8088 to handle 16 bits internally allows it greater precision and speed when dealing with any data, especially numbers. While an 8-bit machine can only handle at one time integers as large as 255, a 16-bit machine can handle integers as large as 65,535. The limitations of an 8-bit unit can be overcome by special-purpose number-handling software, but at the expense of

poorer performance.

One must not be misled into believing that the 8088 is a 16-bit machine. The 8088 is able to receive over its data bus only 8 bits while internally it can handle 16 bits. Therefore, it takes two 8-bit bytes to receive the full 16 bits. The 8088 chip designers attempt to alleviate this data bottleneck by creating a 4-byte (1 byte = 8 bits) instruction queue within the 8088. Thus the high-speed memory allows the microprocessor to receive outside data as fast as possible while allowing the processor to work as soon as sufficient data is accessible.

The 8088 lies somewhere between the 65C02 and a standard 16-bit machine in handling data. It can handle 16-bit

## Hardware Considerations

The IIc features built-in 80-column capability (switchable to 40 columns), an integrated 1/3-height disk drive and a connector for an external drive. Unlike its predecessors, the IIc is "slotless" and is expandable only through ports in the back of the machine for a serial printer, plotter, modem, mouse, hand controls and joystick. There is, however, no facility at present for expanding its memory beyond 128K.

The PCjr, which also can display either 80 or 40 columns and contains a single disk drive, is, in many respects, more expandable than the IIc. While the jr has no provision for a second IBM disk

drive, second drives are available from outside sources. There are also slots for two ROM cartridges; much software that might otherwise be available only on disk may show up for the jr in cartridges.

In display resolution, the jr has the edge over the IIc. While the latter's high-resolution color graphics mode is just a trifle coarser than the jr's medium-resolution mode, the jr adds a high-resolution color graphics mode. This mode, while providing only two colors, is comparable to the IIc's—monochrome—graphics mode. It should be noted though, that while the IIc's resolution is slightly inferior to that of the jr, the

number of colors available from it is somewhat—although not significantly—larger in comparable modes.

If disk capacity is important to you, the jr wins by a margin of greater than 2:1. It can store 320K on its single drive; the IIc's maximum is 140K. Of course, the fact that a second drive is available from the manufacturer for the IIc but not for the jr is an important consideration. This not only doubles the IIc's external storage capacity, but also facilitates making copies of disks and doing other operations. If you expand the jr's memory, there is software available that will let you partition a section of that memory to act as a RAM disk, in effect

**Photo below shows the relative sizes of the Apple IIc and IBM PCjr. The former occupies less desk space. On the opposite page, upper left, are a trio of keyboards: the IIc, the IBMjr's old "Chiclet" style, and the new**



words like a 16-bit machine but receives data 8 bits at a time like an 8-bit machine.

Both the 65C02 and the 8088 have 16-bit address busses. However, the 8088 augments its bus with a hardware segmentation scheme and segmentation registers, which allows the chip to access 1 megabyte of read-write memory. The 65C02, without additional memory-handling hardware, is thus limited to 64K of direct memory access. In the Apple IIc, the memory limitation is overcome by the use of additional software and hardware. Larger memory is achieved at the cost of degraded performance.

The PCjr has a 4.77-MHz clock, while the Apple IIc runs only at 1.02 MHz.

The difference might suggest that the PCjr should run nearly five times as fast as the Apple IIc. In fact that conclusion might be inaccurate for these reasons:

1) Different operations take different numbers of processor cycles, depending on the architecture. Thus a specific instruction may require more cycles in the 8088 than in the 65C02.

2) The PCjr employs a screen refreshing method that steals one out of every four cycles from the processor. The PCjr uses the same memory for the screen as for programs.

3) As stated earlier, differences in the size of the data affect the processor speeds.

On the average, the 8088 in the PCjr is

roughly twice as fast as the Apple IIc's 65C02 for equivalent instructions.

The points we have mentioned seem to imply that the PCjr has more horsepower under the hood than the Apple IIc, but it is not that simple.

The processor is not usually the device that slows microcomputer performance; rather, the disk drive, memory, printer and screen update speeds do. Also, a great deal of a microprocessor cycle time is spent in the operating system, whose efficiency can alter the results the user observes. Lastly, most programs are written in high-level languages that are not efficient and can rob a computer of any advantages inherent in its microprocessor. ◇

giving you the equivalent of a second drive, but that is not something you can stick in your briefcase and take home with you.

The jr uses DOS 2.1, the latest version of PC-DOS (except for DOS 3.0, which is intended primarily for the new PC AT). The IIc can run regular Apple DOS, Pascal, or Apple's new ProDOS. It's difficult to say which is the best, since once you are accustomed to an operating system it becomes hard to see its limitations. The DOS from IBM has a few more features (like time-and-date stamping of files), but most people will probably not come into close contact with any of the operating systems in the

normal course of running their applications programs.

To make ProDOS easier to use, Apple has available a "front end" called AppleWorks that acts as a buffer between the computer user and the operating system. Learning to use PC-DOS requires wading through pages and pages of manuals, and, perhaps, even referring to books on the subject written by people outside IBM.

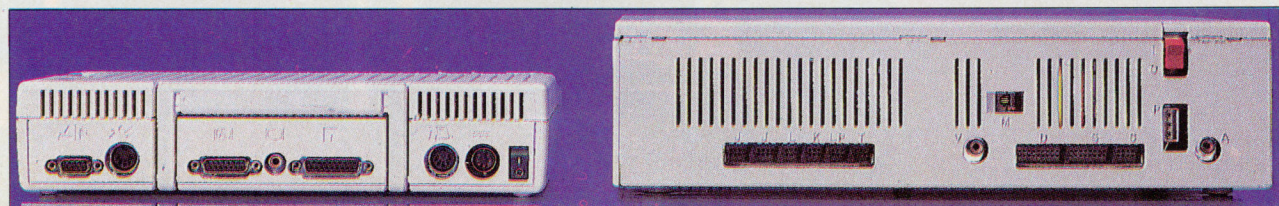
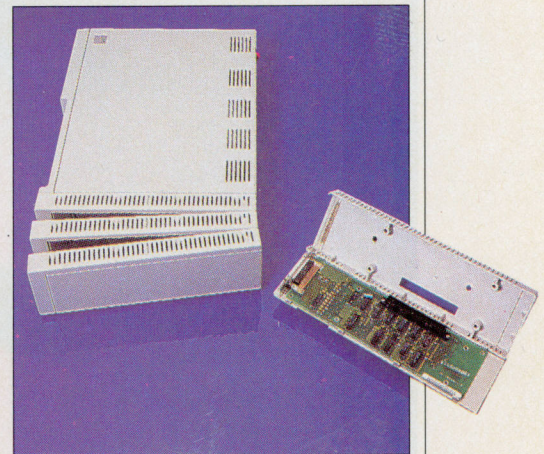
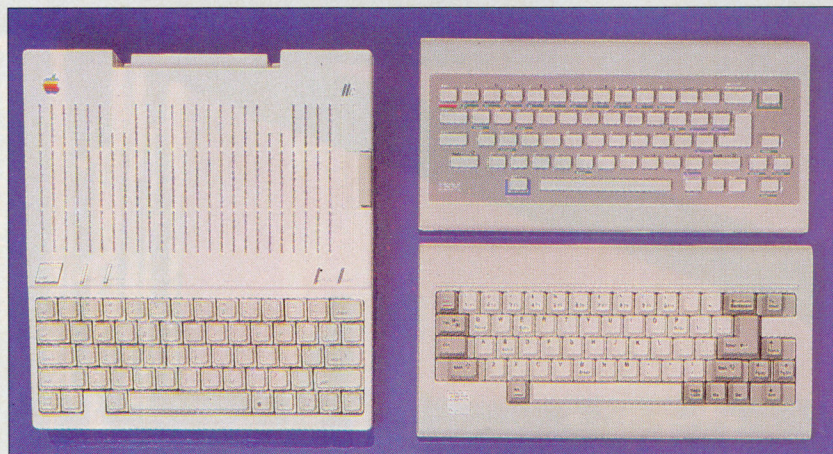
The jr has a number of connectors on its rear panel for peripherals such as a video monitor, a TV receiver, and a serial device (e.g., a printer, mouse, or external modem). If the optional direct-connect modem is installed, it too is

accessible from the rear panel.

While neither computer is truly bus-oriented, at least part of the jr's bus structure is brought out to the world, hidden behind a panel on the computer's right side. When this panel is removed, additional memory (up to three 128K modules, for a total of 512K), a parallel printer interface, or a speech digitizer can be added. If more than one module is added, an auxiliary power supply module must also be used. This type of expandability, which allows for a certain amount of flexibility in putting together a system to meet your requirements, is a definite plus in the jr's favor. Note, how-

(Continued on page 93)

**typewriter-style introduced for the IBMjr. Photo at upper right, shows the add-on expansion modules for the IBMjr. At the bottom are rear views of the IIc (left) and the jr (right) showing peripheral ports.**



## Faceoff

(Continued from page 53)

ever, that a special utility (supplied by IBM) is required to allow you to make use of memory in excess of 128K.

Probably the greatest change in the new PCjr is its keyboard. The old "Chiclet" type with the hard-to-read legends has been replaced by one with real keys that can be used by a touch typist. In a much-publicized move, IBM has made this new keyboard available free of charge to owners of *jr*s with the old style one. The cordless infrared arrangement has been retained and seems to function as well as the original.

The Apple IIc's keyboard is an integral part of the computer. It, too, is suitable for touch typing and offers, as does the *jr*'s, upper and lower case. In what is probably a bid for the educational market, Apple has included a switch that turns the QWERTY keyboard into one using a supposedly more efficient Dvorak layout. The keytops are removable so they can be arranged to accommodate whichever layout is in use.

The CPU in the IIc is a 65C02 8-bit CMOS microprocessor running at 1.02 MHz, an enhanced version of the Apple II's 6502. The *jr* uses the same 8088 found in the larger PC, with a 4.77-MHz clock. This does not mean, though, that the *jr* is four or more times faster than the IIc (see page 52).

The number crunching power of both machines is impressive. The *jr* in many applications may not be faster than the IIc, despite its so-called 16-bit CPU—while the *jr*'s 8088 has a 16-bit internal structure, all its dealings with the rest of the system and with the outside world are 8-bit operations. In similar "painting" programs, the IIc actually seemed somewhat speedier, perhaps, due in part to how the software was written but also due to the extreme efficiency of the 6502 family for certain types of operations.

But despite its somewhat awkward appearance and construction, the *jr* is probably a better computer in terms of hardware simply because it has expansion capabilities the IIc lacks.

### Portability

The Apple IIc has a handle and is designed to be portable. (The handle also serves to elevate the rear of the computer and to permit air to enter it for ventilation.) The *jr* has no handle and is not really intended to be portable, although a carrying case is available for it.

The IIc can be powered by either an external supply that requires 120 V ac (house current) or directly by 9-20 V dc. This latter capability means that it may obtain its power from a car's cigarette lighter receptacle. The *jr* will operate

only from 120 V ac. The ac-to-dc conversion is done externally for the IIc, internally for the *jr*.

Even though Apple has given the ac power supply that comes with the IIc a contoured look, you still get the feeling that it should be powering an electric train rather than a computer. IBM uses a similar-sized unit for the 128K *jr*, but adds a second heavy black transformer to power its add-on modules. None of the power supply units are particularly lightweight.

As of this writing, the IIc uses a video display, but Apple is working on an 80-column by 25-line LCD screen that should be available about the time you read this. A battery pack is already being marketed by a third party vendor. These features could make it truly portable.

### Software

Both computers have broad software bases, and there are probably comparable programs for the basic 128K versions of both. In fact, the 128K Apple can probably run more sophisticated programs than a 128K *jr*.

Why? Is the 8-bit computer more powerful than the 16-bit one? Not necessarily, but for some reason 8088 programs seem to take for granted the availability of lots and lots of memory, and the result is a sort of "software sprawl." Programs for 8-bit computers are *tight!*

However, the *jr* will find favor with a number of users simply because it can run a number of such popular programs as Lotus 1-2-3, which, because of microprocessor incompatibility and memory requirements, cannot be used on the IIc.

### Documentation

The user manuals provided with the IIc are a joy to read. They are colorful, imaginative and clearly written. The *jr* documentation is comprehensive but often dull. It seems that IBM does not devote as much effort as Apple to make the support materials user friendly. In fact, many of the manuals for the IBM add-ons are boring, dense and a bit reminiscent of IRS tax manuals. But the major *jr* book, "The Guide To Operations" manual, in general is readable and fairly straightforward.

Documentation, as any micro owner painfully knows, is very important, especially in the target market where there are so many computer novices. Apple seems to understand; IBM seems to agree but apparently only grudgingly.

### Which One?

Which of the two computers will benefit you the most? To a great degree, that

depends on who you are. The determination will rest primarily on the software available for each.

Apple has long known that if it could get its products into the educational system and have millions of students learning about computing using Apples, these same students (and their teachers) would later buy Apples for home use. Consequently, there is a large amount of educational software for the Apple.

IBM, increasingly aware of the value of this strategy, has introduced a reading program for the primary grades called "Writing to Read." The program helps teach children how to read by helping them type words and parts of words representing speech sounds on a *jr* or PC.

The company, some educators believe, may also be reaching for the educational market with the *jr* and its optional speech synthesizer. In addition to having its own vocabulary of 196 words in ROM, the device can record about 18 seconds worth of speech in digital form (from an accessory microphone) and is programmable from BASIC. It could easily find use in language laboratories or other learning reinforcement applications.

As of this writing, however, Apple continues to dominate the schools—especially at the K-9 level. IBM is increasing its penetration of high schools, but so is Apple. In the light of recent events, many analysts believe that it is at school that the major battle of the war for the educational market will be won.

On the other hand, if you principally use computers in business, your choice will probably be—whether you consciously make it or not—the PCjr, again because of the software factor.

While there is undeniably much business software available for the Apple, any *new* business software, with very few exceptions, will be written for the PC family of computers. And, while that software is aimed at the PC/XT/AT market, the *jr*, with its expanded memory, will be able to run most of it. If you use a PC at work, you'll probably want a *jr* at home.

Of the two computers, the IIc is the better looking and more sturdily constructed. The software available for it makes it the better suited for home and personal use, especially in a family with school age children. But the PCjr, with its expanding software base and the support of the world's largest computer company, is probably the choice for those who wish or need to remain in the software mainstream. Regardless, considering their prices, one cannot go wrong in buying either machine. ◇