In addition to this innovation, Zilog also came up with another important commercial advantage. Whereas the Intel chip depended on a special clock generator chip as well as a system controller chip, the Zilog team managed to combine all the logic needed for a microprocessor-based computer onto a single chip. Even though it was relatively expensive, the fact that it could replace several other chips made it very attractive to manufacturers.

Although the 6800 had not fared well compared with the 8080, it was still popular among some designers and programmers. Motorola eventually designed a highly sophisticated eight-bit microprocessor called the 6809 that enhanced the 6800. Unfortunately, by the time the 6809 hit the market, a rival company called MOS Technology had come out with a further 6800 enhancement called the 6502. This is the most popular of a number of processors known as the 6500 series. All the members of this series use the same instruction set, but differ in their power and capabilities.

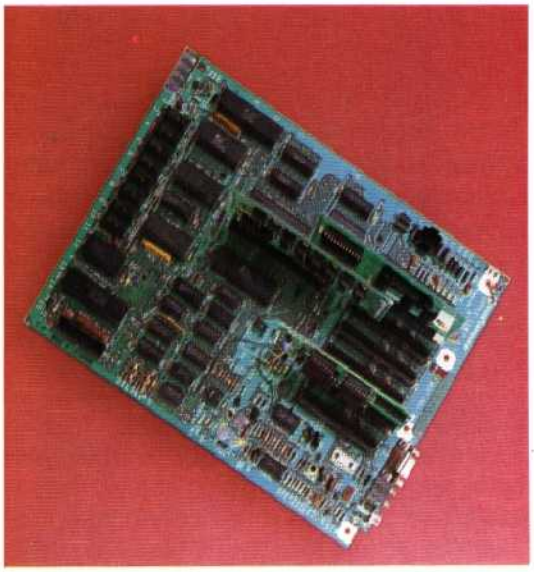
MOS Technology's 6502 follows a design philosophy very close in spirit to Motorola's 6800, but it is not compatible with the 6800 either in terms of hardware requirements, or software compatibility. The Z80, on the other hand, incorporates the entire instruction set of the 8080, and can replace it in a computer system, albeit with some major design surgery.

The 6502 offers an instruction set that any 6800 programmer would feel at home with, advanced capabilities, and slightly easier interfacing requirements. But it provides neither software compatibility, nor the possibility of chip-for-chip replacement. Given these facts, it is hard to imagine that the 6502 would enjoy its present prominent position if it hadn't been for another lucky chance: the 6502 was used in the phenomenally successful Apple computer.

When the Apple appeared, desk-top microcomputers were dominated by S-100 based bus designs. These relied on a 'motherboard' to convey power and signals to a separate board for every function. A minimal S-100 system would therefore require a power supply, a motherboard, a CPU board, a memory board, a VDU board, and probably a printer board and a separate disk drive board. It is therefore easy to see how expensive an S-100 system would be compared with a one-board system such as the Apple.

Relatively cheap though the computer was, the major breakthrough for Steve Wozniak and his team at Apple came with a piece of applications software called VisiCalc. This program proved very popular with businessmen, who found they could use it to generate financial predictions more quickly and easily than with a calculator, pencil and paper. VisiCalc was so successful that it gained Apple massive sales for their computer, and this established the 6502 as one of the leading microprocessor designs. Commodore also opted for the 6502 in the PET and its successors.

Yet a further boost came in the UK when Acorn produced its BBC Micro, also based on this chip. The BBC had originally specified a Z80, but no British manufacturer was able to come up with a suitable design in the time limit set.



Chip Count
Sophisticated chips reduce the number of chips needed on a circuit board. When Apple upgraded the Apple II, the new IIe version had half the number of major chips

While the 6502 chip established its dominance of eight-bit computer design, 16-bit computers began to appear on the market. Intel offered the 8088 and the 8086 for these computers, while Motorola produced the 68000 and Zilog produced the Z8000. All three 16-bit designs have their merits, but none is compatible with their eight-bit predecessors. Fortunately for Intel, Digital Research and Microsoft were quick to come up with operating systems for the 8086/8088 (CP/M-86 and MS-DOS respectively), while Zilog and Motorola were badly served by the software community. IBM's adoption of the 8088 in its PC computer has also given a further boost to the Intel chip.

The fight for market dominance among 16-bit chips promises to be a repeat of the eight-bit chip's history. Intel's 8086 (and the cut-down version, the 8088) have become standards in the same way as the Z80 and the 6502. Chief among the reasons are software support from the MS-DOS and CP/M-86 operating systems, and their selection in top-selling micros, notably the IBM and the Sirius. Zilog's Z8000 chip has only been used in one general-purpose micro – the Olivetti M20. Olivetti struggled to provide the machine with software, finally launching a plug-in card with an 8086 to allow it to run MS-DOS and CP/M-86 software. Since this time, Zilog have set about designing a new chip, the Z800, which is not only 16-bit, but can run software based on the Z80 processor.

In spite of the recent rapid growth in the 16-bit field, the majority of computers currently on sale are based on either the Z80 or the 6502 eight-bit designs. The 16-bit computers undoubtedly offer speed and power advantages over their predecessors, but there's plenty of life left yet in the eight-bit machines, in view of the vast amount of software that has already been developed.