

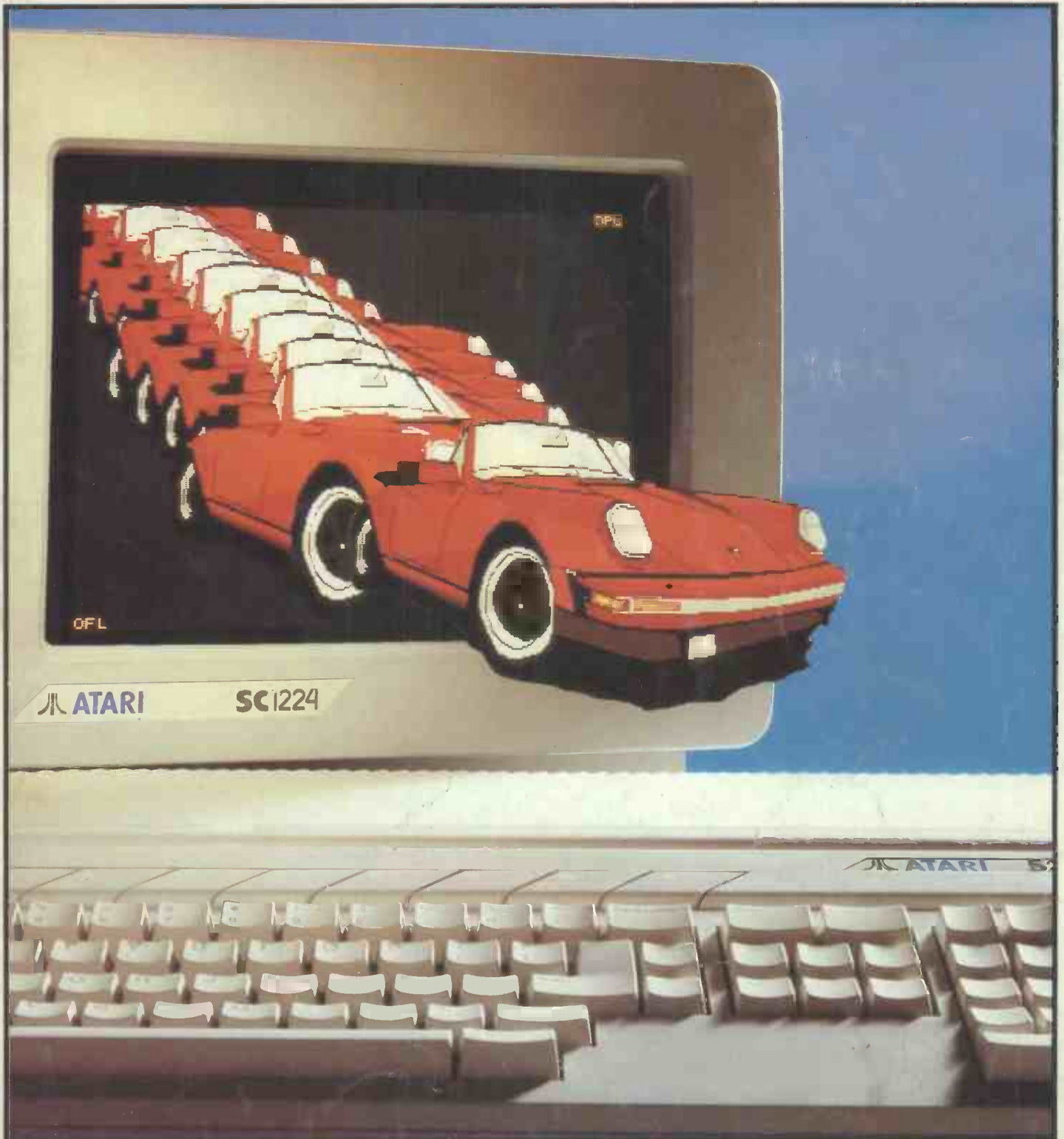
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Cover photography by Philip Gatward
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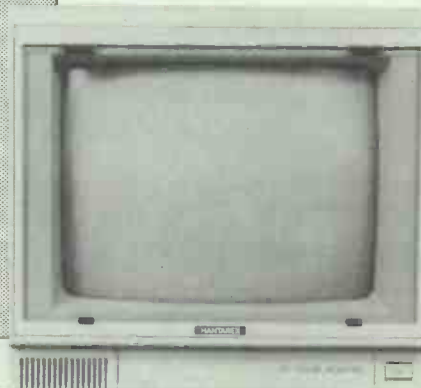
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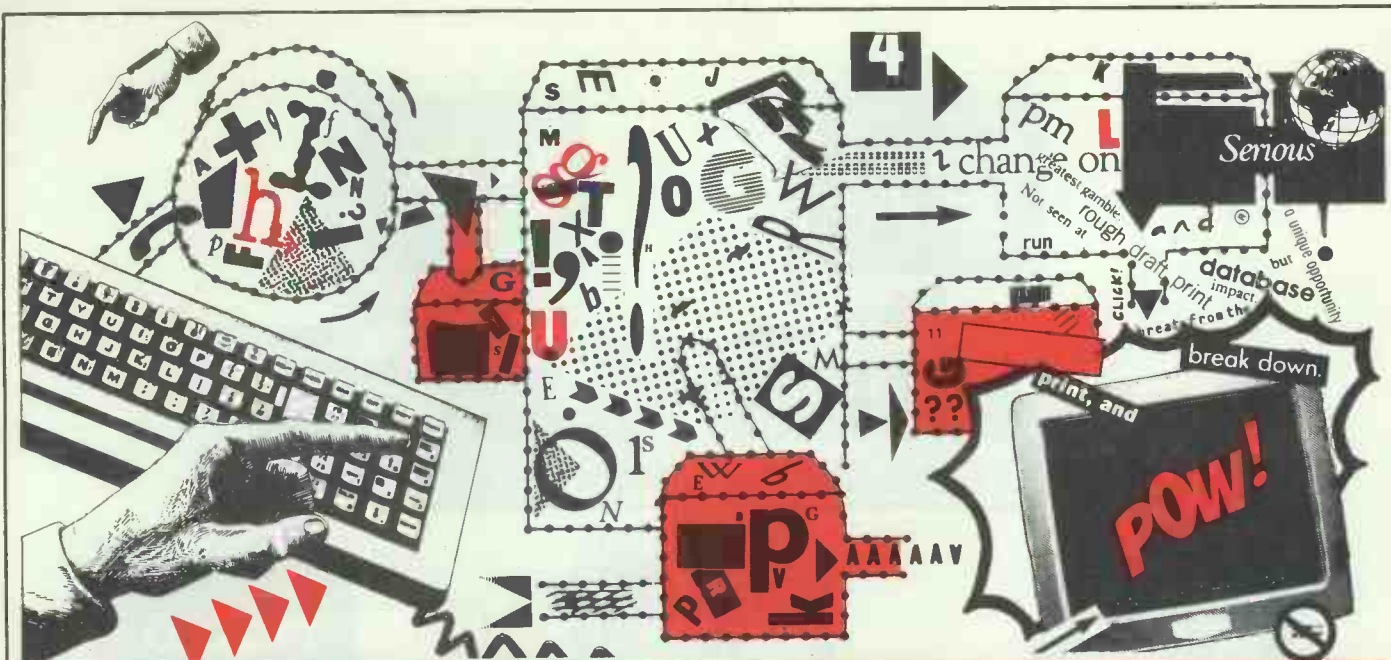
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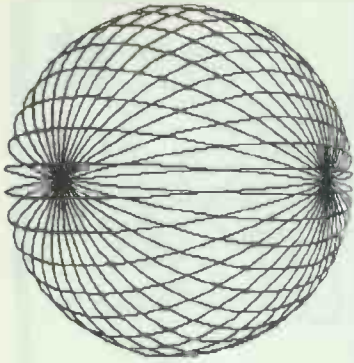
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```
(( \ draw a ball using circles
DO
  FROM 5 BY 10 TO 175
LOOP
  \ pitch back by loop index
  \ and apply 40 degree yaw
  ROTN 0,#X,40
  \ then draw a full circle
  ARC 360,400
END_DO
))
```

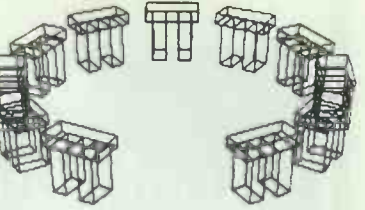
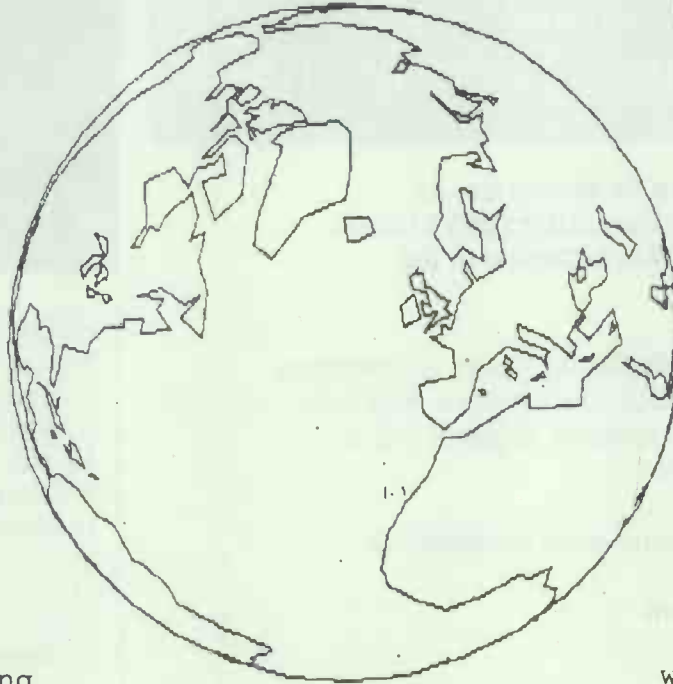
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```
PROC 'PI_BOXES' \ 3 boxes set
ICON 3D \ up as a 'PI' symbol
POSN -75,0,50 BOX 50,100,200
POSN 25,0,50 BOX 50,100,200
POSN -100,0, 0 BOX 200,100,50
END_IC
END_P
```

```
(( \ draw a ring of PI_BOXES
DO
  FROM 30 BY 30 TO 330
LOOP
  3D POSN 0,0,1500
  \ roll by loop index &
  \ pitch by 60 degrees
  ROTN #X,60
  2D GAP 0,-600
  PI_BOXES
END_DO
))
```

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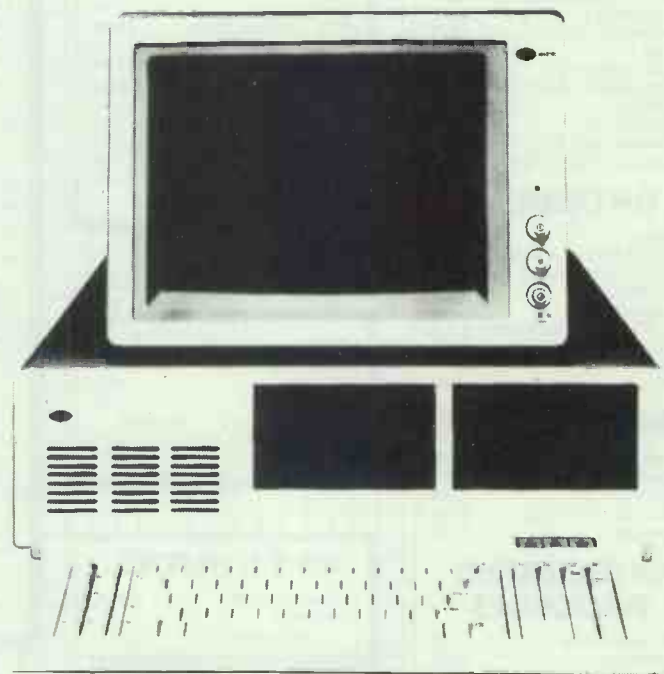
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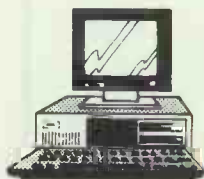
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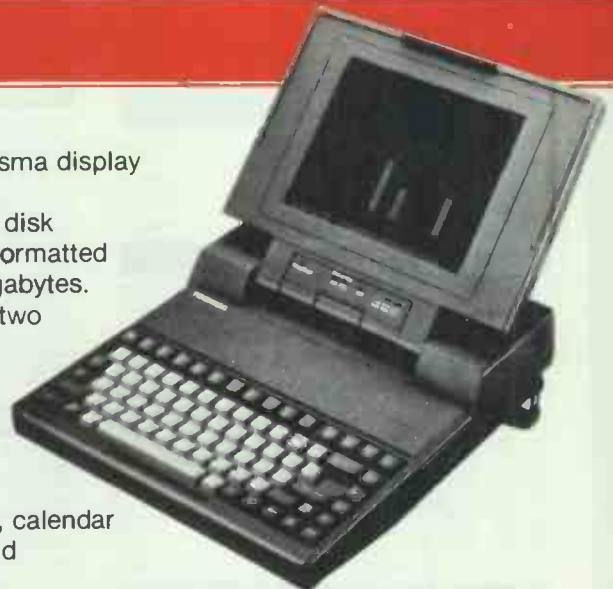
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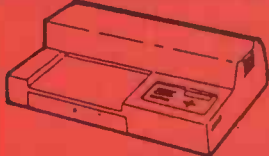
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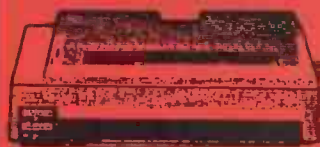
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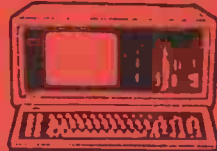
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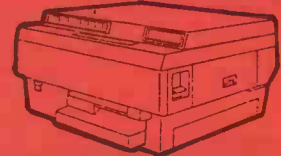
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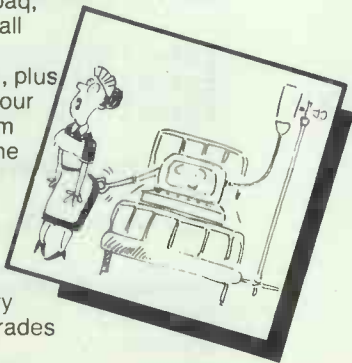
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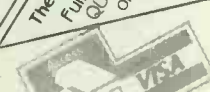
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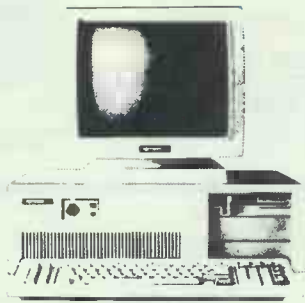
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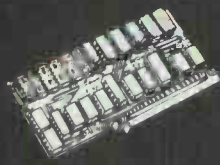


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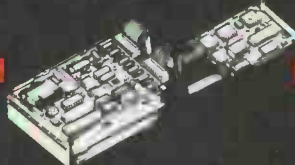
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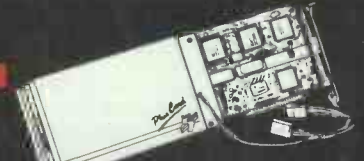
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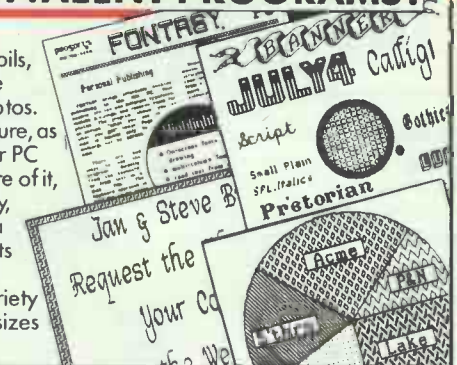
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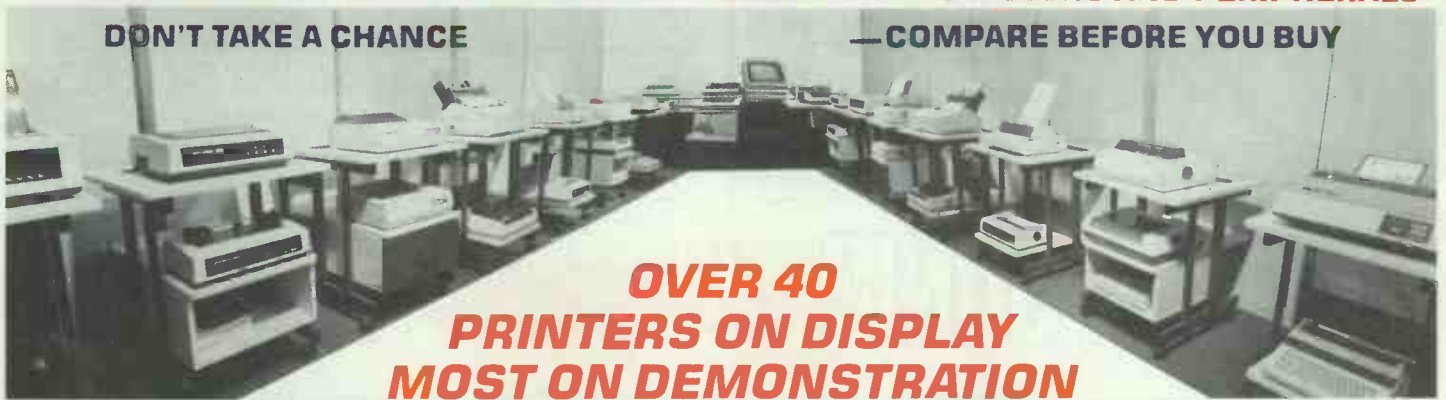
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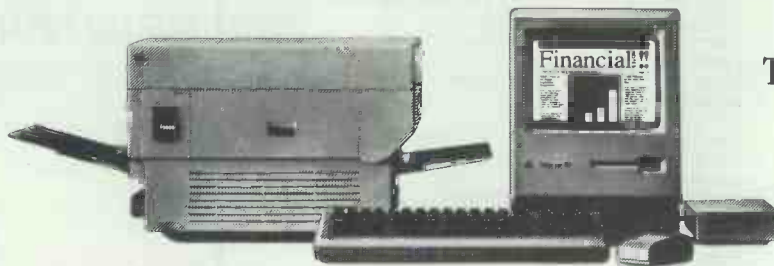
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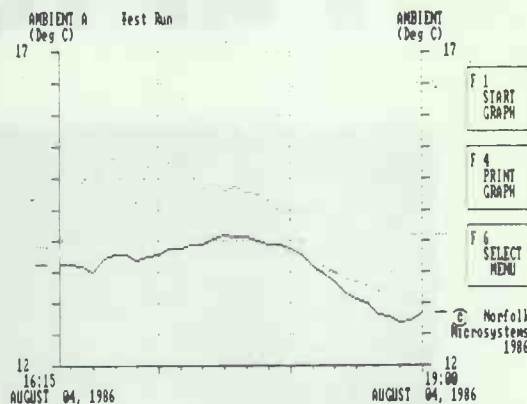
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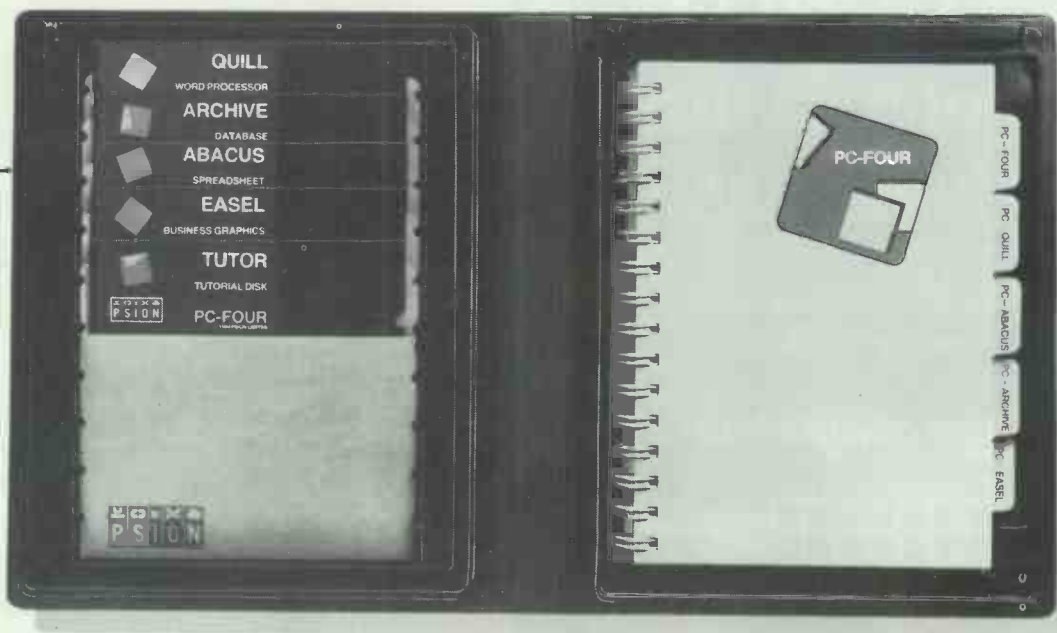
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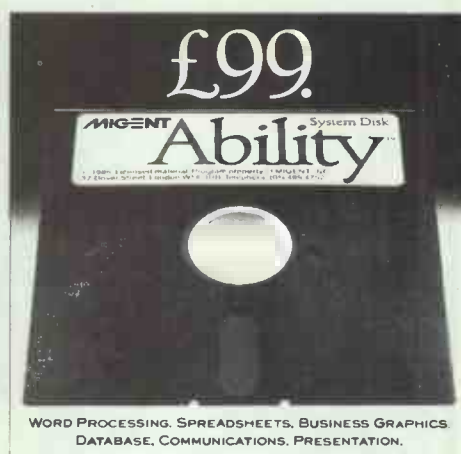


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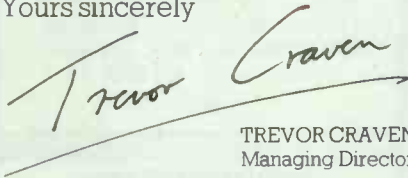
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Managing Director



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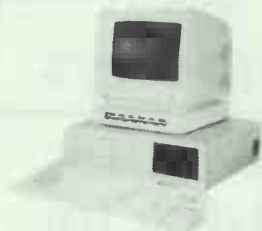
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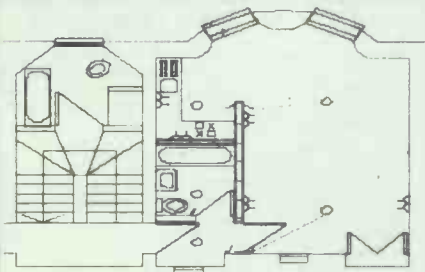
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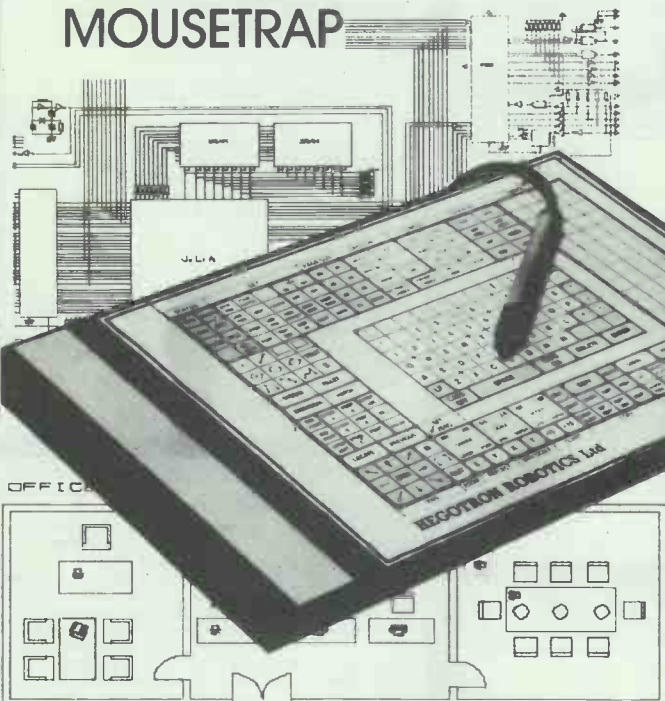
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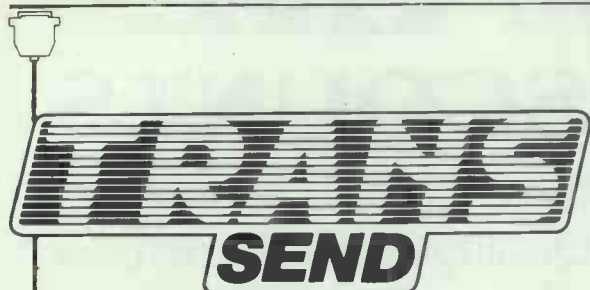
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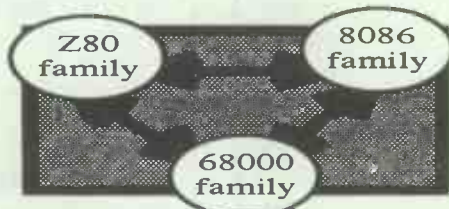
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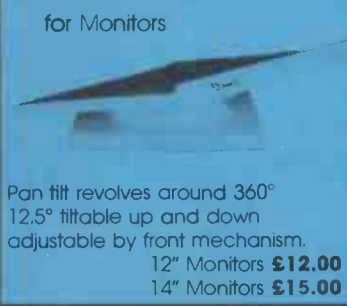
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HiSoft Pascal80

Pascal80, our popular Pascal compiler for CP/M machines like the Amstrad and Einstein computers, has changed dramatically. It now includes a fully-interactive editor so that you can edit, compile, correct, re-compile and run all from a simple menu, error messages rather than numbers, variant RECORDS, FILEs of any type, register variables, upper or lower case reserved words, CHAINing and more. Pascal80 is now a complete Pascal development system, is still much faster than Turbo Pascal and yet costs only ... **£39.95**
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Lace in excellent condition

My Christmas present this year was from Apricot, which has announced the bargain of all time — a conversion of a standard Apricot PC or Xi into an IBM AT.

The cost is virtually that of an AT without disks, which is right and proper — because that is what you are buying.

For £900-odd, you get a new motherboard. It has a new processor chip, and new memory chips. That's what we, in the trade, call a computer. You get a changed keyboard, and a changed monitor. You keep the disks.

Your new machine will not run Apricot software any more, but it will use Apricot disks.

I'm irresistibly reminded of the legendary small-ad in a shop window: 'For Sale: one second-hand football. Outer leather casing needs replacing. Bladder missing. Lace in excellent condition.'

Too hard to please

The fuss over the specification of the Amstrad PC has come home to roost. Alan Sugar has said if people think his PCs overheat, then he'll fit fans. If they think the machines will work better with pink spots, he'll supply those, too. His advice to people who have fans fitted is: disconnect them. They use power, putting an extra strain on the power supply, and adding to the heat...

Judging from comment in other magazines, the office Amstrad (complete with pink spots, having been upgraded by myself) is the only one in the world which isn't imitating Three Mile Island.

I gather this is the machine showing its gratitude to me,

personally. I rang an ex-colleague, the other day, to try and find out where she got a report on Amstrad PC failures. She it was who gave me the clue: 'You aren't writing stories on the Amstrad, are you?'

Yes, I said, I am.

'But you designed it, and you get a royalty on the sales. Don't you think that is unethical?'

I don't really know what to think about this. On the one hand, flattered. Surely people don't really think a journalist could design a computer! On the other hand, annoyed: would I design a computer that wouldn't work in high-resolution graphics? But then again, flattered that a mere purveyor of gossip should

become the subject of gossip. And again, annoyed that an old friend should believe this sort of thing.

But why shouldn't she? I believe this sort of thing myself.

At last year's Comdex in the States (see the report in the January issue) I was told (by a colleague) that a certain opinionated pundit, writing for a very popular US computer magazine, was on a contract retainer to PCs Limited, the *uppest and comingest* American clone maker.

I believed it.

I didn't ring him up and ask, because I had no information beyond my colleague's gossip to check out. But then, neither did my colleague — he said he'd

been told that he would be shown cancelled cheques, but he hadn't actually seen them.

Nonetheless, I believed it.

Grounds for believing it are, almost exclusively, that this pundit has mentioned the company, PCs Limited, enthusiastically in his column.

But his opinions, to be frank, are rather less enthusiastic than my own. I think the company has done amazing things, and deserves to be mentioned more often.

Even so, I was indignant, and when I bumped into him at a party, I snubbed him.

Enough philosophy and head-shaking over the irrationality of humankind, already. To the point, to the point: did I design the Amstrad? Do I get a royalty?

No. Had I designed the Amstrad PC, I would now be able to retire and write my novel. And the Amstrad PC would be different. It would have had:

- an intelligent keyboard which you could carry around like a lapheld computer;
- a single expansion slot, not three; or maybe a plug for the bus, with the option of attaching an expansion box;
- a standard IBM keyboard that fitted into its socket;
- a built-in modem and bundled foolproof comms software for the modem;
- a printer, for one model; and
- EGA and even PGA colour cards.

As a result, the machine would have cost twice as much, been launched six months late (at least) and nobody would have even looked at it.

And the editor would have fired me.

Tutorial time

There is obviously a need for something to take the pain out of learning to use a micro. MS-DOS, even with Gem or Windows, is not the answer. And with low-cost, PC compatibles taking hold, there are many micro users around, making it



Seriously, I'm very tempted to keep the news of the £400 Atari ST a secret. As for the news of the £200 ST, I don't think I can bear to let it out.

By announcing now that it might happen, in March or even before, there is a real risk that some buyers might hold off the machine until then.

Worse, it is also possible that Jack Tramiel might hear of it, and come over in person with the juggernaut determination of a steamroller, and squash the decision in advance.

But the decision is pretty well made, my moles tell me. 'Alan Sugar has told us what the price of a Gem-based computer is — £399,' is what Atari boss Bob Gleadow (shown above) is supposed to have told his advertising consultants. 'That's what we will sell.'

The price could be activated anytime now, but for one thing: Atari UK is short of machines. Cutting the price too soon would just cut revenue by the same amount.

My own guess is that the eventual price as announced, might be above that. Amstrad's Gem-based PC1512 has gone up, and Atari may feel that it can afford to follow. On the other hand, it might just feel that it would be nice to have a lower starting price than Alan Sugar.

theoretically possible to sell to a mass consumer market.

The problem facing the industry, however, is a subtle one: it is the difference between 'training' and 'salesmanship'.

Take for example an excellent program called Javelin, launched last year at over £500. Hardly anybody bought it.

The reason was hard to explain, but simple to grasp. Javelin turned out to be 'just what I wanted' for many people, but only after a couple of hours' tutorial to explain what it actually did. (No, I am not going to explain what it does, here.)

The authors couldn't follow their preferred route of putting up the price. 'If we'd put it up to £1200, then people would have been

prepared to spend time selling it to prospective customers,' they said. 'But you can't ask £1200 for something that used to cost £500, not even if the people who have bought it say it would be worth twice that.'

So it sells, in America, for \$100, at which price people don't mind buying it in the vague hope it may be sort of useful. Then they tell their friends, and so on, and it is now selling, people say, very well thank you.

Once they have bought the software, some of those users will spend £1200 of their company's money on a training course to learn how to use it. But that's a special, unique program. No-one in their right mind would consider spending even half that amount for a training

course on (say) WordStar 1512, when the program costs under £100, and the computer to run it under £600.

Computer-based tutorials are attractive, because they can follow you — theoretically, at least. PC Tutorial from Cedarhurst Computing, for example, is memory-resident. You can jump into it while running things like WordStar and dBase, and back out. You get 20 diskettes, and it starts you off from scratch. It costs £50.

More to the point, there is some chance of seeing this sold in shops. The shopkeeper makes a profit selling it, instead of wasting time and keeping other customers waiting while trying to explain something face to face. And in all

probability, the shopkeepers will be trying to explain something they probably don't understand all that well themselves.

I haven't seen PC Tutorial, yet, but unless it is very different from anything else I have seen, I remain sceptical about how many people will actually have the patience to use it to learn what they are about.

Javelin, by the way, is now the subject of a special 'educational' promotion by Ashton-Tate.

The company has announced a new education policy for school and college students, and involves selling the company's main software programs at cut price (at least 60 per cent off) to schools, with unlimited copying of the manual



The picture shows the Sigma Design Laser View Display system, which Katakana Limited sells. It uses an AT, and an enormously detailed screen, to show full desktop publishing detail of two pages.

Details from Katakana on (0628) 75641.

Of course, you can also do desktop publishing with an Amstrad PC. For as little as £3943, Leicester-based Mass Mitec will supply one of its wonderful 'workstation packages' with laser printer and Multimate, plus Inset text and graphics, which will start you off, and it also supplies things like the Harvard Publisher-based system with an HP LaserJet, at £5869 including hard disk.

But will you get what you see on the screen, when you print it?
I hope not.

There is a lot of speculation being printed, suggesting that an AT-type Amstrad is likely to be launched in the next couple of months — please ignore it. There are indeed secret projects in the Brentwood House headquarters, and an AT is on the cards — for March 1988, not 1987.

The major project is high-resolution printers, not computers. Amstrad is hoping to launch 24-pin printers, for both Joyce and PC machines, which will give very good NLQ output. Not up to laser quality, but pretty good.

There is, however, a very important computer under development there: a bog-standard Amstrad, but fiddled to take the EGA high-resolution colour card which now appears to be so important to Americans.

I believe this will be shown to the world in March, or at the Which Computer? Show. At the moment, it's a secret.

Secrecy is a two-edged weapon, however, when it comes to desktop publishing.

There are two reasons for Amstrad's secrecy about

this machine: first of all, Amstrad doesn't want its competitors to find out (naturally); and secondly it doesn't want existing customers to find out, and decide not to buy the current models.

I can quote exactly the sort of buyer I mean: a friend whose company uses typewriters, and would like to get word processors. The company has considered the Amstrad PC1512, and is seriously working out what it would involve if it bought 30-odd. And, of course, if the company got 30, then it would be worth getting a really nice laser printer . . . so better not buy the Amstrad, because nobody knows if it will really work properly with high-resolution screens.

For desktop publishing, what you see on the normal graphics CGA screen better not be what you get on paper — because the screen shows the letters as big, chunky blobs. What you want is a screen that shows you as nearly as possible what the page will look like, which on a laser printer is 300 dots per inch.

The Wyse 700 terminal is an obvious candidate — see the review of it with the Wyse AT Benchtest in this issue on page 104 — and even if the actual pixel size isn't very tiny, it is still dense enough over the whole screen and gives a pretty good impression of the white paper that will emerge from the laser printer. It has 1280 x 800 pixels in its highest resolution mode.

Will the Amstrad work with the Wyse?

My techies tell me that there is a simple question to ask: does the Wyse 700 terminal use the screen memory that IBM sets aside for the use of the colour graphics adaptor, CGA?

If it does, the Wyse 700 will not work. On the other hand, if there is a new version of the Amstrad that will work with the EGA, perhaps the same fiddle will work on the Wyse?

I asked Amstrad. In high secrecy mode. It refused to admit that it was doing any experiments on high resolution. But then it also became clear that Amstrad didn't have a Wyse, nor any details of one.

Eventually, I became convinced that Alan Sugar was saving the thousand-odd quid that it would cost to get a Wyse terminal and perform the experiment, and that Amstrad simply didn't know the answer.

Kode Group, which sells the terminal, said it would call back with the information. But it didn't know.

Incredible! There must be a fortune awaiting the first technical whiz who can tell the world 'Go ahead, buy the Amstrad, and with our desktop publishing package and the Wyse high-resolution screen, you can do anything you like.'

Watch this space for details. Call Xitan for some light, call Microsoft for some more, but don't expect to find anyone who actually knows the answer.

Even call Mass Mitec, if you like. It has some neat packages, and it is contactable on (0533) 718031. But it didn't know the answer to the question either.

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Most of us will just wait for simpler systems.

Cedarhurst is in Chiswick, London on (01) 994 6762.

Wordy joke of the month

It was a sunny day in November, and I was thinking. The Amstrad PC, I thought, has a mouse. I wonder if WordStar 1512 uses it?

I moved to the bottom of the page with the mouse. Up again. Wow! It works!

Up to the top: and the top line filled up with spaces, like:

t h i s !

It was on this day that MicroPro wrote to me, pointing out that my evaluation copy had been in my possession for longer than the 30 days it said on the form. Would I like to pay for it, please, or else send it back?

Hmm. Send it back — presumably, before I discover anything else untoward about it?

Twenty, twenty vision

The irony of the statement 'We believe that Twenty/twenty is an excellent product, that had an unfortunate beginning with ISPL' was probably unconscious, when made by Mike Lauterback, managing director of Mirle International.

Mirle has taken over the product, which keeps track of conflicting data — files from Lotus, dBase and Supercalc, for example — in a quasi-database form.

What Lauterback is trying to refer to, I think, is the fact that ISPL, the company which launched Twenty/twenty, has gone bust.

But the 'unfortunate beginning' of Twenty/twenty



All the drawbacks that users of PCW 'Joyce' Amstrads have to face when trying to connect to a dial-up computer, are covered by the Miracle dedicated WS4000, starting at £170 plus VAT.

It doesn't need a serial interface — it has one. It not only runs at 300 and 1200/75 bits per second, but can be upgraded to work at 1200 bits or even 2400 bits per second. You can use Amstrad's own Mail232 software, or you can buy Sage's ChitChat from Miracle, with modem and software together costing £260 plus VAT. Brochures on (0473) 216141.

was, in fact, its winning of the 'business software product of the year' award in the 1986 British Microcomputer Awards.

Mirle is on (0462) 33244, and existing users as well as prospective users should contact it for upgrades to the original product.

The product has a new price, too, of £350. Hopefully, Lauterback won't enter it for any more Awards.

Boost for your system

I'm really looking forward to using PolyBoost on a Gem-based system — once GEM is available in a version that tolerates 'background' programs.

PolyBoost will in fact work with any PC program, and



Looking exactly like an ordinary Zenith AT-alike, this is in fact the Compaq 386-alike. It should be available in shops (or from OEM suppliers) any day now, and Zenith says it runs faster than anyone else's, with tricks like loading the ROM software into special bits of RAM, which operates faster; like using memory paging; like burst-mode refresh (don't bother asking for details); and disk cacheing. There is also video go-faster software.

the idea is to speed up a system by running three special go-faster programs.

Disk speeds are increased by a caching system — an old trick, and not enough on its own to account for the 'up to 20 times faster' claim made for the package. With the disk speed-up there is a screen display booster, which the authors say can make screen operations ten times faster than normal — also eliminating screen flicker.

The bit I really want to see before I believe, is the keyboard improvements section.

This is supposed to cure 'cursor overrun' by controlling the type-ahead buffer.

Normally, when you hold your finger down, the auto-repeat feature feeds a string of characters to the computer — sometimes, faster than the software can accept them.

Normally, the computer keeps a careful count of how many characters you have generated, and carries on feeding them to the main program. Of course, by this time you may have long taken your finger off the button, and have to watch, helpless, while data scrolls past unstopably.

The product costs £80 plus VAT, from Software Construction Company Limited on (027 979) 2566.

Ignorance is not bliss

Would any other industry put up with the level of ignorance the micro business accepts in its sales staff and managers?

I rang the managing director of a company which had launched an 80386-based supermicro. 'Who should I talk to,' I asked, 'for technical questions?'

He responded: 'I'm your man.'

'Good,' said I, 'what I want to know is — since there is no purpose-written operating system for desktop use of that chip — will you be buying a networking operating system?'

'Ah, now you've got me,' he said. 'You'll have to ask one of my techies.'

If one were announcing the awards 'for Manager of the Year in Micros', this chap would be second on the list

— announcing the recipients in traditional 'Miss World' reverse order. He's dim.

On the other hand, the managing director of one of the country's largest hardware distributors is not dim at all. He's brilliant. But he is also a man who honestly believes that it is impossible to get data on his firm's central computer onto his desktop PC, which is functioning as a dumb terminal. The data is on his screen as we speak, but he is convinced that he can't 'download' it. Yes, he is using Sidekick — why do I ask?

He isn't unfit for his job, just untrained. The requirements for his job are not technical wizardry, but honesty, an understanding of the financial pressures on an international corporation, and an ability to select and motivate his fellow directors.

But having got the job, in any other business, he would be fed into a period of three to six months of intensive training.

In a baking group, he'd be sent round all the sites, sent on seminars by baking equipment manufacturers, be expected to roll his sleeves up and get flour under his nails.

In the airline business, he'd have to visit several agencies with the sales staff, noting how tickets are made out and learning the major routes covered by his carrier. Perhaps he wouldn't be able to hear a flight number, and immediately tell you what time it left which airport — but he'd know which book to pick up and find out.

But computing, it seems, is 'too hard' to be learned like this.

Well, what nonsense! No-one is so stupid that they couldn't go on a one-week assembly language course and come away with a detailed, if not skilled, grasp of how a particular chip works, with its support circuits. And a manager who spent an afternoon being trained in the theory and rudiments of disk formatting, and didn't come away with a clear understanding, would be incapable of buying a bus ticket.

Passing over the fact that I do know a couple of senior managers who I would never trust to buy a bus ticket, I have to ask: why?

Snobbery is part of it. John Weatherhead illustrated this, perhaps unwittingly, perhaps not, when he



It looks like a bog-standard Hayes Smartmodem. It is, with the additional feature of running at 2400 bits per second, as well as 1200. Like the Quattro, it costs a fortune, at £725 plus VAT. It should be available now.

advanced the 'you'll have to ask one of my techies' as an excuse for not understanding a problem I was having with a piece of Reflex hardware.

As boss of the outfit, John has to be tactful about what he says in print. Quoted as saying: *'The buffering on the card is not up to the standard of other boards we make, but we can get away with it most of the time, and it is a cheap card, what do you expect?'* John could anticipate losing that particular franchise before he'd collected his royalties.

When John says you have to ask one of his techies, he is just making an acceptable excuse. In fact, it holds no water for those who know him: he has an Honours degree in electronic engineering, and vast experience of the micro business, both hardware and software.

What I find unacceptable, is the fact that this is regarded as an OK excuse.

It isn't. For a senior manager to be unskilled at the more esoteric arts of his business is forgivable, but

to be ignorant of essentials is an error which should be remedied. For managers to actually boast of ignorance of the simple nuts and bolts of his trade is pathetic.

It is a habit of our business, a custom which has become established through cowardice and laziness. It should be ended.

Over-ambitious project

It is two years (or so) since IBM frightened the knickers off the software business by launching a whole range of own-label applications packages. It was going (said observers at the time) to literally take over the whole retail software business. No-one could compete. Even Lotus would go out of business.

Olivetti now says it is going to dominate the software business, with the Olisoft label.

Don't waste time laughing. What Olivetti actually means is something less ludicrous. It means it is going to actively promote Unix-compatible DOS software.

Software which runs under PC-DOS and MS-DOS is only theoretically capable of running in a 'DOS partition' of Xenix. You tell Xenix that part of the time it has to obey DOS commands, and load your DOS programs into that part of the computer.

Olivetti, 25 per cent owned by America's AT&T, which has a close, not to say family relationship with Unix-owning Bell Labs in its turn, has been deeply committed to making Unix a popular operating system.

The idea, put forward when the company announced the 3B2 minicomputer, was that you could connect your micros to the 3B2, and it would work both as network and as a multi-user Unix system.

If it were a network, the 3B2 would be a fast file server. And if it were a multi-user mini, the PCs would be terminals.

If you could get software which ran under PC-DOS on a network, and the same program prepared to run under Unix or Xenix, then the user need never know which operating system was running.

That was the theory. It fell



*Olivetti has it half right. It sells pre-formatted diskettes, with demos of popular software. Don't like the software? DEL ** and it's gone.*

What 3M is doing in the US is cleverer: the company sells its preformatted diskettes with real software on it. It only runs a couple of dozen times, however, then scrambles itself. If you like it, you phone 3M and it gives you a 'key' number which resets the counter, while 3M rushes you the official program with manual, direct from supplier.

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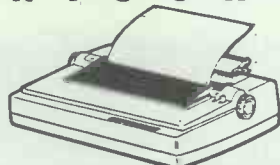
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'That's going to teach her to go out to lunch and leave me to enter 200 items of dBasell data. I shall say there was a power glitch — so sorry! Now, where did I put the crossword puzzle?'

Oh, all right. It's actually a model plugging in Acco Europe's power spike suppressor. There's a two-way Power Filter at £62.16, a four-way filter at £84, and a Surge Protector plug at £12.96 (all ex VAT). But don't pull them out of the wall. Details on (01) 650 4818 — the firm's publicity consultants, who believe Accodata's own number should stay a secret.

down on a simple point: the failure of software publishers to rush out new diskettes of their programs, guaranteed to run under Unix.

What Olivetti is trying to do is not take over the software retailing market, but to actively sponsor retailing of dual-standard programs.

Having said all that, I should add feel free to laugh, anyway. It isn't going to happen.

Communication breakdown

There is 'no need' for a file-transfer protocol on Telecom Gold. I rang up technical support, and it told me so.

That is why Lotus has brought MCI Mail into Europe for the first time, in order to distribute binary files to its customers. MCI Mail does have a binary file transfer protocol.

Should you buy a modern microcomputer like the Toshiba, with 3.5in disks, you may find you have enormous fun trying to get software into it. You would find that Toshiba will help up to a point, by pretending that the problem doesn't exist. The company will give you a list of people selling IBM software on Toshiba standard diskettes.

This is why Belmondo Research, in Bristol, sells a pair of disks — one 3.5in, the other 5.25in — and a cable, to connect a Toshiba (or a Zenith 181, or any other 3.5in PC-DOS machine) to a standard PC.

You connect them, transfer the program down a serial cable, and bingo!

Zenith supplies a similar product called XFER, for the 181.

Transferring files from one machine to another can be enormously complicated, because of the habit communications programs have of reducing the amount of data in each byte, by one bit. They assume that the information must be ASCII. They also assume that the information must be accurate.

Of course, there are solutions to the problem. XModem is one, and works very well — unless the version of Xmodem you have has been 'improved' by some clown.

Another is Kermit, a file transfer and error-correction protocol supported by Alan Philips at Lancaster University. Kermit is included as an option in several programs, such as Crosstalk and ProComm, and since it has a central authority maintaining it as a standard product, it varies very little from one to the next.

I have a 1200 bits per

second Hayes modem. Made by Hayes, it doesn't run at 1200/75, and I wanted to use it to send a large file to a colleague. No way the two modems would talk. 'Not to worry,' I told my colleague; 'I'll take it into my other office, where I have a Miracle 3000, which can talk 1200/75 and 75/1200, too. We'll transfer the data tomorrow.' Too late, he said.

How easy and simple it would have been, to dial up Telecom Gold, dump the file into his mailbox using Kermit to check that it went through without error, fast. But there is, of course, 'no need for file transfer protocol' on Gold.

As a statement of fact it is nonsense. It isn't even accurate, anyway. Gold has Rap, and it has sub-user groups which use error-correcting protocols. The trouble with Rap is that I don't have a version for the PC, only for the Apricot. And I don't belong to the groups.

You ought to try, by the way, running WPMail on Gold. It's a real laugh! 'Put paper to top of form and hit space!' it says, and scrolls the information off the screen as soon as it's

arrived. Use it, and you find it expects you to 'start your cassette.'

I sent it a WordStar file. Unfortunately, I can't show you what I got back, because our typesetters don't have the IBM character-graphics.

One micro in three, in the US, has modems. In the UK, one micro in thirty has a modem.

I wonder why?

Telephone to the rescue

If you think about it, needing to use modems to transmit information from one computer to another is a very silly idea. At your end the modem turns perfectly ordinary electrical data signals into noises which you send down ordinary wires to be converted at the other end back into data.

Come digital networks, all this will cease and we will be able to plug the telephone lines directly into our computers.

In the meantime Lion Systems has decided to turn



Fly a helicopter on the Amstrad PCW 'Joyce' range — for £30, this Spectravideo package includes a Quickshot 2 joystick, a joystick interface, and a program, Tomahawk Flight Simulator. Go to WH Smith, John Menzies, Alders, and computer stores — or call Spectravideo on (01) 330 0101.

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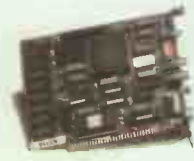
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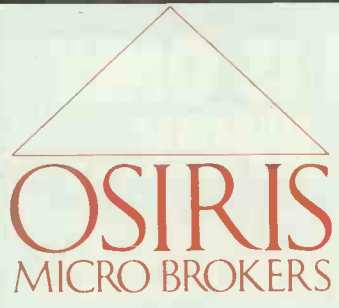
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SMART 3	£375																								
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MULTIMATE	£199	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #f00; color: white;"> <th style="width: 33%;">MEMORY</th> <th style="width: 33%;">ENHANCED GRAPHICS</th> <th style="width: 33%;">HARD DISKS</th> </tr> </thead> <tbody> <tr> <td>AST Rampage (XT), 2Mb</td> <td>£395</td> <td>Paradise Switchable EGA Adaptor</td> <td>£199</td> <td>Tandon 20Mb Business Card</td> <td>£365</td> </tr> <tr> <td>AST Ramvantage (AT), 2Mb</td> <td>£495</td> <td>Taxan EGA Compatible Colour Monitor</td> <td>£399</td> <td>NEC 20Mb HD with Controller Card & Software</td> <td>£350</td> </tr> <tr> <td>AST Rampage (AT), 2Mb</td> <td>£595</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>			MEMORY	ENHANCED GRAPHICS	HARD DISKS	AST Rampage (XT), 2Mb	£395	Paradise Switchable EGA Adaptor	£199	Tandon 20Mb Business Card	£365	AST Ramvantage (AT), 2Mb	£495	Taxan EGA Compatible Colour Monitor	£399	NEC 20Mb HD with Controller Card & Software	£350	AST Rampage (AT), 2Mb	£595				
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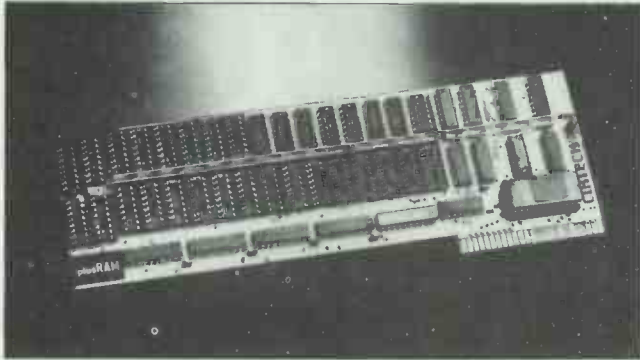
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This Cirtech card costs £99, and provides 256k of memory upgradable to 1Mbyte to Apple II users. Unlike earlier Cirtech expansion cards, this one works to Apple memory expansion card standards, rather than published 'standards' which Apple doesn't itself observe, say my disgruntled sources. Details on (0896) 57790.

the situation to its advantage. Its Orator plug-in PC card will, if so asked, act as a 2400-baud modem. But calling the £800 Orator a modem is something of an understatement.

At the heart of the Orator is a Digital Signal Processing unit which will, if so instructed by the PC, act like a modem, turning data into tones and vice versa.

But manufacturer Lion Systems has looked further than this. For example, the DSP circuits can be used as a speech processor, storing voice messages as binary disk files which, by means of data compression and pause compression, take up as little as 1k per second. Using this and the modem facilities, it is possible for your PC to act as a telephone-answering machine.

You record your message using a special free handset (BAPT approvals wouldn't allow Lion to use the telephone for this purpose, despite all phones having a perfectly serviceable microphone and speaker built in). When your friends call up to find out why you're late for dinner, they can listen to your disk-based message. The machine will then go on to record their irate response in another disk file for you to listen to when you return, or remotely down the phone.

The potential for this technology is immense. Because voice messages are stored as ordinary binary files, they can be transmitted over the phone, stored in online databases and passed around on networks.

The software that runs the Orator is a function key-driven, memory-resident

package that additionally offers all the facilities one might expect of a comms package — VT100 emulation, error-checked file transfer, viewdata mode and short-code dialling for voice and data calls.

Because the hardware side of the Orator is all software configured, the potential for third parties to develop new applications is exciting, to say the least.

And when, finally, digital networks do arrive, and conventional modem users are throwing their Hayeses and Miracles and Dowties in the bin, Lion Systems will just be issuing new disks.

Watch out next month for a full review!

Lion Systems can be reached on (024026) 3951.

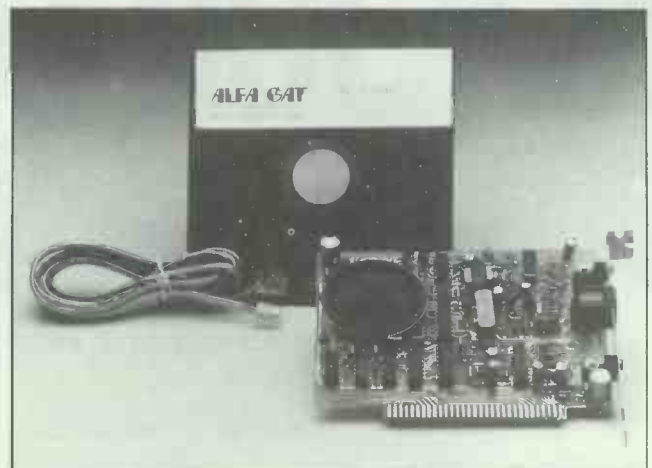
DC

Psion runs out of miracles

Psion boss David Potter is capable of miracles. Psion has sold a vast number of Organiser II pocket computers to people both here and in the US — a machine which (to be kind) is hard to use, and too big to keep in a pocket.

It sold Xchange to Sinclair for the QL, and even got it running, before there was an operating system for it to run on.

And it launched a version of Xchange — word processor integrated to database integrated to spreadsheet integrated to graphics — on the Apricot and the PC.



This little card does all the phone-managing you might want, according to its suppliers, Alfa Gat, in Tel-Aviv.

Samples weren't available at press time, but for \$350, you get a PC-compatible card which can wait until a line is free, then dial a complex sequence of numbers (coping with PABX problems if necessary) and open up a little window on your screen when the number is about to ring, adding a little note saying who it is, and any other important details you may have noted about them (account number, for example, or first name). It's called Mul-T-Dial, and I have no information about approvals for use in the UK, but if you want to call Israel, the number is given as 03-284743, 284084, and Oded Gottfried is the contact.

There, unfortunately, the miracle stopped, because where users of the Organiser have no other software to run except the firmware, and users of the QL had no other software to run except what they wrote themselves, users of MS-DOS computers had quite a large choice.

They generally chose not to run Xchange, and people who looked at it told me their reasons: it wasn't (they said) powerful enough.

To celebrate the launch of the Amstrad, Psion has launched a special version of Xchange called Psion Four.

The Amstrad PC is larger (at least 512k of memory), and faster (an 8086 processor) than most PCs. It

has new facilities — like a mouse, and GEM.

To take advantage of these extra features, Psion has, of course, launched an expanded, updated version of Xchange, right?

Wrong. It has a program suite which people regarded as inadequate, and has therefore produced a reduced version of it.

The age of miracles may still be with us, perhaps, but this doesn't look like one of them. To quote this column's previous comment: if you have the author's own assurance that the new program is inferior to the old one, what more information do you need?

Sorry, David.

END

PCW price rise, damage minimal

Now listen here, you lot. I'm not going to beat about the bush. The cover price of PCW is going up by 10p as from the March issue. We all know that inflation continues to drive up the price of all the essentials in life like beer, Isaac Asimov reprints and PCW. Last year we put the price up by a whole 15p, so count yourself lucky we've been able to show some restraint this year.

To show we're not all made of silicon here in the VNU mausoleum, we're delaying putting up the subscription price for a further month. So if you're quick you can get twelve issues of PCW, which would normally cost you £14.40, for a mere £12. Cripes — you don't need to be a Cobol programmer to realise what good value that is. So get your pencil out of your ear and fill in the subs card now. You know it makes sense!
Derek Cohen (editor)

IS YOUR COMPUTER A BLABBERMOUTH?

There's always somebody ready to pry into your business.

It might be someone who innocently stumbles across a piece of confidential information. It might be the company sneak who just has to know what everybody else is earning.

Worst of all, it could be somebody who thinks formatting hard disks into oblivion is the funniest thing since Laurel and Hardy.

Protec is an inexpensive software security programme that protects your computer from these types of problems. It is an access control and encryption system for IBM PCs or hard disk compatibles. Once installed, Protec is a complete DOS shell on your hard disk. (As a point of interest, it was selected as Editor's Choice in the September '86 issue of PC Magazine USA.)

The security manager decides which users can access which parts of the disk, while himself retaining access to the whole system. The most important regular users can have data directories that belong to themselves alone.

Protec protects your data by using file- and directory-hiding techniques that cannot be easily picked apart with DEBUG or utility programmes. If even stricter security is required, encryption programmes can also be installed turning files into unreadable mush.

Protec's snoop-proof features include one called No-Copy, which prevents anyone from pirating software or valuable business information.

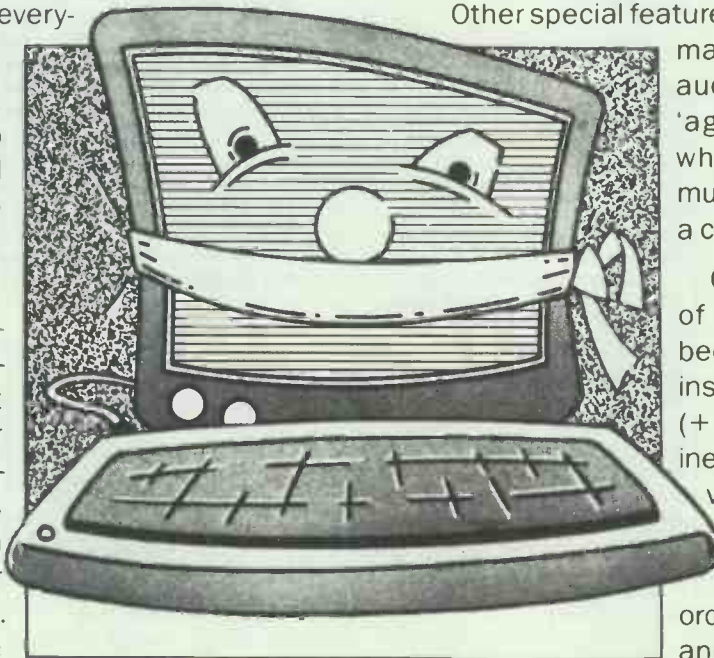
The security manager decides whose names to put on the log-on screen and assigns the log-on codes. Minimum password lengths can be set up, so that users don't apply easily-cracked, single-letter passwords.

Other special features include electronic mail, violation reports, audit trail files and 'ageing' passwords whereby passwords must be changed after a certain period of time.

Over 25,000 copies of Protec have already been sold. It is easily installed and at £170 (+ p&p) is surprisingly inexpensive. Dealer and volume discounts are also available.

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PCW/2

THE WEST COAST CONNECTION



It is rumoured that IBM is about to close the ever-widening gap in the micro world, while graphic workstations are on the horizon for 1988. And our US correspondent, Tim Bjarin, has a few things to say about talking computers. . .

An offer IBM couldn't refuse

If you consider that there is a worldwide market of over ten million IBM PCs and compatibles, and that IBM owns around 70 per cent of the mainframe market, it had to be only a matter of time before IBM realised that it needed to address the issue of making all these computers work together by developing a common link between its mainframe computers, minicomputers and personal computers.

To date, most of these machines operate very much in their own little worlds; and communicating between them has been difficult, if not impossible.

Dealers who have been close to IBM are just

beginning to leak information that IBM is about to release the first PCs that will be part of this new line of computers.

The first two machines will appear in early 1987. One of these will reportedly be a PC based on the 8086-2 Intel chip. It will have 256k RAM, a single 3½in disk drive and a suggested list price of around \$1295. This machine could possibly signal that IBM is moving to accept the more durable 3½in format as the way it will handle disk storage in the future. The second machine is what could perhaps be called the small footprint AT, designed to conserve desk space and be more upgradable.

Dealers have confirmed that any machines released during 1987 will be part of a new line of PCs that could implement proprietary technology at any time. Such technology will be designed to be 'hard to clone'. Dealers also believe that 1987 will be the year when IBM begins to give us the common thread that ties its whole range of computers together. This will have a dramatic effect on the personal computer industry.

No matter what machines IBM does release in 1987, you can be sure that they will all be part of IBM's grand scheme to recapture the parts of the computer market that have escaped its clutches.

Balancing the books

AppleWorks has been one of the most successful packages ever released for the Apple II line of PCs. And, just like Lotus 1-2-3, there is a great market for software that works as companions with 'base' products.

Broderbund Software of San Rafael, California, has just introduced a financial management package that works with Appleworks. The package, called On Balance, lets you record and reconcile bank and credit transactions, create and track budgets and print out reports and cheques.

The program updates cheque registers automatically and warns when payments are overdue. The On Balance files can also work with the AppleWorks spreadsheet.

On Balance is a nifty product that gives new life, power, and functionality to your AppleWorks program. It costs \$99.95.

Amiga provides the spur

When Dave Morris, founder of the original Amiga Company, gave sneak previews of the Amiga graphics chip at the Consumer Electronics Show in Chicago during the summer of 1984, it was the talk of the show. Soon afterwards, Commodore made Mr Morris an offer he couldn't turn down and very soon the Commodore Amiga Personal Computer was born.

The graphics chips at the heart of the Amiga have helped to define what excellence in screen management should be, while at the same time spurring industry giants like Intel and Texas Instruments to develop industrial-strength versions of these types of chips. As a result, you should expect to see graphic workstation products in 'general' offices by the late 1980s.

It was considered strange that the Amiga chip seemed destined to be an enhancement to the world of entertainment, because although the Amiga has software for almost every



The Commodore Amiga heralds a new era of computing

type of application, it is always positioned more for the consumer market than the potential serious business user.

One of the reasons for this is that Commodore is not a business name, but has traditionally kept itself in the heat of the consumer computer wars. However, Commodore is now hoping to break out of that mould with a new version of its Amiga PC.

Sources close to the company believe that it has a new version of the Amiga graphics chip that will rival any of the industrial-strength

products already released. It appears that Commodore will also base the new computer on the more powerful Motorola 68020 processor. This chip runs at 16MHz which means that programs literally race through their paces, instead of crawling along.

The new Amiga will cost around \$1995. If Commodore does release this machine, watch how companies who have traditionally provided graphic workstations take note. Maybe we will even see graphic workstations get a stronghold in the business market as early as 1988!

On your marks, get set, go!

The concept of desktop publishing is one that has attracted a lot of attention, and is rapidly becoming part of our business environment. And a desktop publishing product from Manhattan Graphics is quickly becoming the talk of the Mac world.

The newest version of Ready, Set, Go has features and capabilities normally only found on very expensive typography programs. Its ability to merge text and graphics, as well as design a page effortlessly, has made it one of the most exciting products for the Mac to date.

With Ready, Set, Go you can design as many as a thousand pages and the text will flow from each page as you edit it, or you can add new pictures or designs to the page. The screen fonts, ▶

THE WEST COAST CONNECTION

The customer reaps the benefits in the cut-price computing war

With PC clones being in great supply, a scenario reminiscent of petrol stations undercutting each other's prices to attract customers is being acted out in the States. The result is an all-out pricing war.

All over the US, computer dealers are using every trick in the book to get customers to come in. They offer low prices, and in some instances even throw in a case of floppy disks or memory expansion cards just to get the customer to buy.

One company that has offered cut-rate prices on a wide range is Tandy. You can buy the model 1000 with 256k RAM, for \$799 — and that includes a colour monitor.

One of the leading Korean manufacturers, Hyundai, has just released a computer called the Blue Chip PC. This particular model is sold through mass merchandisers such as Caldor and Target stores in the Eastern US. For about the same price as the Tandy model 1000, you get a dual-disk system with 512k RAM, a monochrome monitor and free software.

In high-tech areas like

The Amstrad PC1512 will have to fight hard to earn its keep in the States



Tandy has cut the price of its model 1000 to \$799 including colour monitor



Boston or Silicon Valley, you can get even better deals: CCT Computers of Sunnyvale, California will sell you a personalised system configured to your own specification. The CCT-286 AT-compatible runs at 8MHz, with 640k, seven DMA channels, a 1.2Mbyte floppy and a controller for hard and floppy disk drives. This system sells for \$995.

One of the most interesting places to buy low-cost clones can be found in the heart of Silicon Valley. Fry's Electronics is actually part of a large valley grocery chain, and is the only store where you can buy potato chips on one rack, and 256k DRAM chips on another! Although Fry's carries some smaller brands, it is known for its ability to get real IBM PCs, Compaqs and Apple products and sell them at incredible discounts.

As you can imagine, any new player entering the US computer market will be up against some tough competition. This applies as much to Amstrad as anyone. Although the Amstrad PC1512 is a great buy in the UK, in the US it will be just one more low-cost PC clone.

► design layout, and built-in spelling checker put it way ahead of its time.

Industry professionals

and observers believe that Ready, Set Go will redefine the way desktop publishing should go, and

will be the product to watch for this year.

The added abilities that this product gives you as a

general-use word processor makes it worth the purchase. And at \$295 it is worth every penny.

Micros should be seen, not heard...

Although voice synthesis is no longer new, getting a computer to talk back to a user properly requires a lot of memory and good programming technique to be effective. But a new product from Microphonics Technology in Auburn, Washington could change all that.

Pronounce Plus is a voice-controlled product that allows IBM PC users to develop 'Voice-Macro' commands and add voice-control to most spreadsheet, word processing, database management, CAD and accounting programs running under PC-DOS or

MS-DOS.

No programming is required because Pronounce Plus runs concurrently with applications programs, and memorises keystrokes and instructions as they are actually performed, storing up to 256 commands at any one time.

This is the first practical program for voice commands I have had the chance to use.

Pronounce Plus is priced at \$795 complete, and includes a plug-in board, 68k of concurrent software, a microphone and documentation.



'Stop worrying — my husband doesn't notice anything when he's on his computer.'

END



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A language laid to rest

I refer to the correspondence on accuracy in Basic and Mr Murphy's letter in the November issue of *PCW*.

The solution he suggests (converting numbers to strings) not only creates a substantial amount of work, but will not cover all the possibilities without considerable attention. This is contrary to the whole foundation of what should be a simple language in which the programmer does not have to consider the machine's way of thought, but can think on familiar lines (that is, lines familiar to human beings), and is yet another example of the difference between the original ideas of the language and the way in which it has unfortunately developed.

The only way forward is to use a better version of the language, and although it has a number of less than perfect details, True Basic does overcome the problem. Although True Basic is a binary-based dialect, it does not require the programmer to specify integer, short or long real variables, but will show $33.35 + 4.14 = 37.49$ without any special efforts.

Isn't it time that versions of Basic which were written for 4k memories were laid to rest, alongside other medieval — but praiseworthy — attempts to overcome the high cost of memory which arose when 64k was more than the average user could afford, and therefore machine registers were not designed to hold larger addressing modes?
Neville A Joseph, Wendover, Bucks

This is the chance to air your views — send your letters or contact us on Telecom Gold 83:VNU200 or PCW Online: PCW 009. The address to write to is: Letters, Personal Computer World, 32-34 Broadwick St, London W1A 2HG. Please be as brief as possible and add 'not for publication' if your letter is to be kept private.

Charting obscurity

In these days when so many computer applications manipulate text, I am surprised that the *PCW* Converter Chart (supplied with the November 1986 issue) does not include the invaluable `INSTR$` instruction which finds a substring within a string. Space could easily have been made on the chart by transferring the universal and unaltered `EXP` or `SGN` to the list of shared instructions at the top.

Micropolis Basic was my first dialect (in 1978), and an upgrade with improved editing and merging facilities included a useful option to save memory by deleting these facilities from the Basic when the program was working. Why can't we delete from modern versions of Basic all those obscure mathematical functions that some of us have never used?
Alexander Sandison, London WC1

You're right — we should include `INSTR$`, and `EXP` and `SGN` can be moved. Our major problem is cramming it all into the space and the time it takes to update the chart. We'd welcome suggestions, alterations and improvements from readers.

Not in the same league

With reference to the Compaq DeskPro 386 Benchtest by Peter Jackson in the November 1986 of *PCW*, I find his 'comparison' — or rather, his reference to the Compaq machine as being a contender to the IBM System/38 — as rather mind-warping.

As I'm a System/38 programmer, and also quite capable of programming and using micros (I use them as networked PCs to the 38), I

think I can make a reasonably unbiased view based on his Benchtest.

The System/38 is not a 'small minicomputer'. It began life as a medium-to-super minicomputer and has now, with the new model 700, grown into a fully-fledged mainframe system. The 38 has always had strong competition from below in the form of the System/36 and its SSP operating system, and from above with the IBM 4300s running the VM operating system. However, it has survived, and the 38 is arguably one of the most powerful business data processing machines available.

The 38 operating system (CPF — Control Program Facility) uses 64-bit address resolution — already a significant increase in memory capacity over the DeskPro 386. Internally, though, the machine uses a 48-bit address bus to cut down on hardware costs. The MI (machine interface) transforms the different-sized addresses, and this is not apparent to the user. IBM could increase the address space to 64 bits at the machine level at any time without affecting user applications. Disk storage is 14 gigabytes, using the highest-capacity disk drives currently in production (25 megabits per square inch).

However, this is only a practical limit, as the 64-bit CPF resolution can, theoretically, address a great deal more. You can have as many as 256 local users and remote users can extend to a theoretical 20,000, but you would run out of processor and network resources long before that limit was reached. CPF is vastly more powerful than any micro or 'super-micro' operating system (and Unix if you are a supporter of the 38 stable).

Logical data views over physical data files are just one of the 38's powerful integrated pseudo-relational database functions. ('Integrated' in this case

means that the machine handles most of the database functions as opposed to the operating system. Security is another integrated function.)

I have no doubt that the DeskPro 386 is a powerful machine, but only as long as it is viewed in the right context — as a super-micro.
Warren Allen, Arnhem, Holland

Intelligent implications

David Levy's arguments in 'Literary Choice' (*PCW*, December 1986) have implications which he may not have considered.

One useful rule in estimating the intelligence required to perform any action is that one should never assume that an action is the result of a higher function of intelligence if it could equally well be the result of a lower function. In the case of Ms Chisman's program, the function performed is the random selection of preset words and phrases in fifteen categories — this is a very low function of intelligence. One could build a machine containing fifteen faceted wheels, with words or phrases in the appropriate category printed on each facet, and have the machine spin the wheels. This would perform the same function, but I would not on those grounds argue that a glorified fruit machine was intelligent.

The fact that the end product of one process is not readily distinguishable from the end product of another process does not mean that one can directly equate the two processes in terms of skill or intelligence. One could write a program which enabled people to write programs, simply by presenting them at each stage with a series of alternative instructions which they could type in, any of which would be correct. The results would be

indistinguishable from computer programs created by a programmer, but one would not argue that anyone playing this game was *ipso facto* a computer programmer.

These programs, considered as intelligence tests, effectively consist of a multiple-choice test in which every answer is correct. The end result, a mark of 100 per cent, is indistinguishable from a mark of 100 per cent awarded in an examination in which it is possible to get the answers wrong. The functions of intelligence required to attain those results differ.

If Mr Levy really regards 'intelligence' as an assessment of product rather than process, then, as he asked Mr Goodwin, what value does he put on intelligence?

Stephen Airey, London Academy of Computing and Electronics, London SW17

As long as they don't invent low-intelligence machines to edit magazines, we'll be happy. (Whaddya mean, you thought they had already?)

Defending the Amstrad PC

Paul Herzlich ('Letters', *PCW*, December 1986) really should get his facts straight when he joins the Amstrad bashers. As I can base my opinions on one month's use of the Amstrad PC (and not a few minutes at the *PCW* Show), perhaps I can better inform your readers of the pros and cons of this machine.

Let's take each of the 'drawbacks' in turn. Firstly, the keyboard and screen. Yes, keyboard appraisal is subjective — he disliked the Amstrad's, I find it good; as for its durability... they said the Amstrad PCW8256 keyboard (which is inferior to the PC's) wouldn't last — my department has 27 PCWs and not a keyboard fault in sight!

As for the screen resolution, who's kidding who? The Amstrad mono screen is not the best I've used but it's perfectly legible, and anyone who says otherwise is playing one-upmanship. Unlike Paul, I have used it for hours and have not had to visit an optician.

Secondly, compatibility.

Here is a list of software, bought for the Olivetti M24, that I have run successfully on the Amstrad PC without modification: WordStar, WordStar 2000, Word V2.1, Word V3.0, GEM Write, dBasell, dBaselll, dBaselll+, Lotus 1-2-3 V2.0, SuperCalc 3, GEM Draw, GEM Word Chart, Super Project Plus, SideKick, Norton Utilities and IBM diagnostics. ChitChat required the device driver (in the CONFIG, SYS file) to be changed from 'DEVICE=RAMDRIVE.SYS' to 'DEVICE=ANSI.SYS', and ran perfectly thereafter. COPYIIPC and COPYWRIT (both programs to copy protected software) would not run. The parallel and serial interfaces are IBM standards. Not bad, eh?

As for the RAM upgrade to 640k, I would hazard a guess that Amstrad is simply being over-cautious in insisting that machines are returned to the dealer for this operation. The PCB has the spare sockets for the extra RAM — I wouldn't mind giving it a go. Anyway, how many users would attempt such an exercise? Most would turn to their dealer no matter which machine they had.

Thirdly, Mr Herzlich's statement that the Amstrad PC is a 'box' not a 'solution'. Sorry, Paul; the Amstrad is much more of a 'solution' than similar machines that come with 128k, no monitor, an 8088 (4.77MHz) processor and one disk drive for £100 more than the 1512.

As for IBM's next move, who really knows? But to imply that the Amstrad PC will not be a mainstream machine in twelve months' time is naive. Are people going to stop using Lotus, dBase and Word during this time? Users have invested years in these products and are not going to be easily weaned off them. What is more likely is that the cosy cartel (Microsoft, Ashton-Tate, Lotus, IBM, Olivetti, Compaq *et al*) will wake up, reduce their apparently obscene profit levels, and start writing for the 80286 and 80386 machines in the unprotected mode. But this will take time and until then, 'Why buy any other PC?'

R Elliott, Erskine, Scotland

But if we all sit back and stop complaining, Alan Sugar's head might get even bigger. At least by griping about what he hasn't done,

we might yet get a £1000 80386 machine with a 40Mbyte disk from him.

Putting the file in order

I was interested to read Kathy Lang's review of PC-File (*PCW*, December 1986), but I would like to correct a couple of points.

There is an authorised buttonware distributor in the UK, namely Ashgate. PC-File is available with a printed manual for £40 plus VAT.

The latest version of PC-File (version 4.0) is shareware only in the US; in the rest of the world, it is sold as a non-copyable package. The current level of support provides the answering of problems by mail. If sufficient people request it, a hot-line service will be provided.

An improved version called PC-File/R is also available, for £60 plus VAT, which provides a complete overhaul of the code and adds a full relational capability. This product has never been a shareware product. **John Woodgate, managing director, Ashgate Ltd, Unit B, Buzzard Works, Billington Road, Leighton Buzzard LU7 8TN**

Overpriced PC emulators

I am a Motorola MC68000 CPU enthusiast, and my only interest in IBM PC programs stems from the fact that some manufacturers who utilise the MC68000 CPU are also intending to produce IBM PC emulators.

Commodore already has such a product — Sidecar, but at £600+VAT, it is dearer than a complete Amstrad PC1512 system. When you consider that Sidecar has neither a keyboard nor a monitor, but only a 5¼in disk drive, an Intel 8088 or 8086 chip, the MS-DOS operating system and RAM, this pricing is ludicrous.

This tendency to overcharge on hardware add-ons is typical of Commodore, whose 2Mbyte RAM upgrade costs £750 and whose hard disks cost the earth. Atari, on the other hand, seems to make some

effort towards keeping prices at a more competitive level, and has forecast a price of £200+VAT for its PC emulator, despite the generous inclusion of 512k RAM.

The Motorola MC68000 processor is capable of addressing up to 16Mbytes of RAM, so Atari should provide facilities on its new models for expansion up to at least 8Mbytes.

Michael Kingston, Bristol

Watch this space — if Atari brings out an ST9320, we'll be sure to tell you first.

Plea for Andromeda help

I recently bought a second-hand 500k Andromeda Alpha D3 but, unfortunately, there was no documentation with it.

The manufacturer, ITCS, seems to have disappeared and the distributor, MBS Microtex, can't help either. Does anyone have any information — or even a spare set of manuals — that I could have?

J Risely, Knaresborough, N Yorks

Medical attention

I was wondering if any *PCW* readers could help us out. The Neurology Research Unit at the Westminster Hospital uses an Apple IIe for the control of equipment, and the analysis of waveforms recorded from the muscles and nerves of patients suffering from Motor Neurone Disease. The suite of programs used has the facility to cope with waveforms input directly from the recording equipment and also via a digitising tablet.

This second means of input would greatly speed our work, enabling us to look at the data in a variety of different ways and also look at waveforms from other sources. The programs are configured to accept input from The Apple Graphics Tablet (number 030-0076-00), the Talos Digitiser or the Summa Graphics Tablet.

These have now have been discontinued. If any reader has such a device they no longer use and would be

willing to sell to us, or knows of any compatible equipment we could try, we would be very grateful.

HG Rogers, senior technician, Neurology Research Unit, Westminster Hospital, Page Street, London SW1 2AP

Perhaps a dealer or Apple user has a device lying dormant they would be willing to donate to such a worthy cause.

A sticky question

I had a good chuckle at Martin Banks' BT project ('Room for one', PCW, November 1986), on how he would make mighty sums on his MB00 series of old-fashioned classics. Now, a small query: I've been using WordStar for a couple of years, with reasonable satisfaction, until coming upon all the recent enthusiasm for WordPerfect.

While I realise the power harnessed by this 'perfect' program through its 40 function keys, I don't think much of the template they provide as a guide to those functions. I'd be more inclined to buy the program if I thought that a set of stickers were available to fit on the function keys directly, as I've been using a similar set of stickers as a guide to the WordStar controls.

If Martin would care to enquire about that — and indeed, to write his own estimate of the WordPerfect program — I'd appreciate it very much.

Patrick Rogers, Mount Argus, Dublin

Martin Banks replies: How I sympathise, Patrick, I really do. Every software designer seems to have their own idea on which control functions are needed, and their own logical construct of how they should be accessed by the user. It's unwritten law in these circumstances that all such user interfaces will be completely different from those used on any other package.

I have to admit that I haven't tried WordPerfect, so I don't know what it's like or what its 40 function keys get up to. I agree wholeheartedly, however, that if it hasn't got stickers for the relevant keys, it ought to have. Us bears of little brain out here in the real world need more than the manual to find our way around.

Personally, I feel things would be a whole lot better

if the software industry got together to produce a common standard for the user interface to commands and function keys. Instead, of course, everyone goes around suing anyone who produces a package with a similar user interface to theirs. The result is what Patrick has found — difficulty, and an eventual reluctance to use anything beyond the package that is known.

If Daimler and Benz went around suing every car maker for making vehicles that looked similar by having a wheel at each corner, we'd have some pretty stupid-looking cars. More to the point, there probably wouldn't be any cars at all: we'd all have got fed up with the differences.

Compiling experiences

Following the review of Zorland C by Mike Liardet in the November 1986 issue of PCW, here's my MS-DOS C compiler experiences.

When I first got my PC (a Zenith Z150 with a 20Mbyte hard disk) a couple of years ago, I foolishly bought Digital Research's DOS C compiler. This had a very limited notion of DOS 2 (pass 'fopen' a pathname, get NULL back!) and was slow and bulky. DR obviously wasn't impressed with its handiwork either, as the product was dropped from the company's range some months ago.

The next compiler to fall into my hands was Lattice V2.15. A sturdy compiler this, with a full set of library functions and reasonable code. No register variables, though, and very large EXE files.

Because I work for a company which distributes

language products, I soon got my hands on Manx Aztec C V3.20e. This blew Lattice away completely, with code much smaller and considerably faster. When V3.40a came with its source-level debugger, and so on, Aztec C became the top compiler. Considering that its Commercial package includes the full source of all its library functions along with a set of useful Unix utilities, and that the list price is comparable to Lattice, I find it very hard to accept the (ongoing) industry feeling that Lattice C is the most professional compiler for MS-DOS machines.

The story does not end there. I bought Microsoft C V3.0 at the beginning of 1986 and was fairly impressed, although I still thought Aztec was the best.

Now, Microsoft C V4.0 includes three large manuals, the wonderful Codeview source-level debugger, and a much more complete description of 'far', 'huge', 'pascal' and Microsoft's other extended keywords than is offered by the V3.0 manual. The ability to access more than 64k of data in a small-model program and to specify that a Pascal-style function-calling sequence be used (it's faster but less versatile than C's) is truly wonderful, even though in general, Microsoft's code is no better than Aztec's. Both still show Lattice (now on version 3.10 and not a lot better really) how to generate code properly and how to implement register variables. Lattice's documentation contains the lame excuse that there are not enough registers on the 8086 (and so on). Nonsense!

I bought Zorland C at the PCW show and find it almost exactly comparable to Lattice except that it's a tenth of the price and has slightly worse documentation! If I didn't already own the Microsoft

and Aztec C compilers, I'd use Zorland all the time.

You do not get what you pay for. If Zorland equals Lattice at a fraction of the cost, which is my claim, why does everyone take Lattice so seriously? Lattice itself must be worried, as the upgrade from V3.00 to V3.10, which includes a completely new documentation set, is free! Lattice knows it's losing the C compiler battle.

Finally, Zorland's library is not as comprehensive as either Lattice V3.10's or Microsoft V4.0's. Microsoft's library incorporates a vast number of string functions not present in Zorland's, as well as the 'alloca' function which grabs memory from a function's stack and automatically releases it when the function returns.

Adam Denning, London N8

An unbiased view

Among all the hype surrounding its launch, Guy Kewney's review of the Amstrad PC1512 (PCW, October 1986) appeared to provide objective evidence that this really is 'the perfect PC clone'.

For those of us who've actually managed to get our hands on one, however, it seemed strange that he had no criticisms of the PC1512's extremely 'lightweight' keyboard, an important point for any computer being considered for serious business use. Nor did Kewney acknowledge that the choice in screens, between paper white and low-resolution colour, makes the PC1512 less than ideal for business applications. The increasing number of applications which rely on high-performance graphics means that many of us do already need EGAs; while those who prefer a green screen will not be able to simply plug one in, as Kewney suggests, since the PC1512's monitor is non-standard.

Yet for those of us who read the trade press, none of this is so surprising: Kewney has been employed by Amstrad 'to ensure the success of the PC1512 launch.' Nice one.

Now, how about a really objective review. **JR Gilliat, customer support manager, Small Turnkey Systems, London N19**

Just think what a dog the machine might have been if Alan Sugar hadn't had the benefit of Guy's expertise. END





BANKS' STATEMENT

Beat the clock

As humans strive to adapt to the furious pace of technological development, the intense pressure takes its toll.

Martin Banks tries to keep up.

Every so often, I find myself wondering about all these computer things. I'm not so concerned about the technology as such — which manufacturer is making the best use of the latest gizmo, for example — rather, what the things are actually being used for.

The reason for this mental exercise is founded, in the end, on the fact that I rather like people. I like them, with certain exceptions, a good deal more than most things material, such as computers. The trouble is, I get the distinct impression from reading history books and current newspapers that not many individuals feel the same way that I do. They can't do, otherwise they wouldn't do unto others what they seem to enjoy doing so much.

I am finding it just a touch sad that the computer is becoming the latest weapon in a long line of tools that individuals use against one another, either directly or, more commonly, in some subtle and indirect way. Let me give you an example. I recently saw an item in an American magazine for a clever bit of kit for your average PC. At least, I thought it was clever — until I started to think about it. This bit of kit is called PC Type Right and it comes from that house of many clever things, Xerox.

PC Type Right sits between the keyboard of a PC and the keyboard port. It is a little box that has a dictionary built into it so that, as you type a word at the keyboard, you can verify the accuracy of your spelling. Get a word wrong and the machine will beep to draw your attention (and other people's in the same office) to your abject failure.

At first this struck me as a rather clever idea: after all, having the spelling-checker online is more efficient than having to close a file, run the spell-check program, re-open the file and see what comes out. However, then one or two 'but what ifs' occurred to me.

But what about the spelling check-

er, for example? We have all heard about those that come up with some very improper alternatives if you miss the middle 'r' out of further. Strangely, the one alternative not normally suggested is the correct spelling. This may not matter when the check is an option made after writing something, but what if it's online? — you're stuck with it. What if you mean to spell something wrong, just for effect or to add a bit of humour to a business communication? The thing just won't let you.

There would seem to be great scope here to introduce a whole new level of computer-controlled conformity into life. Language is one of the things that shows we're alive and kicking. It is always changing and developing, with ever-revised dictionaries acting as its history books. If the computer won't even let you past the keyboard unless you conform . . .

Another example that popped onto my desk the other day was a press release from Selby MillSmith, a management psychology consultancy (whatever that is). It has always struck me that an individual is either naturally good at management, or not. If the latter is the case, no amount of psychology will make them better at it. And if you try and make individuals compete in that way, many of them simply burn out.

This is, of course, what we find in much of industry these days, especially the computer industry where, if you're over 40 you're a freak, or you've got something on the MD (or, of course, you *are* the MD). Most others have burned themselves out long before that time, which is why Selby MillSmith has introduced a 'lifestyle management system' for computer-industry executives.

It seems that, these days, having a 'lifestyle' and then being 'burned out' by it are particularly important icons in the 'career path' of the average 'computer-industry executive', so I suppose it's sensible for them to have a computer program geared to

monitoring their progress.

Actually, it's supposed to help people cope with the stresses of a job, but I can't help feeling that it would be a lot more sensible to change the system that causes the stresses in the first place. Why is it that humans insist on producing inadequate life systems, and then demand that we adapt to fit them?

Perhaps the best example of this, and how the computer is used as a major weapon in the process, can now be seen in the City of London. Callow youths with Oxbridge degrees are being turned into the modern equivalent of the battery hen, all for the sake of Mammon. Poor things!

Not, of course, that they are *poor* as we might understand it. These young executives, with brains like IBM mainframes, can earn up to £150,000 a year and drive company Porsches. They are also probably in desperate need of Selby MillSmith's lifestyle management package because if Mammon and its computers get their way, they aren't going to have much of one, anyway.

Imagine having a job where you slept at your place of work, and you worked whenever there was a dealing floor anywhere in the world open for business — which essentially meant all the time. You were paid lots and lots of money but never got a chance to spend any of it, so it actually stayed in the bank — that is, Mammon's back pocket. You had a Porsche but never got the chance to drive it. In fact it was fourth-hand at least, but only had 35 miles on the clock and was now being re-valued upwards as an antique. Soon enough you died at your desk, and Mammon promptly passed the Porsche on to the next bright young thing and forgot you ever existed.

I can't help wondering if this is the kind of automaton that computer technology is turning us into, and wondering whether we will soon be seeing the computer-equivalent of the free-range egg!

END





Atari blitter

The battle is on between Commodore and Atari to persuade buyers of the advantages of the 'blitter' chip. Nick Walker looks at the prototype with which Atari is hoping to pull the carpet from under the Amiga's feet.

Approximately three years ago Atari and Commodore, and to a lesser extent Apple and Texas Instruments, engaged in a drastic price-cutting war on their home computers. The result: Texas Instruments was forced to pull out of the home computing market with massive losses; Atari survived, but only just; Apple gracefully retired early on; while Commodore, badly bruised, won through. The full effects of these 1983 home computer wars were not felt in the UK due to a strong home market dominated at that time by Acorn and Sinclair.

Retrospective

Like two gladiators with a score to settle, Atari and Commodore are preparing to fight another battle. Both

companies released Motorola 68000-based computers in 1986 with very high-quality colour graphics and Macintosh-like WIMP (Windows, Icons, Mice and Pull-down menus) interfaces. Early on it looked as though Commodore's machine, the Amiga, would be strictly for the business market with a price tag to match; however, a recent price cut to approximately £1000 has brought the machine within the budget of many enthusiasts.

Atari has now retaliated with announcements of its own price cuts for the ST range, and has introduced a new chip to try to match the Amiga's graphics. Once again the swords are drawn as Atari and Commodore do battle in what I predict will be the 1987 'home computer wars', with

Christmas 1987 as the most probable show-down.

The question is: will the Atari's new graphics chip give the ST the Amiga's graphic power? I took the opportunity to review a prototype and also took a look at the new 'competitively-priced' machine.

Hardware

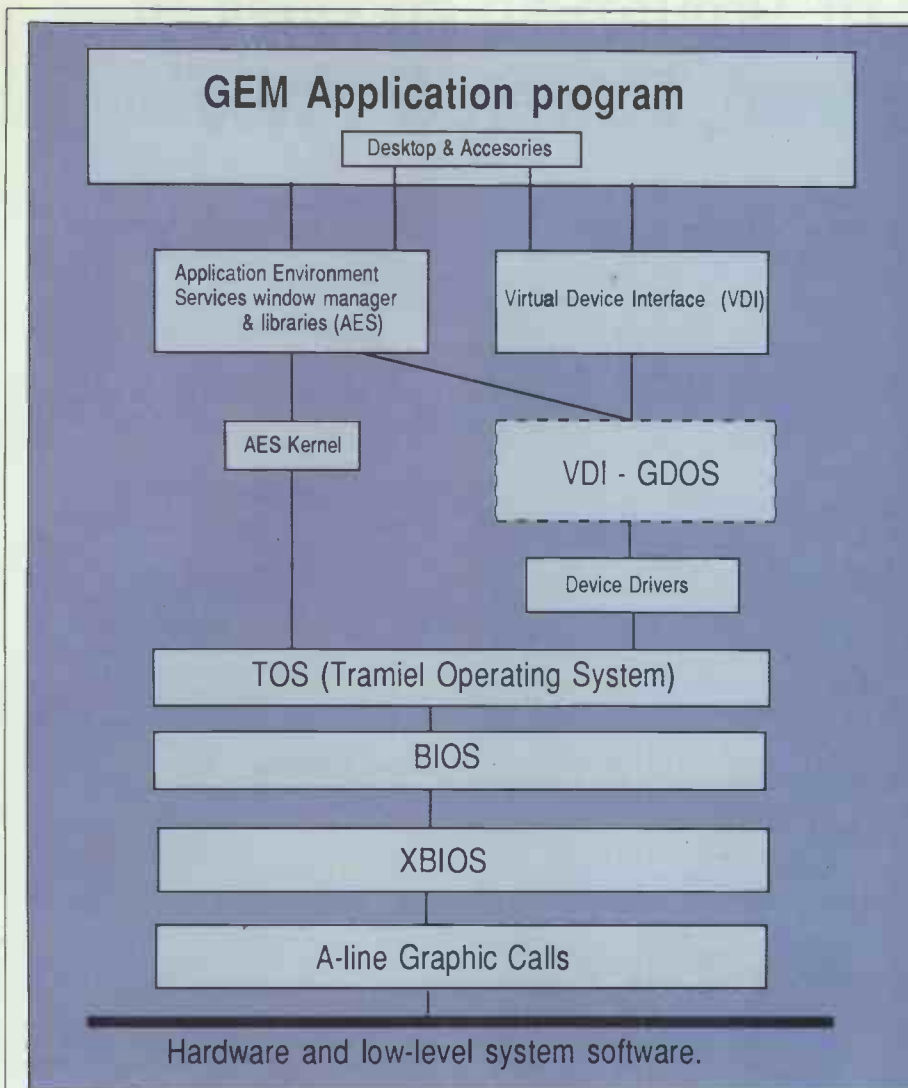
The two machines that Atari will be pinning its hopes on in the early part of 1987 will be the 520STFM and the 1040STF (the original 520ST was Benchtested in *PCW*, July 1985, while the 1040STF was reviewed in *PCW*, May 1986). The 520STFM has 512k of RAM, a 720k floppy disk drive and an internal power supply, while both machines use the elegant expanded case of the 1040STF. This eliminates the ugly housebrick-size power supplies of the original 520ST in return for a slightly larger footprint.

The complete list of ports on the ST is described in the 'Technical specifications' box. *Nothing* has been removed, which means that the ST still remains one of the best ported machines available. The right-hand side of both machines now contains the 720k 3.5in double-sided floppy disk drive; presumably the 360k drive will eventually be phased out and software will become available in the 720k format. I, personally, find it particularly annoying to receive a package on two or more copy-protected 360k disks and be unable to transfer it to a 720k disk in order to eliminate disk swaps.

Both the 520STFM and the 1040STF use the same Revision 2 PCB. This means that memory upgrade for 520STFM owners should be easy, although the board itself is to be replaced shortly by a Revision 3, which will contain the new graphic blitter chip. Atari hopes to replace both machines with their 'blitterised' versions in March 1987, but the good news is that it seems unlikely that there will be a price increase.



Photography by Philip Gatward



The architecture of the Atari's operating system. 'Blit' is one of the graphic primitives at the 'A-line'. All operating system calls above this A-line will take advantage of a blitter chip; directly accessing the hardware/software below it could crash the machine

Before discussing the blitter in detail, it is worth describing exactly what a blitter is. The name 'blitter' comes from the Apple term, 'bit-blt', which stands for 'bit-mapped block manipulator'. Initially this bit-blt was a software graphics function which allowed the programmer to define an area of a monochrome bit-mapped screen, specify a destination and issue a command to move the block. The software would then calculate all the intermediary points and move the rectangle across the screen. The simplest blit operation works only on 'word' boundaries, and in monochrome. Further enhancements work across 'word' boundaries and operate on the specific bits within a word that form a single colour plane on colour displays.

A blitter chip is the hardware realisation of this 'bit-blt' operation using DMA (direct memory access) to operate directly on screen memory. When manipulating a block of screen images, the blitter (if properly designed) takes care of a number of tasks that, in other computers, would take up a lot of processor time. Such tasks include: calculating all the in-

termediate points between the image's source and destination; masking out the undesired area just outside the image that belongs to the same memory word as the desired bits, and shifting the bits horizontally to match the word alignment to the destination.

Unfortunately for Atari, the first blitter that the public became aware of was the Commodore Amiga's blitter. While there is no doubt that the Amiga's blitter is a true blitter, it also adds a number of other functions that greatly enhance the chip. Jay Miner, the Amiga's chip designer, prefers to call it a 'blimmer' for bit-mapped image manipulator.

Briefly the Amiga's blitter distinguishes itself from other bit-blt devices by its ability to draw lines and fill areas, as well as the logical operations that can be applied to the image blocks during transfer. Also the chip can combine three source areas in one of 256 different ways to form the destination area.

Atari's blitter is a more modest device than the Amiga's but, nevertheless, is still very impressive in action. The chip sits directly on the bus

along with the disk DMA controller, the video chip and, of course, the processor. For existing ST owners this makes the addition of a blitter no easy operation, as there is no user extension of the bus on the ST. Consequently the machine has to be taken to a dealer for the chip to be soldered on top of the 68000. For this reason the blitter will exist in two forms: as a DIL (dual in-line) package that fits over the processor; and as a square custom ship for the Revision 3 PCB.

The Atari chip is a basic blitter; it has no line-drawing or fill capabilities. Unfortunately, you can only move one screen image to one destination, but, on the other hand, it does have the advantage of working in all three ST screen resolutions, including monochrome. A one-word mask can be applied to the block via 16 logical operations, a typical use of which would be to give increasing shading to an image as it crosses the screen.

The one feature that the Atari blitter has that the Amiga hasn't is the ability to blit from one colour plane to another. The most obvious use of this facility would be when the colour planes were being used to give perspective and where you wanted to show something coming towards or going away from you.

Both machines have lost the bundled monitor of early ST packages; the 'M' in the 520STFM stands for 'modulated' which means that you can plug this machine into a television. When used with a television, the machine can only really be used in 16-colour low resolution mode (4-colour medium resolution with 80-column text is just about readable but soon becomes very tiring). 1040STF owners will have no choice but to buy a monitor either from Atari or a third-party manufacturer. Atari has dropped the Thomson colour monitor originally supplied and replaced it with one of its own manufacture. This is noticeably clearer and brighter than its predecessor. The high-resolution 'paper-white' screen has also been updated to include a tilt and swivel mechanism. This solves the problem with the old unit where the bottom of the screen was obscured by the ST's casing.

As for the various other ST products that have been temptingly shown at various computer shows, the IBM PC compatibility add-on is looking very dubious in the light of two software-based products that look set to do as good a job and will undoubtedly be cheaper.

The 2080STF and 4160STF, with 2Mbytes and 4Mbytes of RAM respectively, should be available by summer 1987. These machines will be of a new, three-box design that will be capable of taking expansion cards. The 32-bit machine, if and

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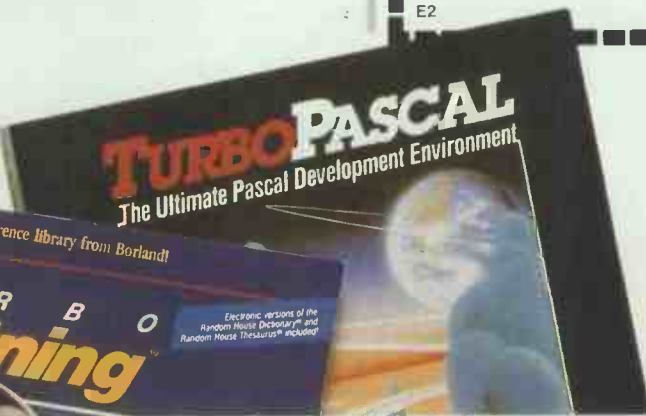
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E2



when it appears, will probably be on an expansion card. Sadly there is no reduction in the price of the 20Mbyte hard disk to match those of the machines.

Software

Hopefully by now all STs will have their operating systems in ROM. This significantly improves the performance of the system and does, of course, free most of the RAM for the user. The ST's operating system consists of TOS, a version of CP/M-68k, with GEM from Digital Research providing the WIMP environment.

While there is undoubtedly an advantage in having the operating system in ROM, it does mean that updates are more difficult to distribute. Furthermore, relations between Atari and Digital Research are not all they could be, so current Atari STs are using version 0.97 of GEM while Digital Research is up to version 2.0 with the IBM-compatible version. Although a new set of ROMs will be issued with the blitter chip, I was disappointed to hear that Atari hadn't



taken this opportunity to update this version of GEM. Furthermore, a number of bugs in GEM and TOS have been eliminated — but not in accordance with Digital Research. This increases the divide between the ST's GEM and the IBM-compatible GEM, which seems to defeat one of the fundamental principles of GEM — machine independence.

The burning question in all existing ST owners' minds must be that of compatibility. Will fitting a blitter chip make any existing software incompatible? Will existing software utilise the power of the blitter?

For the answer to all these questions it is necessary to understand a little about the ST's system software. Like all operating systems, this is best imagined as a number of layers that decrease in 'user-friendliness' the nearer you get to the hardware. Most users will never see beyond

GEM or possibly TOS, but programmers in search of faster or better graphics may well have to delve down further. All graphic commands on an Atari ST should filter down through the layers to a base level of 16 graphic primitives known as the 'A-line'. One of these graphic primitives, regardless of whether the machine has a blitter or not, is a blit operation. In a 'non-blitterised' machine this operation is simulated through software in the ROM, otherwise the operation is based to the blitter. If a programmer goes below this A-line level to access the graphics directly, the results will be unpredictable.

The more elaborate graphical applications (mainly games) may well not feel the benefit of the blitter. While in theory, no application should crash with the blitter in operation (it should just be ignored), in practice things are different. Practically *all* the better games (for example, Major Motion, Time Bandits, The Pawn, Psion Chess) crash, although GEM applications, such as 1st Word, Basic and TDI's Modula-2, benefit from the blitter in scrolling and window movement.

By the time the blitter is made publicly available, there should be a software switch to turn it off when running incompatible software. It may seem a little strange that a graphics chip doesn't operate with 'graphical' applications — but don't worry, the demos created so far give a glimpse of what's to come and it's very impressive indeed.

Prices

The Atari 520STFM costs £399 and the Atari 1040STF costs £574 (both excluding monitor). Other Atari peripherals are priced as follows: a 20Mbyte hard disk, £799; a 'paper-white' monitor, £149; a colour monitor, £399; a 360k external 3.5in floppy disk, £149; and a 720k external 3.5in floppy disk, £199.

Conclusion

If graphics, processing power, ease of use and sound are more important to you than established 'base of' applications, then both the ST and the Amiga are worth investigating.

The Atari ST blitter chip does bring the machine closer to the Amiga in graphics performance, but the Amiga still reigns supreme in this department. However, in its favour the Atari does have a much stronger user base and there is a greater range of applications available for it.

If you do want one of these machines, don't spend too long pondering. Buy the machine that appeals to you, and give it all the support you can.

END



At last, Atari's medium-resolution colour monitor is now available. It is smaller, brighter and clearer than the Thompson unit it replaces

Technical specifications (520STFM)

Processor:	Motorola 68000 running at 8MHz
ROM:	196k
RAM:	512k
Mass storage:	One 720k 3.5in floppy disk drive
Keyboard:	92-key including ten function keys
Size:	18.5ins x 11.5ins x 2.5ins
Weight:	24lbs
I/O:	Two mice/joystick ports, a ROM cartridge port, MIDI-in and MIDI-out, serial RS232, a parallel Centronics printer port, a parallel hard-disk port, an external floppy disk port, an RGB/monochrome monitor port and modulated TV output
DOS:	TOS with GEM friendly front-end

Heavyweight ATs

The Olivetti M28, the Wyse pc286 and the ITT XTRA XL are all attempts to improve upon the definitive IBM PC/AT. Peter Jackson discovers by what methods and devices these AT clones have tried to beat the original machine's specification.

The IBM PC/AT is posing problems for the compatible makers who want to build one, not because of any great technical complexity or BIOS trouble, but simply because the AT represents the end of a particular line of development. The pinnacle of the AT standard is a machine with an 8MHz 80286, 640k RAM, a 1.2Mbyte floppy and a fast hard disk running MS-DOS 3.1, and one of those can be put together cheaply by any competent electronics manufacturer.

With that in mind, there is no point in building an AT expanded beyond the MS-DOS limit of 640k and the bus compatibility clock speed limit of 8MHz unless it is going to run Xenix, or unless Microsoft is going to launch MS-DOS 5 next week. But since it is so easy and so cheap for everyone to build fully-configured AT clones that push the limits as far as they can go, how can the battalions of clone makers distinguish their machines from each other?

The simple answer is that most of them don't try, and just churn the things out at the lowest price possible. The larger manufacturers, however, can't afford to do that in any meaning of the word. They can't compete with the bottom-end clones on price, and couldn't be seen mixing it in the gutter in that sort of company anyway. The only course is to go upmarket, and with the AT

architecture and software limiting how far upmarket they can get and stay compatible, that takes some deep thought.

There are various approaches that can be taken to this problem, from the angles of marketing, performance, ergonomics and graphics, or a combination of these. And the three machines covered here — the Olivetti M28, the Wyse pc286, and the ITT XTRA XL — demonstrate several additions to the AT standard that can help make a clone something rather more. While all machines with an 80286, 640k RAM, a 1.2Mbyte floppy and a hard disk are created equal, some can be more equal than others.

Olivetti M28

The Olivetti M28 was released in the middle of 1986 as the top end of the M20 range, above the M21 portable, the abortive M22 laptop, and the M24 and M24SP desktops. The machine was meant to be more than a clone and was aimed at the multi-user Xenix market; Olivetti has recently corrected its aim with a hefty price cut, and new help for top-end dealers and systems houses who can handle multi-user systems and Xenix.

In external design, though, the M28 looks like an inflated M24 with the same square, blocky look to it. The new case is taller than the M24 to make room for the bigger AT-compatible expansion boards, and is taller than the AT itself but narrower and about the same depth. This design means that the M28 takes up less room on the desktop, but lifts the monitor high enough off the desk surface to make it uncomfortable. Of course, in its multi-user mode the



From left to right: The ITT XTRA XL,

system box can be stood on its side on the floor, or otherwise hidden.

There is space for two half-height floppy drives on the front panel, and a hard disk can be fitted either under the floppies, or in place of one of them, or both.

On opening up the M28 box in the usual IBM PC way (by removing five screws on the back panel and taking off the cover) it looks like a masterpiece of Italian design. An almost empty green motherboard filling half the case, and a set of expansion slots with four sparsely-populated boards, complete the visible electronics. And then the problem is working out how even Italian designers can build a PC without a microprocessor or memory.

In fact, the M28 is Tardis-like. The bare motherboard sits on top of a false bottom to the casing, and removing the base of the machine reveals an enormous circuit board filling the whole area, mounted in such a way that when the machine is on the desktop, the components on this board face downwards.

'All three machines are good performers that can certainly do anything the IBM AT can do, and do it rather faster...'



the Olivetti M28 and the Wyse pc286 — top-drawer AT clones which look beyond the original specification

The connection between the main circuit board and the slotted motherboard is made by one of the 'expansion cards', which turns out to be rather more than that. The connection is made by three buses — one standard 8-bit IBM expansion bus and two small extra ones, and the motherboard is linked to the system board by connectors on the expansion board, which in fact is part of the basic system. This board is the standard M28 graphics controller, which gives both IBM monochrome and colour graphics adaptor (CGA) displays as a similar board does on the M24.

On the main board, accessed by removing the base plate of the system unit, the contents are fairly conventional. The 80286 chip is there, with a socket for the 80287 maths processor, 1Mbyte of RAM with the first 512k soldered and the rest in sockets, two BIOS ROMs labelled PBUM and PBUL, two empty sockets for more ROM, and a large custom chip of unknown provenance and function. Also on this board are the

keyboard interface and the system's first two parallel and serial interfaces; this means that when the system is assembled these IBM-style, 25-way D connectors are upside down as far as the user is concerned.

The main surprise with this board is its size. The thing is enormous, and must cost Olivetti a lot to manufacture, particularly since it is made in Italy rather than Taipei. That the price of the M28 is competitive says a lot for Olivetti's component purchasing talent and its volume manufacturing. It is illuminating to compare it with the system board in the Compaq DeskPro 386, which — admittedly without memory, but with expansion slots on it — is not much more than half the size.

Returning to the blank motherboard, the system graphics controller board fits next to the casing at one edge, leaving seven expansion slots. Four of these are 16-bit, AT-type slots while three are 8-bit, and the minimum system with floppy drives only uses one 8-bit slot for a high-density disk controller board that can

handle both 1.2Mbyte and 360k drives. The hard disk machine uses one more 16-bit slot for its Winchester controller.

On the review machine, another slot was filled by one of the things that Olivetti thinks will give it an edge — the Olivetti enhanced graphics controller (EGC). This board, which connects to the system graphics controller and to one of the small buses on the system board in the base of the machine, provides a colour graphics resolution of 640x400 dots in 16 colours chosen from 72. This means, for example, that four standard 320x200 four-colour CGA pictures could be displayed simultaneously on the EGC display.

The EGC was initially developed for the M24, which has the problem of not being able to use IBM-compatible enhanced graphics adaptor (EGA) boards without disabling the built-in colour graphics. And since that would require cutting connecting tracks on the boards as well as changing the system ROMs, Olivetti regards it as impossible to



The power switch and the reset button are on the front of the M28



The parallel and serial ports don't occupy any slots



The 102-key Type 2 keyboard; there is also a PC-compatible Type 1

In perspective: Olivetti M28

The M28 is in something of a no-man's land in the high-end AT market. It is aimed at the multi-user Unix market, but has no extended RAM facilities for Xenix on the 80286. As a single-user machine it is a good performer, but the EGC graphics card now looks limited in resolution and performance, and Olivetti has been wise in changing the M28 so that it can accept and use EGA adaptors. In fact, as an AT-compatible, the M28 minus the EGC is very much in the mainstream of the clone flood, and Olivetti's move to take it upmarket into multi-user dealers and vertical markets should help in distinguishing it from the rest and getting to Olivetti's traditional small, multi-user, business system market.

Technical specifications

Processor:	Intel 80286, 8MHz
RAM:	640k
Mass storage:	One 1.2Mbyte floppy drive, slot for second 1.2Mbyte or 360k drive; 20Mbyte hard disk
Display:	Monochrome and CGA standard; optional EGC with 640 x 400 resolution in 16 colours
Monitor:	Monochrome or dual-standard colour
Keyboard:	83-key, PC-compatible Type 1; 102-key Type 2
Expansion:	Four 16-bit and three 8-bit slots; five free in hard disk configuration
I/O:	One RS232, one Centronics parallel port on system board
Operating system:	MS-DOS 3.1 or Xenix System V
Price:	Basic 20Mbyte CGA system, £3394; EGC card, £582

support EGA on the M24, despite the fact that some third-party dealers are doing the conversion as a service to users.

Now, although the M28 design has been changed to make sure that EGA boards *do* work in the machine, Olivetti reckons that the EGC is established enough to sell in its own right. However, that depends on applications software producers adding EGC drivers to their packages, and that support is slim so far. Olivetti claims that EGC drivers are often missed by users, since the same board is sold as the DEB by AT&T in the US and drivers are provided under that name on US packages. But a quick, unrepresentative check shows that none of the graphics-based packages on hand, apart from Digital Research's GEM, supported the EGC; in particular AutoCAD, the industry standard in CAD software, did not have an EGC or DEB driver in the driver update issued in the middle of 1986. Anyone considering buying an EGC board should check the software availability first.

To be fair, the EGC does have a big advantage in that it works with the standard Olivetti colour monitor, while EGA graphics require users to buy a new — and expensive — screen on which to display them.

Olivetti itself shows off the EGC board with its Enhanced Personal Presentation System (EPPS), a package designed to produce slides and overhead projector transparencies in a variety of text and picture styles. EPPS requires the EGC, and will also work with the Olivetti mouse supplied with the review machine. This is an OEM version of the Logitech two-button design, and is a flat, lightweight device that plugs into a special port on the back of the M28 keyboard.

EPPS is a combination of menu-driven application and screen-painting program with icon libraries thrown in, something like VCN's Execuvision and Concorde presentation graphics packages. An EPPS presentation is made up of a series of 'slides', each one created by freehand drawing or by calling in, resizing and positioning standard icons such as maps, flags, logos and Olivetti PCs, and then adding illustrative text. Pauses can be inserted so that a slide is built up as a sequence of elements, and animation within a slide can be done using the EGC's 'blink' feature to switch pixels instantly from one colour to another.

The slides are actually stored as text files with programming-like instructions, which can be edited at will to control a presentation, and graphics or text screens can be captured and imported from other ap-

plications such as 1-2-3 and built into slides. For output there is a direct-connect interface with Polaroid's Palette transparency production system, and standard printers can also be used for black-and-white drafts.

In use, EPPS can be driven using onscreen menus and painting techniques, or directly by producing the controlling text files with the built-in graphics programming language. And there is no doubt that effective slides can be produced by the EPPS/EGC combination. But the actual screen-drawing, controlled by the EGC, seems slow compared with some of the EGA boards now appearing on AT clones, although the colours are bright and the shapes are sharp enough.

EPP's strong features are the Palette interface, the presentation editing and the icon library, although the user interface is clumsy and the range of standard icons is slim compared with VCN's. There is still a feeling, though, that these days the M28 and EGC are not the top high-resolution graphics combination around — and the EGC is not compatible with the new industry standard, even if it did appear on the scene first.

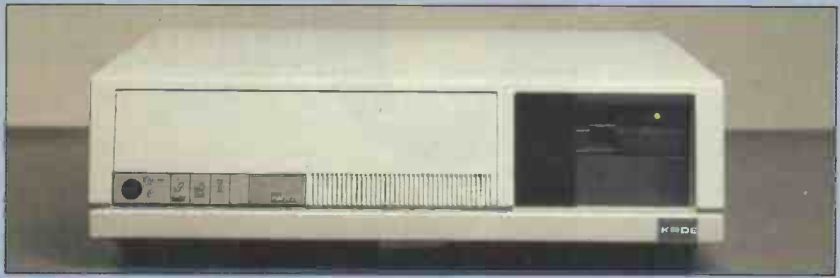
Overall, the M28 is a fast machine with AT compatibility, unexceptional features and a rather unpleasant keyboard — the review machine had the Olivetti Type 2 keyboard, confusing things with its 18 function keys across the top and odd Help and '00' keys on the numeric keypad — which clacks and clatters, and on which the keycaps feel too small.

The machine did everything you might expect of it, and did it adequately. But it is not special in any way outside the EGC, and perhaps Olivetti is wise to put extra serial communications boards in it and sell it to run Xenix.

Wyse pc286

Wyse is a company that has followed the well-trodden route from dumb-terminal manufacture to PCs, as its terminal customers have moved towards attaching local intelligence to host machines. And it has now followed the equally well-trodden route from its original ordinary 8088-based PC clone up to a high-powered AT-compatible.

But it is obvious from the first sight of the pc286 that the added value in Wyse's AT design comes at least partly from ergonomics and design. The machine is finished in mid-grey, with a distinctive raked front panel and a Bang & Olufsen-style sliding screen in smoked black plastic to cover the disk drives when not in use. The design makes the box look smaller than it is, and it is in fact lower than the original AT and more like the PC in scale. Users will



The pc286 has a stylish sliding screen to cover the disk drives



There are six 16-bit and two 8-bit slots on the back panel



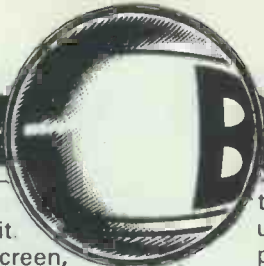
The terminal-size keyboard is dwarfed by the big system box

In perspective: Wyse pc286

Terminal maker Wyse is hoping its graphics expertise will gain extra sales in the CAD market, and the WY-700 adaptor and monitor should certainly help with those customers who want 1280 x 800 graphics in AutoCAD or 160-column displays in Lotus 1-2-3. As an AT clone the pc286 is a solid piece of work with some neat features, like the software, keyboard, or front-panel control of processor speed while applications are running. However, the customers that Wyse will gain with the graphics they may lose on the keyboard, which is poor and should be replaced with a more solid design matching the casing. Compared with other clones the pc286 is fast and compatible, and a pleasure to use with the WY-700.

Technical specifications

Processor:	Intel 80286, 6MHz or 10MHz, software or hardware selectable
RAM:	640k standard
Mass storage:	One 1.2Mbyte floppy drive, slot for second 1.2Mbyte or 360k drive; one or two hard disks
Display:	Any IBM standard adaptor, or WY-700 adaptor giving 1280 x 800 dots in monochrome
Monitor:	Monochrome, high-resolution monochrome, or colour with amber and green switch options
Keyboard:	84-key, AT-compatible standard; any AT-compatible board with DIN socket
Expansion:	Six 16-bit and two 8-bit slots; six free in hard disk configuration
I/O:	One RS232, one Centronics on adaptor
O/S:	MS-DOS 3.1; versions earlier than 3.0 do not work
Price:	20Mbyte CGA system, £2250; Wyse 700 (inc adaptor), £895



BENCHTEST

have to check that AT-size expansion boards fit.

Apart from the drive screen, the front panel has the usual AT barrel lock with an unusual LED indicator to show the lock status, along with three more indicator lights showing power-on, hard-disk access and the processor speed. This last indicator, which is marked with a lightning flash, also has a pushbutton to switch the 80286 processor speed between 6MHz and 10MHz while the machine is running.

Inside, the design is more conventional than Olivetti's. One big motherboard holds the 80286 (with a socket for the 80287 maths chip), 640k RAM soldered as standard, six 16-bit AT slots and two 8-bit PC slots, a real-time clock/calendar with a back-up battery, and not much else. In most configurations just three of the slots are used: one for a combined Winchester and floppy controller board; one for the short board holding one serial and one parallel port; and one for the display controller. The disk controller and serial/parallel board come as standard, while the choice of display adaptor is left up to the user for reasons we shall see later.

Officially there is space for three storage units, with one half-height, 1.2Mbyte floppy drive, and a choice of 360k floppy and full-height and half-height Winchesters filling the other two. And although it looks possible from the case design to have three drives in the right-hand stack, including the 1.2Mbyte floppy, and two half-height hard disks in the left-hand stack, the Wyse controller will only handle two floppy drives and two hard disk drives with a maximum of three drives installed at any one time. The review machine came with one floppy and one 20Mbyte, Seagate ST-225 half-height Winchester filling half the left stack.

It is when it comes to the choice of display adaptor that Wyse's attempt to give itself a unique selling point comes to light. The pc286 will take all the usual IBM-compatible boards giving monochrome, CGA, and EGA displays. But on top of that Wyse is offering its own display adaptor to drive the WY-700 high-resolution, monochrome graphics monitor, a screen that can display a maximum resolution of 1280 x 800 while emulating IBM monochrome, and CGA text and graphics.

The WY-700 and its supporting hardware and software are remarkable products. In its IBM emulation modes the adaptor — a double-decker expansion board in a single 16-bit slot — does not need any special drivers in the applications software, but even at minimum resolu-

tion it displays text characters using a 16 x 32 pixel cell compared with the IBM 8 x 8.

Beyond that, using its own software or drivers provided by applications, it can give an expanded text display with up to 50 lines of 160 characters each, and three graphics modes: 640 x 400 in four shades of grey; 1280 x 400 in a single shade with two pixels per cell; and a full bit-mapped mode with 1280 x 800 dots in one shade. In this last mode, the WY-700 could display eight full IBM CGA screens using the CGA's highest-resolution monochrome mode.

However, the WY-700 monitor is not a monster. It has a compact 15in diagonal screen, and on top of the system unit it does not look at all out of place when compared with the standard Wyse colour monitor. The display on the screen, even in IBM text modes, is remarkably sharp and steady, and uses a restful cream-coloured phosphor. Compared with the blurry green of too many IBM-compatible monitors, it is a pleasure to use.

'... the three machines covered here ... demonstrate several additions to the AT standard that can help make a clone something rather more.'

Of course, the high-resolution modes of the WY-700, like Olivetti's EGC, need software drivers if the full benefits of the screen are to be gained. The mid-1986 copy of AutoCAD I tried had just had a WY-700 driver included on its driver update disk, and it worked well. And Wyse's US presence and position as one of the industry leaders in text and graphics terminals means that the mainly-US graphics software market is likely to add drivers for the system.

For those users who, like me, think colour is overrated and hate green and amber screens compared with white, the WY-700 should be on their wish list. The usual caveat applies, however: if there is some special software you want to use with the system's high-resolution modes, make sure the appropriate driver is available.

Wyse's own driver software for the adaptor includes utilities to clear the entire screen in high-resolution text modes — CLS only clears the first 80 columns and 25 lines — to set a tim-

er that will power-down the screen to save phosphor burn, to switch between the default font and a user-created one if required, and to switch between high-resolution text modes. The saver and resolution-switching utilities are RAM-resident, and can be called up at any time from within applications.

The Wyse alternative to the WY-700 is a more standard colour display with its own CGA-compatible adaptor on a short 8-bit board, and apart from the clarity and sharpness of the colours — excellent again — the main feature of the monitor is a front-panel switch that allows you to switch between monochrome green, colour, and monochrome amber displays at will. This is similar to the way the Epson PC's Taxan monitor works.

After the quality of the screens, the big disappointment with the pc286 is the keyboard. All Wyse has done is take the IBM-compatible keyboard off one of its terminal models and provide a telephone-style jack plug on the back panel of the machine to plug it into. As a technique it works, but the small terminal-scale board looks silly next to the big system box and monitor, and even though the keys have the same size, spacing and step as other AT keyboards, they feel more cramped. The feel of the keys is light with no tactile feedback, and I would not like to use it for fast, intensive work.

However, Wyse thoughtfully provides a more conventional DIN socket on the back panel that will take any AT-compatible keyboard including the new IBM 'Enhanced'. I tried this by taking an AT-style keyboard from an old PC clone and plugging it in; it worked fine, and was much preferable to the one supplied.

In use, the pc286 felt like a fast machine in most operations, particularly disk access. But a disk drive test program showed that the Seagate was half as slow again as the IBM AT drive, with an access time of around 70ms; I can only say that it didn't feel like that. The operating speed of the processor can be changed from 10MHz down to 6MHz for those very few software packages that require it, and the change can be done on the fly using the front-panel button, or by software using a SPEED command in MS-DOS just like the one supplied with the Compaq 386. This command can be used in AUTOEXEC files to set the speed of the machine at boot-up for awkward programs, and to enable or disable the front-panel button if required.

In general the pc286 is an attractive, well-built (in Taiwan) and fast machine with excellent colour graphics and above-excellent

monochrome graphics with the WY-700. With a proper AT keyboard and a slightly faster hard disk drive, it could be even better.

ITT XTRA XL

ITT has never made much of an impact in the PC world, despite having entered it with the first of the small-footprint PC clones in the shape of the original XTRA, and having pre-empted the IBM XT 286 with the XTRA XP. Now, following the 80286-powered but XT-compatible XP, comes the full-blown XL.

And full-blown the machine certainly is. It has been designed from the ground up to be rather more than an AT clone, and is aimed squarely at the multi-user Xenix market; the unique selling points are brute power, capacity, and expandability.

For a start, there is space for up to 1.64Mbytes of RAM on the motherboard itself, for use with Xenix in the 80286's protected mode. Then the minimum configuration has a 40Mbyte hard disk drive as standard — a drive with a 20ms access time that the PC disk Benchmark program describes as 'the ultimate in hard disk performance' — with options going up to 145Mbytes. And a communications expansion board is available from ITT with its own 80186 processor, and ports to hook up to eight terminals to the system unit. Using the XTRA XL as a single user machine feels like overkill; but once protected-mode MS-DOS 5 appears, other manufacturers will wish they had some of the things that this machine has built-in.

Inside the box, the standard AT layout has been abandoned. The big power supply is at the rear-most left corner rather than the right, and the expansion slots are where the power supply normally is. The three-slot disk storage stack is almost central, with the standard 1.2Mbyte floppy at the top, while the standard hard disk is in an unusual vertically-mounted position next to the stack. This makes sense when the XTRA XL is placed in what one guesses to be its preferred multi-user floor-standing position, when the hard disk will be horizontal and the floppies vertical.

More evidence for this comes from the shape of the system unit combined with the design of the CGA monitor supplied with the review machine, since the height of the box with the monitor and its standard tilt-and-swivel base on top makes it very uncomfortable to use. The monitor is obviously designed to go directly on the desktop behind the keyboard.

The motherboard comes with the 80286 processor, a socket for an 80287, and eight expansion slots of which two are eight-bit and six 16-bit. On top of that come two serial



Strangely, the serial ports use PC-style, 25-pin D connectors



The XTRA XL's front panel includes an easily-accessible hardware reset



The standard Taiwanese AT-lookalike keyboard has a light, unclicky feel

In perspective: ITT XTRA XL

With the XT 286-compatible XTRA XP below it, the XL has gone upmarket in a big way. The system, with its very fast hard disk, almost 2Mbytes of RAM on the motherboard, and minimum 40Mbytes of hard disk, is aimed at the multi-user Xenix and multi-tasking protected-mode MS-DOS 5 markets. ITT has gone for power and speed to lift it out of the AT clone ruck, and succeeds with a machine whose performance and expandability are hard to match. Now the company needs better distribution from the multi-user dealers, and UK distributor STC should be concerned at the company's lack of penetration so far.

Technical specifications

Processor:	Intel 80286, 6MHz or 8MHz, software or keyboard selectable
RAM:	640k zero wait state, expandable to 1.64Mbytes
Mass storage:	One 1.2Mbyte floppy drive, slot for second 1.2Mbyte or 360k drive; built-in 40 or 80Mbyte hard disk and space for another
Display:	Monochrome, colour or combined adaptors
Monitor:	Monochrome, dual-frequency monochrome or colour
Keyboard:	84-key, AT-compatible
Expansion:	Six 16-bit and three 8-bit slots; seven free in hard disk configuration, single user
I/O:	Two RS232, one Centronics on motherboard
Operating system:	MS-DOS 3.1 or Xenix System V
Price:	Basic 80Mbyte CGA system, £7084

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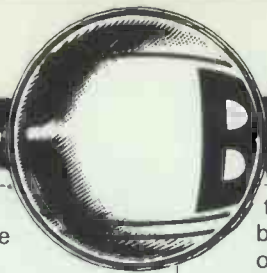
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ports and one parallel port, meaning that in the normal configuration, only two slots are taken up with the combined hard and floppy disk controller and the graphics card. The review machine had a standard CGA card, with no special features, and the standard multi-standard disk controller that can handle 1.2Mbyte and 360k floppy drives as well as the full range of hard disks. One nice feature of the system is that the expansion board securing screws are big, knurled knobs that can be tightened with the fingers — a great advance over the tiny Phillips screws that normally do the job.

The motherboard RAM is in two distinct 1Mbyte banks, one hidden under the drive stack and the other in view under the expansion boards, and uses parity checking. With megabit chips in place, the XL could go up to 8Mbytes of RAM without modification.

The front panel of the system unit has the on/off pushbutton, an unusually-accessible hardware reset and a simple padlock-style lock, along with hard disk access and power indicators, and a logo panel that can, like that on the AT, be rotated when the unit is standing on its optional floor-stand. The rear panel just has power input and keyboard sockets, alongside an unusual DIN-style power take-off for a monochrome monitor and the three interface ports. Strangely for an AT-compatible, the two serial ports use PC-style, 25-pin D connectors rather

than the AT's nine-pin Ds — but since the nine-pin type was only used to make the socket fit on one AT adaptor card alongside a 25-pin parallel port, there is no real argument against this.

All of the hardware is built in Taiwan, which is no longer another way of saying that it is cheap, and is solid and impressive. The keyboard is a perfectly stock Taiwanese AT-lookalike, with the light un-clicky feel that is typical of the breed.

On boot-up, the XL has an impressive range of system diagnostics and set-up options, showing that some thought has gone into the problems that users have in figuring out what their system contains and how it is configured. However, the first power-up of the system produced a hang-up, with the machine's diagnostics unable to find the hard disk and forcing a floppy boot. No big problem, but disconcerting on such an obviously power-engineered machine.

Apart from that, the XL performed flawlessly and fast, thanks to the 8MHz 80286 and the 20ms Winchester. The speed of the processor can be cut using an MS-DOS SPEED command similar to that provided with the Wyse machine, but finding software that jibes at 8MHz is a tough task these days. Most software houses are now used to the fast clones that are taking a lot of IBM's market share, and are making sure that their packages run on them.

Oddly, while the XL was visibly faster than, say, the Wyse running applications like AutoCAD, processor Benchmarks showed the Wyse as being superior in speed. All that proves is that complex applications use disk overlays to get round the 640k limit in MS-DOS, and that a fast disk can more than compensate for a slower processor architecture. It also shows that pure processor-bound Benchmarks are not much of a real-life performance indicator, but then we all know that anyway.

The ITT comms expansion board is reminiscent of the UK-built Chase AT8, which also gives a hardware-assist to multi-user operation on an AT. The limit of three users under Xenix on the original AT was placed not only because IBM was launching its network at the same time, but because the AT architecture is not designed to handle intensive I/O-bound operations. An I/O co-processor board can work wonders, and with the 80186-driven comms option, there is no reason to doubt that the XL's big main memory and very fast disk would drive an eight-user Xenix system satisfactorily.

In fact, reviewing the XTRA XL as a single-user machine is not particular-

ly useful, although reviewing it as an eight-user machine would be a sheer impossibility. This machine is a powerhouse, and a single user willing to pay the money for it could — with the preferable addition of an EGA card and monitor — have a system to drool over. That isn't ITT's aim, though, and it will be up to the multi-user market to determine whether it wants to base its Unix operations on an AT rather than on a 32-bit PC or a 32-bit 68020 box.

Compatibility

I did not expect to find any compatibility problems with any of the three machines, and sure enough there were none. The M28 uses Olivetti's own well-tried BIOS, while the pc286 and the XTRA XL use the equally well-tested Phoenix version. Nothing failed to run and everything worked fine, and there is not much more to say.

As mentioned earlier, compatibility trouble has been ironed out by the increase in the market share of the clones and the need for software houses to service that growing number of users; and, of course, the benefits of experience in cloning IBM BIOS routines has meant that there is no reason — apart from sheer poverty — for any manufacturer to break the copyright law.

Olivetti, Wyse and ITT are three companies which are certainly *not* short of money.

Conclusion

In the AT-compatible market, there are distinct strata of manufacturers. The first band are making clones that run the software and are cheap; the middle band are adding value to the AT spec and running the software faster with better graphics and ergonomics; and the top band are looking beyond the spec to multi-tasking, protected-mode MS-DOS and multi-user Xenix. All three of the machines reviewed here — the M28, the pc286 and the XTRA XL — fit in the top two bands, with Wyse and Olivetti in the added-value region and ITT squarely in the top bracket.

And all three of them are good performers that can certainly do anything the IBM AT can do, and do it rather faster and with clearer graphics. Perhaps users will have to put themselves in the same three strata, with those who want today's technology now, those who want slightly more options for specific applications, and those who want to look further ahead. As ever, the user has the choice; I wouldn't want to be forced to make it.

END

Benchmarks

OLIVETTI M28	
Intmath	2.1
Realmath	2.0
Triglog	15.0
Textscrn	33.6
Grafscrn	11.6
Store	4.9
WYSE pc286	
Intmath	1.8
Realmath	1.8
Triglog	11.9
Textscrn	50.3
Grafscrn	8.9
Store	3.9
ITT XTRA XL	
Intmath	1.8
Realmath	1.75
Triglog	12.1
Textscrn	50.4
Grafscrn	8.65
Store	4.0

For a full explanation of the PCW Benchmarks, see the December 1986 issue, page 164.

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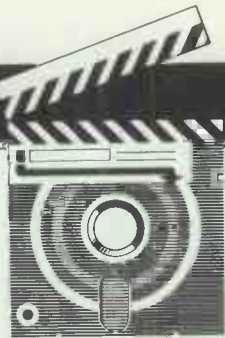
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FileMaker Plus

FileMaker Plus is a flexible and powerful file manager for the Macintosh which supplements your existing database software and allows you to create professional-looking presentations in the format of your choice. Mick O'Neil tests it out.

The major weakness in most database programs or file management software is flexibility in report design. dBasell, the leading database software through several generations of CP/M and MS-DOS machines, was easy enough to use for producing the standard 132-column, line by line, MIS-department printouts, but any kind of specialised reports required the use of its obscure programming language or special formatting add-on software.

Though dBasell Plus significantly improves on its predecessor with its Macintosh-like user interface ('Assistant'), special purpose reporting is still tedious, at best. Noting this major weakness in almost all database

software, ForeThought Inc from Sunnyvale, California, recently released FileMaker Plus, a much improved version of FileMaker for the Macintosh that enhances the database reporting function to the degree that it appropriately refers to it as 'database publishing.'

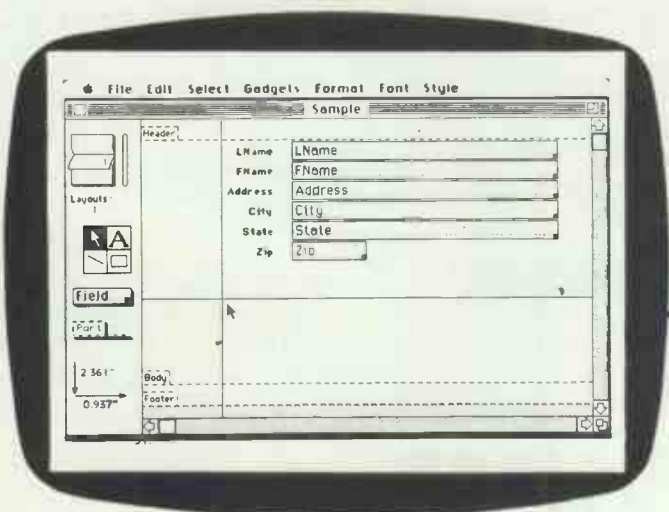
With FileMaker Plus you can create and access a database to produce professional-looking presentations in any format required, from data entry screens, business forms, and form letters, to columnar reports, free-form reports, and mailing labels.

A flexible and powerful file manager in itself, FileMaker Plus includes the capability to import and export data from full relational database

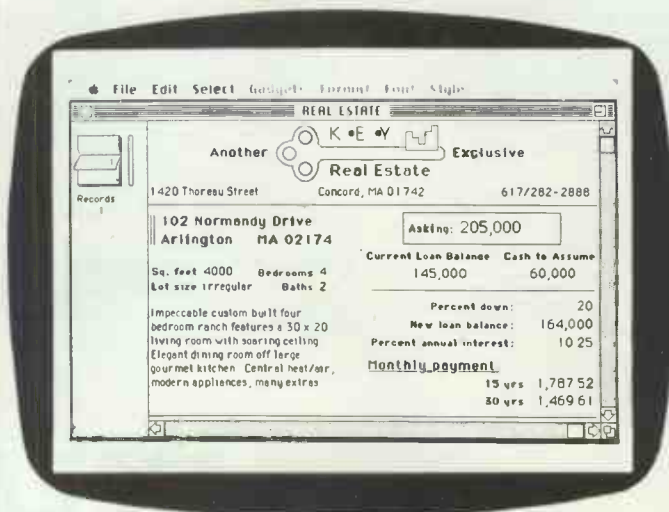
programs, and so offers the power of data publishing to companies that have already invested data management resources in other Macintosh software. In combination with a file transfer and translation system like MacLink from DataViz Inc, this program could well justify the procurement of Macintosh equipment by businesses already committed to PC or PC-compatible equipment.

Capabilities

Before going any further, it is worth pointing out that FileMaker Plus is not a full relational database system in the tradition of Omnis 3 or Double Helix on the Mac or dBase on the PC. Yet, with the capability of opening



FileMaker's 'layout' option allows the user to design any number of forms, all accessing the same database. Fields can be dragged to any location on the page and highlighted with the box and underline tools. The 'grow' handle allows for the sizing of fields



Sophisticated business forms can be produced with FileMaker which combine the power of graphics, numeric, text and calculation fields. The form shown here includes both fixed text and graphics and variable information from the database

eight files and an extensive look-up and update option, it certainly fills in the gap between relational databases and simple file managers.

The number of fields and records is limited only by disk space and because every word, date, number, and calculation is automatically indexed, searching is extremely fast. The search function is comprehensive and allows searches based on multiple fields and multiple criteria with Boolean operators, ranges, exact matches, prefix matching, and empty or invalid field values.

FileMaker Plus also allows sorting records (ascending or descending) on any combination of fields including calculated fields. Because the program does not store data files completely in RAM, FileMaker Plus' sorting process is slower than some database software; but I suspect that unless you are dealing with very large data files, the speed difference will be relatively insignificant.

Data handling

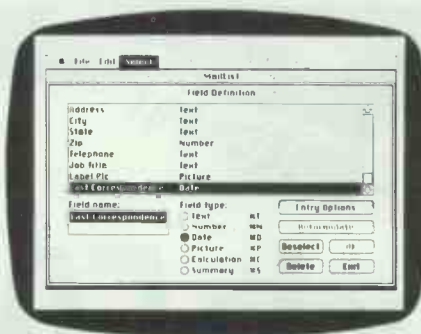
With FileMaker Plus you can define fields as text, number, date, picture, calculation, and summary data. Text fields can hold up to 32,767 characters and feature automatic word-wrap. Thus, you could create a file of all your correspondence or a personnel file with resumés, evaluations, or letters or recommendations. Numbers and dates include flexible formatting options, and pictures can be scaled or cropped.

Calculation fields let you tell FileMaker to compute a formula using values in number, date, or other calculation fields and enter the result, which can in turn be either a number or a date. Calculation fields can be defined using conditional logic, date arithmetic, and over 25 mathematical, financial, date, logical, and statistical functions and operators. Summary data consists of calculations over several records.

FileMaker includes the option to perform accuracy checks on particular fields during data entry. A field can be modified to accept unique values only. This could be useful for transaction numbers in an accounts file or social security numbers in a personnel file. The program alerts the operator that an entry is not unique but offers the user the choice to make an exception. FileMaker also can be instructed to check designated fields for existing values only: that is, the program alert is triggered by any unique data. In this case, the program asks you if you want to add the value to the list of acceptable values.

Flexibility

By now, you can see that this program can compete well head to head against any file manager or non-



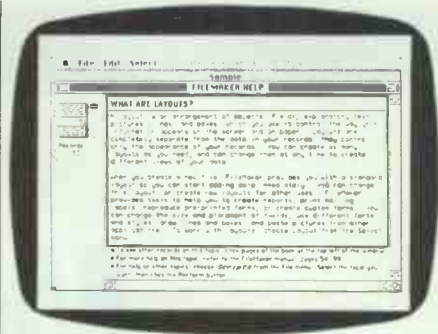
A typical database may include several types of fields

relational database program for the Macintosh. The feature that may make it the overwhelming choice for Macintosh users is its ability to generate forms. With its graphics tools and its 'gadgets', it is possible to design your own forms like receipts, form letters, labels, columnar reports, class notes, and so forth, or to design a template that fits information perfectly on a predesigned form like a company report, job application, VAT form, or the like. ForeThought also includes a disk full of working templates including Expense Reports, Fixed Assets, Mail List, Phone Messages, Roledex, Sales Order, and so on, which you can modify to fit your needs.

FileMaker refers to these forms as 'layouts', and the number of layouts for a file is limited only by disk space. Graphics can be added to the layouts by simply cutting and pasting from any Mac graphics software and, of course, other graphics can be included as individually defined graphics fields. Text can be formatted with any fonts, styles, or sizes. Fields, text, and graphics can be positioned anywhere on a layout and a grid, and a T-Square is provided for accurate placement. ForeThought has significantly increased the utility of FileMaker by adding a 'Preview Option' which allows the user to examine a form onscreen prior to printing, so easing the design task.

Instant replays

Suppose you use the same file to store transactions, prepare receipts, find records for clients who have a balance due, and print form letters requesting payment. This could involve several different layouts, page setups and print directions and the task could seem very daunting indeed. FileMaker allows you to automate the whole procedure by creating a 'script' which records information concerning open files, page setups, layouts, sorts, and so on, and offers a series of steps that can be toggled for inclusion in the script. The procedure is then stored and can be easily recalled and executed from the 'File Menu'. Scripts in FileMaker are similar to 'macros' in Microsoft



The online 'help' feature is formatted as a FileMaker database

Excel, only they are a bit more instinctive to create.

Compatibility

One of FileMaker's most important features is its compatibility with other data formats. It can read and write text files (with tabs), Basic files (with commas), and Syk files (Excel) and can write merge files for use with Microsoft Word's merge capability. This capability insures FileMaker utility in those offices that have already committed themselves to other database software but need a forms generator for existing data.

Price

FileMaker Plus costs £275 (£90 to FileMaker 1.0 owners), but for those who are hesitant about spending this amount of money without seeing the product, ForeThought offers a 30-day money back guarantee.

Documentation

FileMaker comes with a superb 317-page manual that includes an introduction to the program, a quick tour, a user's guide, a series of very useful examples, and a quick reference section. The software itself is provided on three unprotected diskettes including a program disk, a start-up (systems) disk, and a disk containing sample templates.

If the superior documentation and sample templates still leave you confused, an extensive online help option is available and is appropriately formatted as a FileMaker database.

Conclusion

FileMaker Plus is easy to use and powerful, and meets a distinct need in the information processing market. As a standalone, non-relational database program, it competes well against any other software on the market, and as a sophisticated forms generator it's the industry leader.

ForeThought Inc is at 250 Sobrante Way, Sunnyvale, California 94086. Tel: (408) 737 7070. FileMaker Plus is available in the UK from MacSerious Software at 17 Park Circus Place, Glasgow G3 6AH, Scotland. Tel: (041) 332 5622. **END**



Music 5000

*Music 5000 is an upgraded music synthesis system for the BBC Micro.
Noel Williams considers it good value for money and of practical
use in the field of music education.*



Photography by Chris Bell

In the May 1985 issue of PCW I reviewed Hybrid Technology's Music 500 add-on synthesiser for the BBC B. This year it has been upgraded with an extra 0 to become the Music 5000. In hardware terms all this additional 0 does is ensure compatibility with more recent BBC computers — the B+, the B+ 128k and the Master

128. The box looks the same, the sounds are essentially unchanged and the facilities in the hardware are no different to before. If this were simply a hardware review it would be a very short one: in that respect nothing has changed.

However, Hybrid has changed something: the software is now

almost beyond recognition. Both the 500 and 5000 are driven by a music-control language called 'Ample'. When first released Hybrid had high hopes for this language, with several reviewers agreeing that it could form the basis of a standard language for computerised music processing. However, despite the fact that it is an

excellent language for music programs, no-one else has taken it up.

Ample may, however, find a niche in the educational market because, in its simplest form, it provides a notation for music which children will find easier to understand and manipulate than conventional dotted crotchets, demi-semiquavers, triads and time signatures. However, BCE Ample, as provided with the M500, is not an easy language to learn, especially if you are a musician rather than a programmer. Neither your average keyboard player nor your ordinary seven-year-old will find it easy to use Ample.

The Ample language

Ample is a Forth-like control language, using Reverse Polish Notation. It requires the definition of 'words' which add commands to the kernel language, both kernel and user-defined words being available for subsequent use in other words. Fig 1 shows some sample Ample definitions describing a complete musical piece.

The philosophy of Ample is simple: it should, and does, provide a programming language which offers the concurrency required in music control and as much flexibility in controlling the parameters of sounds as possible. This, coupled with the first-class FM synthesis of the M500, would make a powerful package if only people were able to use it. So, instead of upgrading the hardware, Hybrid has upgraded the philosophy. A new version of Ample is now ready, called Ample Nucleus, which is provided on ROM. The important point about this new software is that you do not have to use it; it forms the nucleus of a system which sits there running the synthesiser but which the user need never see.

Music 5000 hardware

The Music 5000 hardware looks like a BBC hard disk — one featureless light brown box. Two leads run from the back: a mains cable and a ribbon cable for the 1MHz port on the BBC. There is a standard five-pin DIN socket for a lead to a hi-fi; Hybrid does not supply a lead for this. An on/off switch completes the box, but there is no LED to tell you that the system is switched on and working. Considering the difficulties you can have connecting any auxiliary device to a hi-fi, it would be comforting to know that the hardware is up and running correctly. The ribbon cable has been lengthened compared with the original Music 500, so you no longer have to drag the BBC within two feet of your hi-fi before you can use it.

The internal circuitry is exactly the same as Music 500 (even after two years this is still impressive). Put simply, the sound quality approaches that of a £400 electronic keyboard. It has a range of at least five octaves — more for certain types of sound, and offers a degree of control equivalent to that of many professional synthesisers. What it doesn't have is any facility for linking with other musical instruments. In particular, it's a little disappointing to find no MIDI socket, considering the increasing prominence of this standard. This means that you can't drive the sound of the Music 5000 from any other studio equipment.

Hybrid has recently corrected another criticism of the original unit by offering a real-time musical interface. This is in the form of a full-size, four-octave keyboard which attaches to the BBC via the user port. Although the keyboard is impressive, it is overshadowed by the software that Hybrid will supply with it. Not only will this emulate a high-class Casio style keyboard, it will also record your attempted melodies in both traditional stave and notes form in Ample. Via the mixer control panel, it is possible to assign one voice channel to the keyboard and play on top of any existing music. At the time of writing, the price for the keyboard hasn't been fixed.

Instead, a set of front ends have been designed to sit between the user and the language. These are designed as user-friendly interfaces or, to drop the jargon, easy ways to make music. They are in fact Ample programs, and are provided as disk-based modules which can be called as required. When you want to carry out a particular musical task, you load the appropriate module. Writing music is now a matter of running applications written in Ample rather than using Ample yourself. Although the modules keep much of the flex-

ibility of the language, they are much easier to use; for example, my five-year-old son, with no knowledge of music, was able to write tunes and play them with different instruments, after only ten minutes tuition.

Modules

Four main modules provide control over four groups of tasks. The main module is a system menu allowing you to load and save music programs, run the program in memory, catalogue the disk or select one of the other modules. You normally return to this menu between use of the other three modules. In addition, by pressing function key 9, you can load a 'jukebox' of demo pieces which include Bronski Beat's *Small Town Boy*, TV's *To The Manor Born*, pieces by Debussy and Bach as well as some original music. Most of these are impressive, though some suffer from the common fault of electronic music — too long and too repetitive.

The three other modules are the 'Notepad' (a text editor for program writing, instrument design and editing Ample words); the 'Staff editor' which allows you to enter musical parts in a mixture of traditional and Ample notation; and the 'Mixer' which allows you to control the dynamics of a finished piece. In all modules, the 'TAB' key switches between the editor functions and 'command mode'. This allows you to type commands in directly, such as SHOW for example, which lists all the user-defined words that are currently residing in memory.

```
"RUN" [DISPLAY % PCW Fanfare "1234"PLAY]

"mix" [M5MIX 48,125=T 0 M5TUNE
1 SHARE 1 VOICES Ringsyn
1 VOICE 128 VOL -3 PAN
2 SHARE 1 VOICES Ringsyn
1 VOICE 128 VOL 0 PAN
3 SHARE 1 VOICES Ringsyn
1 VOICE 128 VOL 3 PAN
4 SHARE 1 VOICES Vibglock
1 VOICE 128 VOL 0 PAN
PNUM SHARE ]

"part1" [sec1 sec2 sec2 sec3 ]
"part2" [sec1 sec1 sec2 sec2 ]
"part3" [sec2 sec3 sec2 sec3 ]
"part4" [rhyth rhyth rhyth rhyth rhyth rhyth rhyth ]
"rhyth" [24, X/// X/X/ X/// X/XX ]
"sec1" [%STAFF 0:24,E/F/Ag// fAg/Ba// ^/g/Ba/C/ 24,B/gAC/// ]
"sec2" [%STAFF 0:48,CEFF 24,c/E/FGF/ 48,cECF 24,B/g/Agc/ ]
"sec3" [%STAFF 0:48,Agff 24,c/E/FGF/ C//ad/G/ 24,B/g/Agc/ ]
```

Fig 1 Complete program for PCW Fanfare

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Music 5000. It has been upgraded from Music 500 with modifications on the main PCB board.

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Writing a musical score

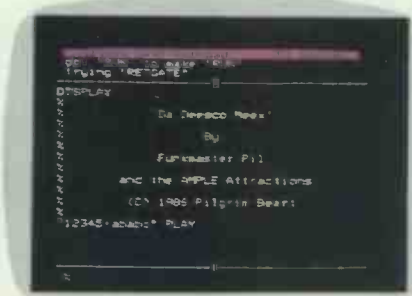
To give you an idea of how all this works, I'll recount how I wrote a simple piece called *PCW Fanfare*.

Firstly, there are four parts: three synths and a drum (the maximum number of parts is eight). If you design complex instruments which use more than two of the sixteen available channels (that is, make more than two sounds at the same time), then this reduces the number of parts you can have. For every pair of sounds an instrument needs, another part will be lost to the piece as a whole. A chordal instrument, for example, may play three notes at the same time, each note having two component sounds, so this instrument will cost you three parts in your piece, leaving five to be apportioned to other instruments. My four parts were all two-channel instruments, so I had four parts unused.

To write Part One I used the Staff editor. This presents graphically the two staves above and below middle C. Using combinations of the cursor keys, SHIFT and RETURN, notes can be entered on the staff. Notes can also be inserted, deleted, copied, raised, lowered, sharpened, flattened, lengthened, shortened and turned into rests, all with a minimum of keystrokes. It takes a while to familiarise yourself with which keys control which functions and it is easy to make mistakes — such as changing the length of a note rather than its pitch — but such errors are also easy to correct. Having used similar editors in the Island Logic system and Yamaha's CX5M Music Computer, I find Hybrid's Music 5000 the best of the three.

Having created a mere four bars, I used the NAME command to name them 'sec1' and the MAKE command to compile them into an Ample word called 'sec1'. I then re-edited the four bars, reNAMEd them 'sec2' and used MAKE to make the edited version of the four bars into another Ample word called 'sec3', so I had three different four bar sections.

Next I called the Notepad editor.



A text processor called 'Notepad' helps to create Ample programs

This simple text editor works on a reserved portion of the screen. When you have typed text into it, MAKE compiles all the text in that reserved portion into an Ample word — as long as it is syntactically correct. First of all I used the command "secl" GET to look at the Ample description of my first four bars (the description is shown in Fig 2). While very different from the Staff editor I had used to create this word, it's easy to see the relationship between the Ample description and the traditional description. 'O.' sets the octave, '24', the length of the notes that follow,

```
"secl" [%STAFF 0:24,E/F/Ag// fAg/Ba// ^/g/Ba/C/ 24,B/gAC/// ]
```

Fig 2 A musical fragment

```
"RUN" [DISPLAY % PCW Fanfare "1234"PLAY]
```

Fig 3 The 'RUN' word

'C' is a note, '^' a rest and '/' continues a note. Music can be edited as easily through this editor as the Staff editor.

Clearing the editor I created three new words, again using NAME and MAKE. These were each to be parts assigned to players in the final piece, each one being a combination of the four original sections. For example, Part One comprised:

sec1 sec2 sec2 sec3

Part Four was defined differently. I wanted a repetitive percussion part. Ample contains a special word for striking a beat using the predefined (or 'natural') pitch of the instrument, so a rhythm of sixteen notes could be the word 'rhyth' defined as:

24, X// XIX/ XIII XX/X

where 'X' is a strike beat, and '/' signifies 'continue the previous note'. '24,' sets the note length to be half that of the other parts — that is,

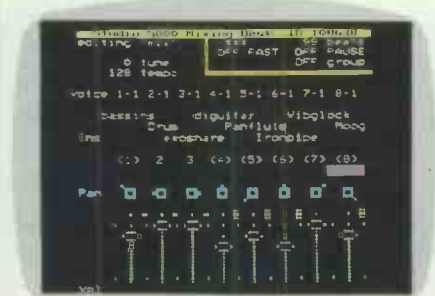
twice as fast. So, 'part4' was then defined as eight repetitions of 'rhyth'.

The four parts then had to be compiled into a piece. A word called RUN is defined containing a title page (using the word 'DISPLAY') and the part sequence (using the word 'PLAY'). In the case of *PCW Fanfare*, this is as shown in Fig 3. The fanfare is then a complete set of musical parts; however, it cannot be played without instruments and dynamics. And so, enter the 'Mix' editor.

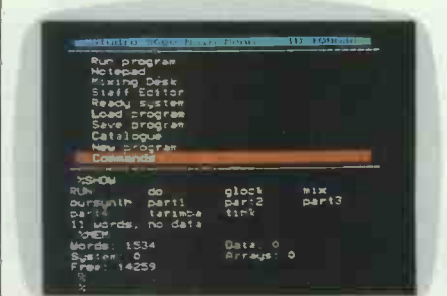
The Mix editor is the most novel of the three editors, and the most fun to use. It provides a visual equivalent of an eight-track mixer where each track is one part of the piece being mixed. *PCW Fanfare* has only four parts so only four tracks are used, the other four being bracketed out.

Each track records the current instrument, stereo position and volume that applies to that part of the piece. Initially these are default settings. The default instrument is called Simpleins and uses only one channel and the simplest waveforms. The default dynamics are maximum volume and central stereo position; these can be altered by minimal keypresses.

For example, to change the instrument on a channel you move the cursor to the instrument name above that channel and press the SHIFT key. A menu of available instruments pops up. There are fourteen preset instruments initially available (another advance over the M500, which insisted that you create your own instruments before it would play a tune). These are listed in Fig 4. Use the cursor keys to move around the instrument menu and select a new



The 'Mixing desk' includes volume faders and stereo pan knobs



The main menu gives access to the 'Mixing desk' and the 'Staff editor'

PERCUSSION : cymbal, drum, cowbell

'CONVENTIONAL' INSTRUMENTS : electric guitar, slapped bass guitar, moog synth, organ, pan pipes, upright piano

EVOCATIVE METALLIC TONES : vibglock (between glockenspiel and vibraphone), ringsyn (a synth sound using ring modulation), ironpipe (a resonant pipe sound), simpleins (default instrument)

SILLY : wha (something like a human voice)

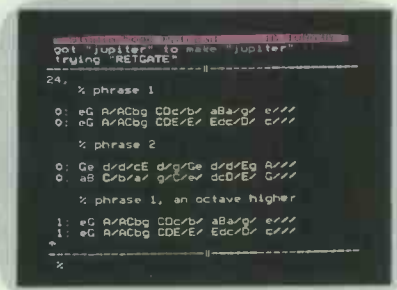
Fig 4 Preset instruments

instrument, then release SHIFT, and the new instrument is in place on the selected track.

In addition to changing individual tracks, the tuning and tempo of the whole piece can be altered. Although you can pause the music to make these adjustments, you can also implement them while the music is playing even if all eight tracks are being used simultaneously, so you can mould your pieces dynamically. You can even 'mix down' a live piece in this way if you hook up a cassette recorder to the output from the synthesiser.

The M5000 system is worth having for the Mix editor alone. It is extremely useful and enormous fun. While it is not equivalent to a hardware mixer, it is much cheaper and it has some features which a 'real' mixer cannot offer, such as the ability to try different instruments in the middle of a piece. The main drawback of the editor is that its Mode 7 display is cramped, so the cursor does not always move as you intuitively expect it to.

You do not have to rely on the editors to use the M5000. You can still write programs completely in Ample through the Notepad editor, and you can set up mixes and instruments in Ample notation. The manual gives little help with this because it is regarded as 'advanced use' and will be the subject of a programmer's guide due for release in Spring 1987. In fact, if you really prefer to tinker with the innards of sounds and experiment with unconventional approaches to music, you will probably find Ample BCE a better prospect because, at present, it is better documented as a language than Nucleus, and it offers facilities for sound synthesis which the new system does not readily provide.



Ample programs are best designed as a series of musical phrases

Problems

The main loss in the new system is the restriction of sound components to 14 waveforms, 17 pitch and 17 amplitude envelopes. Over 4000 simple instruments are therefore possible, but this is paltry compared with the virtually infinite sound resources of BCE. However, for most people four thousand instruments will probably be sufficient.

In addition, instruments can be multi-channel, positioned anywhere in a seven-point stereo spectrum, and can integrate the effects of waveforms through synchronisation, frequency modulation, ring modulation and phase setting, giving perhaps a grand total of nearer 30,000 or more different musical effects.

There are also new programmed effects provided which were not ready made in BCE, notably echo (usable as delay and reverberation), automatic stereo panning, automatic volume control (for example, for crescendos) and pitch glide for portamento and pitch-bending effects. These are very useful facilities, and are more than merely gimmicks because they allow a degree of programmable subtlety often lacking from the average bland electronic music.

If you already own an M5000 you can upgrade the software for £69. However, BCE programs cannot be readily transferred to Nucleus. Only scores can be used, and these must be transferred as edited text files because the syntax of the two languages is not identical.

There are other quibbles. The modular system has been designed more with an eye to the new BBC range than the old Model B. It is almost impossible to use the new system on a cassette-based micro unless you are extremely well-organised, be-



Existing instruments can be edited to create new instruments

cause you are perpetually winding the tape back and forth as you change your mind about the different editors you need.

On Beebs with more than 32k RAM several modules can be memory-resident at a time, but on a standard model B they must be loaded from disk. There is a notable time-lag between selection and loading of a module; this can be as much as five seconds. Although this is irritating, it is not a serious problem.

Documentation

The M5000 manual is an excellent document, one of the best combinations of introduction and reference manual I've ever seen — a far cry from Hybrid's earlier attempt which sadly let down the M500.

Conclusion

The lack of a MIDI interface is a sticking point for most serious musicians. Although connection to other equipment is there potentially, putting it into practise is not an easy task. Chris Jordan of Hybrid tells me that a MIDI interface, though possible, is unlikely to appear because the market is not large enough. He also seems to think that anyone with an M5000 already has such a richness of sounds that other instruments would be superfluous. This is a shame, for there are sounds which the M5000 cannot easily provide, and Ample could provide an excellent front end to other equipment even if the Hybrid hardware could not be used at the same time.

However, these are minor points. In general the whole system is a model of friendliness. I would be very surprised if it did not have wide success in the field of musical education as well as home use.

At £179 the Music 5000 is a real bargain. Most of the criticisms that could be made of the M500 revolved around Ample programming and the manual. The criticisms have been acknowledged, and the shortcomings have become strong points in the M5000. When there is a keyboard to drive the Music 5000 system and an advanced manual for programmers, the system will be hard to match.

Hybrid is on (0223) 316910.

END



The 'Staff editor' provides a more traditional form to enter music

Run around the clock

Peter Malcolm examines the current network technology and explains the principles of operation of the various standards, using local area networks for use in a PC environment as his example.

Networks generally have had a rough ride in the computer press recently. Much of the criticism arises from confusion rather than practical facts, which is a pity because there are network installations that can — and do — work very well. It's also true that networks currently have shortcomings in software standards which can cause problems for certain groups of users.

Types of LAN

Let's define a network as a system of communication between devices, be they PCs, printers or whatever, and ignore the network transmission method and medium for the time being. (Incidentally, all comparison timings are based on actual readings, not theoretical transfer rates, and when I use the term 'PC' I do so independently of machine type.)

Basic disk-sharing systems have been around for some time, and involve connecting a number of PCs to the same external hard disk and time-slicing each PC's use of it. Under our definition, this is not a network at all because each PC can only communicate with the hard disk. Transfer of information is achieved by writing to disk during your time-slice, and the information can then be read by others on their time-slices. Generally the disk is divided into virtual volumes and each user can mount one or more of these at a time, assigning a different drive designation to each. These systems tend to offer little in the way of management functions, but they are relatively inexpensive. As they don't use real network technology (they usually connect up with big ribbon cables), I won't consider them here.

At the bottom end of the true network are RS232-based devices which communicate through a standard serial port to a network access box, which sends data over the network to other access boxes which are in turn connected to other serial devices. These systems enable several PCs to share a printer, for example,

or to send a file from one PC to another (the number of devices is usually limited to approximately one hundred).

However, RS232-based devices have three major drawbacks. Firstly, they are very slow: most serial ports can only manage 9600 baud at best (around 960 characters per second). Assuming there is no network congestion, transferring anything but the smallest files is a slow process — about five times slower than to a floppy disk. When the data is pumped into the network by the access box, it travels much faster (typically 50k or so per second), so even if there is heavy network traffic, the transmit time remains constant.

Secondly, is the receiving device able to accept the data? An unbuffered printer may already be busy printing. The printer, the access box or your PC may have buffers but they are unlikely to be very large, so you may have to wait some time before you can continue processing.

The third major snag occurs if two users want to access the same device at the same time. RS232-based systems will work out that the device is busy and give you a message, but you will probably be held up until the device is clear, and it's almost certain that when you want to print, someone else will also want to.

The next category is what I call mid-range networks, and this is where the bulk of products fit in. All devices on the network have a network interface (usually a plug-in card) which connects them directly to the transmission medium. A device on the network is able to send information to any other device.

Other than PCs, many types of device can be connected and are usually known as 'servers'. There is usually one or more file servers, a dedicated unit with a processor and hard disk storage. Typically, 95 per cent of network transmissions are to or from a file server. Other servers may include print servers which manage one or more printers; gateways to

other systems (mainframes, minis or other networks); and communications servers, which link to other systems via Telecom links for viewdata, telex, file transfer, and so on.

Servers may be PCs dedicated to the task, or purpose-built boxes capable of performing only the appropriate task. Software will automatically spool information to the file server if the required server is busy, and will ensure that jobs are dealt with in rotation. On this type of network you can connect up to a hundred devices, and in practice you can load a file at approximately the same speed as from a local hard disk, depending on device usage.

Mid-range systems have network management software in varying degrees of sophistication, and manufacturers have developed differing levels of operating system support. On some systems, different types of PC hardware can co-exist as well as multiple operating systems for the same PC standard.

The top-of-the-range group doesn't differ much technically from the mid range; the systems are simply more sophisticated, have greater all-round capacity and take a great leap upward in price. They are also fast becoming alternatives to minicomputers. The practical differences are as follows.

Firstly, top-range systems cater for at least 250 devices. They use purpose-built file servers with capacities ranging from 100Mbytes of storage to well over one gigabyte (1000Mbytes), with faster access times, and built-in high-capacity tape streamers, and cost from around £20,000. These networks offer support for multiple operating systems, PC/MS-DOS, p-System, Unix and other manufacturers' standards such as Apple DOS, all running simultaneously and transparently. Some also offer facilities such as fault tolerance and complex mainframe links. The network management software, and operating tools and utilities, are more sophisticated in these systems.

Methods

Common to all networks is the concept of 'packets' of information. A packet, sometimes a fixed number of bytes and sometimes of variable length, is sent from one device for the attention of another device. Each device has a unique identity number (usually called the station address and set by DIP switches on the interface board) and all packets must contain the destination station number. When the destination address sees the packet and identifies its own destination address, it accepts it as data.

To show how this works in practice, assume you're using an IBM PC on the network, loading a Basic program from a PC-DOS volume stored on the file server. Basic calls DOS software interrupts to find and load the file. DOS calls the network device driver (each manufacturer provides one) to translate the DOS sector addresses into the appropriate file server sector addresses. The network device driver then sends a packet over the network, headed by the file server's destination address and containing the 'read' sector's command plus the return address. The file server sees its own address on the packet, picks it up and acknowledges receipt. It then interprets the command, reads the requested sectors from its hard disk, and transmits the sectors back in packets headed by the address of your PC, which in turn picks them up, acknowledges receipt and returns them to Basic through DOS.

Although this example is specific to the IBM PC and compatibles, the same principles apply to all machines and operating systems. Note that some manufacturers modify DOS itself as well as, or instead of, using a device driver, particularly if they allow booting from the network.

There are currently four basic methods of transmitting packets over the network; by collision detection; by token; by frequency division; or by empty slot. The first method is known as CSMA/CD (Carrier Sense Multiple Access with Collision Detection). In this system, each device (or node) listens to the network and transmits only if there are no other transmissions in progress. If two (or more) stations begin transmitting at the same moment, the signals will be garbled and the nodes will detect this. The stations will stop transmitting, and each one will restart the procedure after a random time period (this is shown graphically in Fig 1). Ethernet, Econet, IBM PC Network, AppleTalk and Omnet are all CSMA/CD systems.

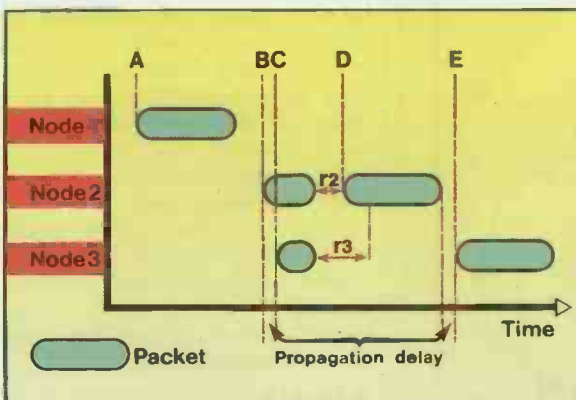
The token method has two variations, depending on connection topology, but logically they work in the same way. A unique packet of data — the token — is passed continuously from one node to the next in sequence (and then from the last back to the first, and so on). When a node wishes to transmit, it waits until it is in possession of the token, and then instead of passing the token on, it passes its packet of data.

The data packet is passed from node to node until it reaches its destination. Normally, the receiving node modifies the packet to indicate if it was received intact or garbled, and then passes the packet on.

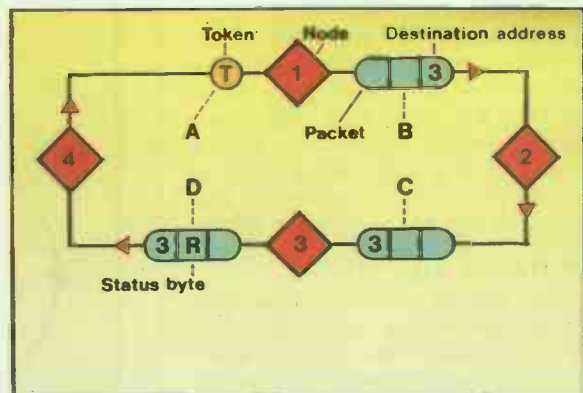
When the packet arrives back at the original sending node, the sender can detect if it reached its destination (it will have been modified if it got there, but not if the destination node was inactive or disconnected); and if it was not received intact, the packet can be sent again. When the packet has been received and acknowledged or if the sender gives up, it passes the token again instead of a data packet, ready for the next node which wishes to transmit (see Fig 2). ARCnet (used by many manufacturers) and IBM Token Ring are the best-known token systems.

The frequency division multiplexing method (FDM) involves each node having the ability to transmit at different frequencies, and hence several conversations can occur at the same time (just like having several stations coming down your TV aerial wire, each on a different frequency). Generally some form of controller is required to allocate frequencies, and separate frequencies are needed for transmit and receive in each conversation. There are only a handful of manufacturers using this system.

Empty-slot systems (also known as Cambridge ring and slotted ring) employ multiple packets (or slots) travelling round a physical network ring. Each packet contains a status



Node 1 sees that the network is clear and transmits a packet at A. Data is passed successfully
Node 2 sees that the network is clear and begins transmitting at B
Node 3 thinks that the network is clear because of propagation delays, and starts transmitting at C. A collision occurs. All nodes detect this and stop transmitting
Node 2 waits random time r_2 , then sees that the network is clear and begins again at D
Node 3 waits random time r_3 , sees that the network is busy, and waits until it is clear at E before transmitting
Fig 1 CSMA/CD



The token is passed from node to node around the ring until a node wishes to transmit
Node 1 takes the token (A) and passes on data packet instead (B). The packet is passed on by node 2
Node 3 recognises its own address as the packet's destination and takes the packet (C)
Node 3 modifies the packet to show it has been received, and passes it on (D)
The packet is passed on by node 4
Node 1 takes the packet because it still holds the token, and then releases the token ready for the next transmission
Fig 2 Token. All token systems use a logical ring even though physical topology may be a bus

LOCAL AREA NETWORKS

flag which identifies the packet as being in use or not, and a node which wants to transmit places its data into a free packet. This arrives, and is returned exactly as in the token method to establish whether the data arrived intact. When receipt of data has been confirmed, the sender marks the packet as free and passes it on.

The empty slot method is not so different from the token system, except that the topology must be a ring and not a bus, and that packets are flagged instead of using tokens. A variation on the slotted ring is buffer insertion where a node inserts its packet into a free space in the ring data stream, but this can lead to timing problems and isn't often used.

Topology

There are two distinct types of network topology: either in a ring, where each node is only physically connected to the nodes before and after it; or using a bus, where all nodes are connected together and theoretically all receive the same signals at the same time. CSMA/CD nearly always uses a bus type topology, as does FDM. Empty-slot systems must, by definition, use a ring topology. Token systems can use either bus or ring. When it's a bus environment the system is known as token-passing (because the token is passed logically between stations across the bus), and in the ring environment it is known as token ring.

A third type of topology, known as 'star', is where all nodes are brought back individually to one central device. This is only necessary where a central controller is used, such as in some FDM systems. Note that a bus system could be star-shaped where only one central connecting point is used, but that does not make it a star topology in this sense (see Fig 3).

Electrical signals

Electrical signals can be transmitted either broadband or baseband. The majority of manufacturers use baseband, an expensive method in which the data is introduced directly into the transmission medium. In a broadband system, data modulates a carrier (as in a modem) and this enables several conversations to take place at once. Therefore, by definition, FDM systems must be broadband.

Baseband systems can only have one node transmitting at a time or the signal becomes garbled (CSMA/CD collisions), and the network speed has to be greater to cope with the demands of all nodes on a single channel. Broadband systems are generally more expensive, but do allow integration with other signals.

such as TV signals in the same medium.

Drawbacks

Each of these variations has its strengths and drawbacks, and the CSMA/CD system has three major drawbacks. Firstly, as more nodes are added, collisions are more likely to occur and delays will be introduced by the random time interval. This practically limits the number of nodes.

Secondly, the packets must be of a minimum size depending on the length of the network, due to propagation time down the transmission medium. When a collision occurs, it must occur for long enough for all nodes to see it, and the further away the node is, the longer it will take. The longer the network, the larger the packet size must be, and this can result in packets of unnecessary length, time-wasting or limits on the physical length of the network.

Thirdly, when data is corrupted (excluding collisions), the transmitter is unable to detect this as the packet is not automatically returned as in token and empty-slot systems; the

sending node must rely on time-out delays and receives no clue as to the problem which occurred. CSMA/CD has, however, been adopted by many manufacturers, is simple to connect and is a cost-effective solution for smaller installations.

Token systems really have only one drawback, and that is if a node becomes disconnected from the passing chain. This is more serious with ring rather than bus networks because if the physical ring breaks, everything grinds to a halt, and therefore devices are needed to ensure that the ring remains linked if a node is disconnected. Both ring and passing systems need some software mechanism to detect when nodes enter or leave the network, to ensure that packets continue to be passed. In practice all token systems cater for this, and the procedure which is undertaken when a node enters or leaves the network — reconfiguring — takes only a fraction of a second.

Token-passing bus systems are simple and cheap to connect, and additions are easily made by tapping into the nearest cable. Token ring is rather more tricky to cable and is expensive. Bus systems also allow weighting of certain stations so that heavy-usage nodes can receive the token more than once in a cycle; in the same way, read-only nodes need not be passed to the token at all.

FDM systems have the advantages of broadband but that does not imply that the manufacturer has designed them to be used over existing cables or with other transmissions, though certainly some have — for example, over existing PABX lines. Here, the data frequency will be way above the limits of human speech, so they don't interfere with the phone. FDM systems are, however, very complex and often expensive.

Empty slot has similar drawbacks to Token Ring, and in addition requires more complex control. It is available from a small number of manufacturers, mainly for educational and scientific purposes.

Media

The most common form of network media is co-axial cable which is used in varying grades, as is the next widely used, twisted-pair cable. Higher-quality cable with better screening improves the maximum run length, because less interference is likely. Manufacturers will recommend different types of cable which vary in price from a few pence per metre to well over £1. It's important to stick to the recommended grade of cable, but that doesn't mean buying it at your supplier's inflated price.

Fibre-optic cable is slowly catching

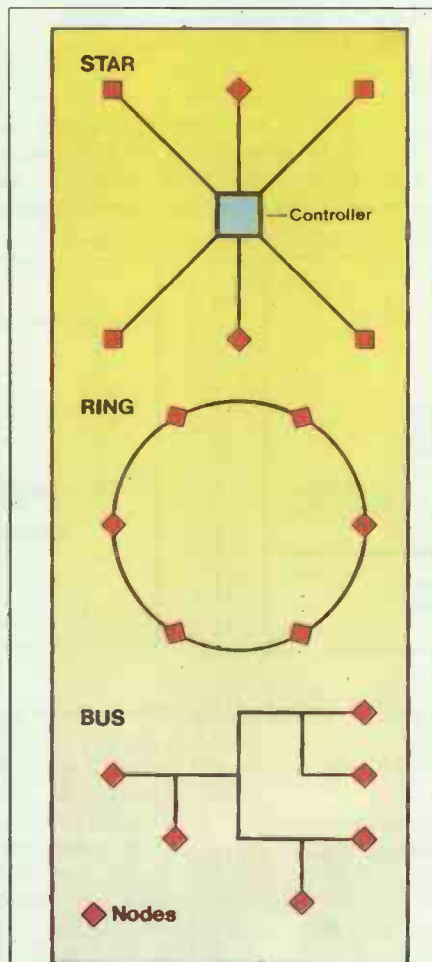


Fig 3. Basic topologies. All other topologies are based on one of these three types

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on and has several advantages. It is totally immune to electrical interference, and can be used in much longer runs before amplifiers are re-

Glossary

Access method	Method of managing network communication
Baseband	Transmission method where data is introduced directly onto the transmission medium
Broadband	Transmission method where data modulates a carrier and the medium can therefore hold several transmissions, each with a different carrier frequency
Bus	A topology where all devices are connected in parallel and hence can all listen to network activity
CSMA/CD	(Carrier Sense Multiple Access with Collision Detection). A network access method where all stations listen to the network and transmit only when it is not in use, with techniques to manage two or more stations transmitting together (collisions)
Empty slot	An access method where a node may insert data into a packet labelled as empty
Ethernet	A widely used CSMA/CD standard developed mainly by Xerox
FDM	(Frequency Division Multiplexing) Using a number of frequencies to hold simultaneous transmissions in the same medium
File server	Network device which offers disk storage facilities to the network
Gateway	Network device enabling connection to other systems such as mainframes, minis or communications devices
LAN	(Local Area Network) Network cabled locally usually within one building or site
NetBios	(Network Basic Input/Output System) A set of machine language calls to provide basic network functions
NetWare	Trade name of Novell's Network Operating System
Node	See station
PC Network	Trade name of IBM's implementation of Microsoft's MS-NET Operating System
Ring	A topology in which each node is connected to the one immediately before and after it to form a ring
Server	A network device offering shared facilities to other network devices
Star	A topology in which all nodes are wired to one central point
Station	A device or node on the network. Each station is usually assigned a unique number or address
Token Access	Network access method where a unique packet of data called the token is passed from node to node. A node must be in possession of the token before transmitting
Token Access	Network using token access method in a logical ring generally using a bus topology
Token Ring	Network using access method in physical ring topology. Used as trade name by IBM
Topology	Network layout or shape
WAN	Wide Area Network usually covering some considerable distance probably using telecommunication links

quired. It can't be easily tapped and is thus suitable for security-conscious installations. The major disadvantage is that the electrical data signals need converting into light and back again, which makes it an expensive and more complex solution.

There are other transmission media, such as modulated laser links, but these are rare.

Speed & stamina

Transmission speeds vary enormously — anything from 20k bits per second to 10Mbits per second, which give transmission rates of about 2 to 900 complete A4 pages per second. Many manufacturers rave about being faster than their competitors, but in practice this speed is largely irrelevant. The limiting factor on all networks is the speed at which devices respond. As 95 per cent of all conversations are to or from a file server, it's the speed of this device that limits the performance of most networks — it's nothing to do with the network speed.

The maximum distance allowed between nodes or repeaters also varies, based on the cable quality and the network speed. With the exception of CSMA/CD systems where total length may be limited, you are unlikely to encounter problems unless your network stretches over half a mile or so.

Signals can be boosted with repeaters or, in the case of bus systems, signal-splitting devices can be used. Splitters fall into two categories, active and passive. Active splitters boost each output to standard levels, while passive ones merely split the available signal three or four ways. Obviously you can't split passive signals too much or the results will not be strong enough. Ring systems only use repeaters because the signal is never split.

Operating systems

A network operating system is the interface between applications programs and the network environment, and it's in this area that the battles are taking place to establish a standard. There are two main contenders:

- Microsoft's MS-Net provides low-level routines to applications software, and is used with minor variations by IBM on PC Network and Token Ring, Ungermann Bass on Net/One, and 3Com on 3Com+.

- Novell's NetWare offers more facilities at a higher level, but it is more complicated for software developers to employ. Novell has made a few neat marketing moves recently, by offering NetWare to ailing hardware manufacturers in order to gain a wider user base, and by im-

plementing MS-Net compatibility as a type of command subset.

The goal with establishing a standard is, of course, to create independence from network hardware which can then be chosen for speed, expandability and features.

Management functions

Management functions are generally network operating system independent and transparent to applications programs, but they can make all the difference between pain and joy for the system manager.

The back-up of file server data is obviously crucial, and is a prime consideration in any system. The major problem is that integrity must be assured across whole volumes as well as within files, so the file server must be read only during the back-up period. Suppose an index file has been backed up but the transaction file has not been reached when a new record is added. The back-up will contain a mix of old and new, and will be useless. In practice, most manufacturers take the server off-line during back-up; this can be overcome by using two servers in fault-tolerance mode and backing them up separately.

Alternatively, automatic back-up routines are now available from at least one manufacturer, which enable you to time a back-up to occur automatically. Facilities for selective back-up of only modified volumes is desirable because few tape drives can cope with more than 60Mbytes, and waiting around to change tapes is tedious and time-consuming.

Password security is offered by many manufacturers in varying degrees of sophistication. Usually each volume can have different read and write access passwords, although they are simple to bypass in some cases. For absolute security, there are a number of utilities available for file encryption.

Utilities for sending messages between stations can be useful, particularly those which appear on pop-up windows. Unfortunately, these background utilities are sometimes unable to run beside others like SideKick, or when graphics modes are in use. Pop-up windows for network management functions are also useful, but tend to suffer from the same problems as message windows.

It's extremely useful to have a network clock in order that all stations keep the same time and date. Most manufacturers provide a driver to set your PC clock to the network clock on booting.

Finally, a system log of who mounted what and when is useful, but tends to slow response time on some hardware.

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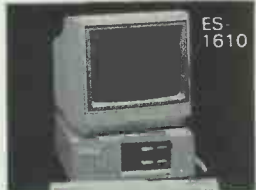
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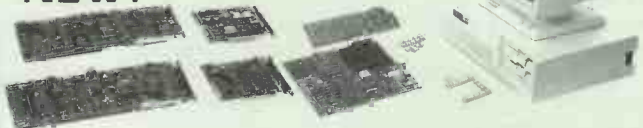
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Prolog power

Although Prolog is ten years old and has found a niche in the world of artificial intelligence, its unconventional appearance has prevented people from fully exploiting its programming abilities. Mike Liardet helps to allay fears with an introduction to the language.

Mike Liardet was working in Edinburgh University's Department of Artificial Intelligence when the world's first version of Prolog was introduced there in the early seventies. During that period, he implemented a Prolog interpreter (it's no longer available), and has maintained a close interest in the language ever since. In this series of articles, he will be explaining Prolog and showing how to get started programming in it.

Prolog is a programming language that has been around for nearly 15 years. It has only recently come to prominence, with a number of excellent implementations becoming available for micros. Its name stands for PROgramming in LOGic. In theory, at any rate, it enables computer users to effortlessly program their thoughts and reasoning about a problem directly into the computer. In practice, Prolog programming is not quite as effortless as this might sound, but no other programming language comes closer to this ideal than Prolog.

Prolog is tailor-made for programming applications in a number of interesting problem areas, and during the course of this series I'll be proving this point with some appropriate, illustrative sample programs. Prolog is especially connected with the field of artificial intelligence (AI), and expert systems, natural language understanding and intelligent databases are probably the most widely-recognised types of application to which it is suited. It is also a natural choice for mathematical problem-solving, artificial (that is, computer) language understanding and network-based problems. And, for the hobbyist, it can also be a lot of fun for coding cognitive games and recreations.

One of the reasons for Prolog's burgeoning popularity is the huge surge in popular interest in AI, with which it is so closely associated.

Also, the last few years' unprecedented increase in microcomputer power has helped to promote usage of the language, since the powerful processing facilities that Prolog needs are now widely available in inexpensive personal computers. Its recent adoption by heavyweight US software marketing companies, most notably Borland, has given Prolog the ultimate seal of approval, with some US reports claiming that Borland's Turbo Prolog is even outselling Lotus's perennial best-sellers such as 1-2-3, Symphony and Jazz.

Because of Prolog's highly unconventional appearance, it is worth emphasising that, like all of the well-known programming languages, it is completely general-purpose and could, potentially, be used anywhere that a more conventional language, like Cobol or Pascal, might be. That is not to say unequivocally that it *should* always be used — although some Prolog users would argue this — but its complete generality might come as a surprise to some experienced conventional programming language users. After all, Prolog has no FOR loops, conditionals, DO-WHILEs, GOTOs or any of the other constructs which commonly appear in the usual languages.

Getting started

The starting point for most readers will be to obtain a version of Prolog. Fortunately they will be fairly spoilt for choice, and competition is pulling down prices rapidly. The box on page 132 shows a list of Prolog suppliers from which readers should get good value for money.

Here, and in the articles to follow, most of the example programs will be written in Borland's Turbo Prolog (reviewed in PCW, October 1986). This should not preclude users of other Prologs from following the series. Most of the examples come very close to the standard Edinburgh Prolog, adhered to by many of Turbo's rivals, if the predicates and domains declarations are omitted.

One of my main reasons for choosing to work with Turbo Prolog is that it is ideally suited to the Prolog beginner. It is inexpensive and simple to use; and it provides a very fast version of the language for the IBM PC, with a fully integrated program development environment which includes an editor, a compiler and a debugger. It has all this *plus* sufficient power and capacity to outlast the user's learning phase, being quite capable of supporting full-size applications as well.

Turbo Prolog's major deficiency is the aforementioned deviation from the Edinburgh standard. Apart from the declarations, the more significant differences lie in its omission of some advanced features which are not absolutely essential, and certainly are not likely to be required by a beginner.

Assuming you are sitting in front of a Prolog system for the first time, you will probably want to do something quickly just to reassure yourself that the system is alive and well. If it were Basic, and not Prolog, that you were working with, you would just type `PRINT 20 * (4 + 5)` and expect to see the answer 180. In Prolog, this kind of interaction can be slightly more long-winded, and depends to some extent on the particular version of the language you have.

For a fast initiation into Prolog, first ensure that the system is at the command level, where you can type in Prolog instructions and have them executed directly. Many Prologs offer nothing but command-level interaction, but in Turbo Prolog you need to select it from the main menu, by pressing 'R' for 'Run'. Unless you have a program already loaded (zap it or comment out its goals statement if you have), Turbo will respond with the message 'GOAL:', indicating that it is ready to do your bidding. From there you can type:

```
X = 20 * (4 + 5).
```

Don't forget the full stop, and the system should respond:

```
X = 180
```




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 ...; that matches or ;


```
Goal : X = cos ( log ( 1 + 2 + 3 + 4 ) ).
X=0.54030230587
1 Solution
```

```
Goal : X = 1 + 2, Y = X * X
X=3, Y=9
1 solution
```

Fig 1 Expression evaluations

```
Goal : 1 + 2 = X.
X=3
1 Solution
```

```
Goal : X = 1 + 2, X = 4.
No Solution
```

```
Goal : 1 + 2 = 2 + 1.
True
```

Fig 2 Expression evaluation = solving goals

1 Solution

From other Prologs try:

X is 20 * (4 + 5) or

X is 20 * (4 + 5), pr(X).

If neither of these work then it's back to your manual, I'm afraid.

When this simple example is working, you may care to experiment with a variety of expressions or evaluate more than one expression at a time. Fig 1 gives a typical interactive session along these lines. Make sure the variables, X, Y, and so on, are in upper case — Prolog identifies variables by an initial capital letter, and the results will be rather different if lower case is used. For multiple evaluations, just separate each evaluation with a comma.

Something different

After you have done a few examples like the ones given, you will probably be wondering what is so remarkable about Prolog as, barring the mysterious '1 Solution', its responses are fairly much like those from a standard language. Now try the commands shown in Fig 2.

Although the examples in Fig 1 appear to show Prolog evaluating an expression, just like Basic, the underlying actions that it is actually taking are fundamentally different, as the examples in Fig 2 show. What actually has been going on, in both Figs 1 and 2, is that Prolog has been trying to solve goals.

In Prolog, the command line you give it is treated as a sequence of goals, with the commas separating them. If Prolog succeeds in solving all the goals on the command line, it prints out the values of the variables that did the trick. If it fails to solve all of them, it prints out 'No Solution'. If there was more than one way of solving all the goals (I'll come to this later) it will print out all the possibilities, along with the number of solutions found.

The only type of goal we have considered so far is that of showing equality (denoted by the '=' sign). If you have experience of other languages, you might have thought that the '=' was an assignment — it isn't. In Prolog '=' stands for equality, just like in mathematics.

Equality, in Prolog, is an example of a *predicate*. All goals in Prolog involve a predicate to express some relationship between objects, and eventually we will encounter many different predicates. In this case, equality is a built-in facility in Prolog (rather like a library function in any other language), so it isn't necessary to write any code to tell Prolog how to go about showing equality.

Prolog will succeed in showing equality for the two sides of the '=' if, following the calculation of any expressions, it can match the two sides (the technical term is 'unify'). Referring to Fig 2 again, Prolog solves the goal $1 + 2 = X$ by calculating $1 + 2$ to be three, and making X equal to three in order to achieve a match. It solves the goal $1 + 2 = 2 + 1$ because calculating both sides produces the same result. And it fails to solve the joint goals $X = 1 + 2, X = 4$ because, after solving the first goal, X is made equal to three, and the

second goal cannot then be solved because three and four cannot match — in effect, Prolog is saying that there is no value for X such that X can equal $1 + 2$ and equal 4.

Having experimented with command mode, it's time to start writing some simple programs. Suppose it were necessary to periodically calculate a complex expression for different input values. You would just retype the expression at command level each time it were needed, but it would be less tedious to set it up once and for all under a name, and then just type the name whenever the calculation was needed. The code to do this is shown in Fig 3.

When typing in the program, be careful not to omit any of the punctuation, and be sure that the variables X and X2 are in upper case. It isn't necessary to adopt an identical layout to the one shown: Prolog is not line-orientated like, for example, Basic, and programs can be arranged in whatever layout you prefer. If you are using Turbo Prolog, you can enter the program directly with Turbo Prolog's editor by pressing 'E' for 'Edit' at the main menu. If you are using another Prolog you may need to modify the code slightly, and in some cases you may need to work with a separate editor program, independent of your Prolog system.

To run the program from Turbo Prolog, exit from the editor and press 'R' to 'Run' (for other Prologs, consult the manual). After a brief commentary, while it compiles the program, the system should respond with the now familiar Goal : prompt. Type in 'do_calc', and when it asks for a number, type in a number. The dialogue should look something like Fig 4. (There is no automatic X=... X2=... printout at the bottom of this dialogue, because Prolog only prints out the values of variables actually entered as part of the command line, and the command line do_calc does not have any variables.)

The program you have just been running contains just a single 'clause.' (A clause is a rule which the program adheres to, to find solutions to goals.) The clause is everything

```
predicates
  do_calc

clauses

do_calc :-
  write("Type a number: "),
  readreal(X),
  write("Here is the result of the calculation: "),
  X2 = (sin (cos (X - 12.3))) * 2,
  write(X2).
```

Fig 3 A first program


```
Goal: do_calc.
Type a number: 9.87
Here is the result of the calculation: -1.3739568
True
```

Fig 4 Running the first program

that occurs after the word 'clauses' in Fig 3. In general, Prolog programs are almost completely built out of clauses and, totally alone, the Prolog clause provides all the functionality of other languages' GOTOs, DO-WHILEs, FOR-TO statements and function definitions, and so on.

Notice that the clause has two parts, separated by the ':-' symbol — the 'head' (do_calc) and the 'body'. We can read this particular clause as saying:

(Head:) In order to solve the goal do_calc (notice that do_calc is a predicate), solve the following goals ...

(Body:) 1 Write 'Type a number:' on the screen
 2 Match X with a real number read from the keyboard
 3 Write 'Here is ... etc ...' on the screen
 4 Match X2 with (sin (cos (X - 12.3))) * 2
 5 Write the value of X2 on the screen
 6 Write a new line to the screen

In this example, the means for solving all six of the goals listed is built into Prolog, so there is no need to further specify how any of them should be solved — Prolog already knows. But, in general, the body of clauses may contain goals which call upon further clauses — we'll come across these later.

When Prolog is given the initial single goal to solve, do_calc, it replaces the task of solving that goal with the task of solving the six goals indicated. As each is attempted, the appropriate action is taken, and the effects can be witnessed on the screen as information is written, or input requested. In fact, goals involving reads or writes always succeed, and cannot directly affect the outcome of a clause; but these input/output goals have useful side-effects, and without them it would be impossible for the user to communicate with a program.

As an exercise, add two or three further clauses to the example program, doing similar calculation tasks. Let the head of these new clauses be, say, do_calc2, do_calc3, and so on. In Turbo Prolog, you will also have to add do_calc2 and do_calc3 to the list of predicates at the top. Just add the names immediately

under do_calc. From the Goal : command mode, check that each clause works on its own, then try:

```
Goal : do_calc, do_calc2,
do_calc3.
```

The system should first of all solve the do_calc goal, producing the same response we have already seen, then work its way through the solution of do_calc2 and do_calc 3. If you like, you can introduce another clause:

```
do_all_calcs :- do_calc, do_calc2,
do_calc3.
```

and then 'do_all_calcs' on the command line will save having to type in the names of all three goals.

Notice that, even if do_calc2 and do_calc3 contain variable names in common, they still work in unison and there is no interference between them. This is because Prolog's variables are always 'local' to a clause. The effect is as if Prolog had spotted the same variable name occurring in two different clauses and (privately) renamed one of them to make it different. If you wanted to be pedantic about it, you could take any Prolog program of any length and change all the clashing variable names so that they were different. As long as you consistently changed every occurrence of a variable name within its clause, the program would still work exactly as before.

The easy way

The simple program examples that we have considered so far are very much the type of examples that would be used to introduce a conventional language. This is convenient here, because most readers will be familiar with these types of example, and their numeric bias should also allay any fears about Prolog being unable to do number-crunching. But the examples are a little bit unfair on Prolog, as they do not emphasise its strong points.

In this section I shall redress the balance, and show Prolog on its home ground. In fact, I'll show how a simple Prolog program can solve a fairly complex route-planning problem, and be able to deal with a multitude of different questions that might be posed.

Up to now I have been describing Prolog in a procedural way, informally describing clauses in an 'in order to do this, do that' fashion. One of the interesting features of Prolog is

that it is quite frequently equally valid to think of its clauses in a declarative way — 'this is true IF that is true'. The advantage of thinking about Prolog programs in a declarative way is that all the clauses can be considered in complete isolation from each other, and if they are all manifestly true, then the program is guaranteed to produce correct results. I am introducing the notion of a declarative interpretation here because that is how the following example will be described; and any doubters will be able to see the correct results for themselves.

Suppose you are a travel agent, offering a range of flights all over the world. You need to be able to deal with a variety of customer queries about these flights, and these queries can get quite difficult to handle, especially when flight connections are involved. Typical questions might be:

- What are the options for travelling from London to San Francisco?

- What flights arrive in Paris before 10:00?

- What journeys from Rome take less than four hours?

- Can I get from London to San Francisco before 14:00?

The program listing in Fig 5 shows the basics needed to handle all the above questions, and more besides.

Ignoring the declarations at the top of the listing, the program starts immediately after the clauses statement. The first part of the program specifies the information about the flights which are available. In another programming language this kind of information might be set up in data statements, but in Prolog the clause is used, like it is for everything else.

In this example, flight information is specified by a 'flight' predicate which expresses a relationship between four things: a city of departure, a city of arrival, a take-off time, and a flight duration. The standard Prolog syntax for specifying a relationship is to give the predicate name immediately followed by brackets, and within the brackets to put each of the things being related, separated by commas. Thus, the first clause gives the information that there is a flight from London to Paris departing at 12:00 and taking one hour. The next clause states that there is a flight from London to Rome departing at 11:00 and taking two hours. The remaining flight clauses have a similar interpretation for the other cities, times and durations given.

Notice that, in these clauses, words like 'london' and 'paris' are used without an initial capital letter. This is necessary because Prolog treats words with an initial capital letter as

LANGUAGES

```
domains
  city = symbol
  duration, takeoff_time = real

predicates
  flight(city, city, takeoff_time, duration)
  route(city, city, takeoff_time, duration)

clauses

flight(london, paris, 12, 1).
flight(london, rome, 11, 2).
flight(london, edinburgh, 13, 1).
flight(paris, new_york, 13, 5).
flight(new_york, tampa, 17, 2).

route(City1, City2, Takeoff_time, Duration):-
  flight(City1, City2, Takeoff_time, Duration).

route(City1, City2, Takeoff_time, Duration):-
  flight(City1, Somewhere, Takeoff_time, Duration1),
  route(Somewhere, City2, Takeoff_time2, Duration2),
  Takeoff_time + Duration1 <= Takeoff_time2,
  Duration = Duration1 + Duration2.
```

Fig 5 Planning your holidays with Prolog

```
route(london, paris, Departure, Duration).
route(london, new_york, Departure, Duration), Departure > 10
route(City, City, Departure, Duration).
route(City1, City2, Departure, Duration), Duration < 2.
route(paris, san_francisco, Departure, Duration),
  Departure + Duration < 20.
route(City1, City2, Departure, 6).
```

Fig 6 Some possible route enquiries

variables, and names of cities are clearly not variables but constants. If we were to write:

```
flight(London, Paris, 12, 1)
```

then it would be identical in effect to:

```
flight(X, Y, 12, 1)
```

and have the interpretation that there is a flight from anywhere to anywhere at 12:00, and it takes one hour!

Another point to note is that, unlike the clauses we have seen so far, these flight information clauses have no body — that is, the ‘:-’ and the rest is missing. If we were to extend the Fig 5 example, it would be quite feasible to introduce some flight clauses with a body, for example:

```
flight(london, athens, 22, 3):- season
  (summer)
```

This would be interpreted as: ‘There is a three-hour flight from London to Athens departing at 22:00 IF the season is summer.’ Contrasting this with the bodyless flight clauses, it can be seen that a bodyless clause is simply an unconditional fact — it is true without any conditions — and ‘fact’ is the Prolog terminology for bodyless clauses.

After the flight clauses, there are only two clauses still to be considered; these are the ‘route’ clauses.

The route predicate expresses a relationship between the same four objects as the flight predicate, but routes are obviously different from flights — we can have a route which has a departure and arrival point not connected by a single flight. This is the major point of the exercise: we want the system to be able to work out routes involving, possibly, many connecting flights.

Both clauses are more easily read in reverse. The first route clause states that:

```
IF there is a flight connecting City1
and City2 with the given take-off
time and duration;
```

```
THEN there is a route connecting
City1 and City2 with the same
take-off time and duration.
```

The second clause states that:

```
IF there is a flight between City1 and
somewhere AND there is a route
between somewhere and City2
AND the flight lands before the
route's departure time;
```

```
THEN there is a route between City1
and City2 with the same departure
time as the flight and duration
being the sum of the flight and
(original) route's duration
```

Using this program, it's possible to handle all sorts of different queries

by specifying various different goals in the command line — Fig 6 shows some example goals to try. The first example given is a request for information on all possible journeys between London and Paris. The second example involves two goals, and is a request for information on any possible journeys between London and New York which leave after 10:00. The third example is asking if there are any round-trips from anywhere at all (there aren't with the flights given). Interpreting the remaining examples is being left as an exercise for readers.

Conclusion

In this first article on Prolog programming I have shown how powerful Prolog can be for dealing with some problem areas: in the example given, an extremely short program is able to handle a wide variety of complex queries.

Homework: Extend the route enquiry program to handle pricing information as well; for example, it should be possible to specify a minimum acceptable price for a journey. **END**

Prolog suppliers

For Prolog-2

Expert Systems International Ltd
9 West Way
Oxford OX2 0JB
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Logic Programming Associates Ltd
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Trinity Road
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Tel: (01) 871 2016

For Turbo Prolog

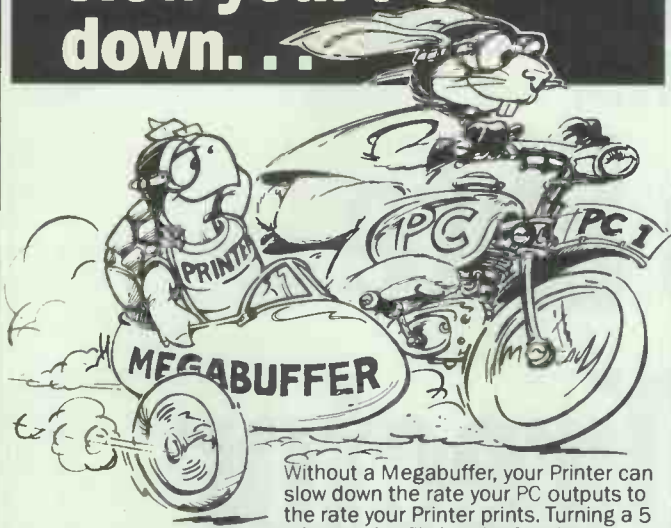
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Bristol BS8 1QX
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For PD Prolog

This PD (public domain) Prolog costs less than \$10, but is of unknown quality
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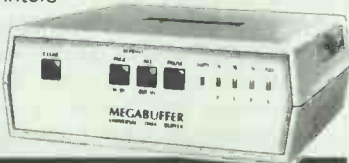


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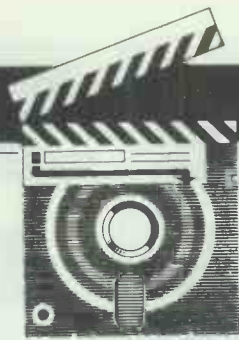
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Degas Elite and Art Director

One of the major criticisms of computer art packages is that they ignore the artist's viewpoint and are designed for experienced micro users. Angie Brew takes a look at Degas Elite and Art Director for the Atari ST with the artist in mind.

How well do computer art packages serve the needs of the artist? Micro-based art packages can give computer users with little artistic ability the tools to create diagrams and freehand drawings, but computers can't give the user the 'creativity' which turns brush and paint or pencil and paper into a work of art. Similarly, the tools provided by computer art packages can either enhance or restrict the scope of an experienced artist. It's from the latter perspective — that of an artist rather than a computer user — that I will be looking at two art packages for the Atari ST.

Degas Elite, published by Batteries Included and distributed in the UK by Ariolasoft, is an enhanced version of Degas. Art Director, from Mirrorsoft, will be coupled with a program called Film Director so that simultaneously they form an effective tool for computer animation.

At the heart of both packages is a set of tools which enable the user to 'paint' the screen with a range of lines, shapes, textures and colours. Both packages are 'bit image' rather than 'object' based: apart from undoing the last instruction, anything painted onto the screen can't be separated from the existing image. In an object-orientated package, lines, shapes and textures are objects that can be manipulated onscreen independently from other objects. It doesn't matter if something has been placed on top of them, or added to

them; each individual object can be retrieved, altered, moved or even replaced.

During the review I wanted to assess whether there were any advantages in using a computer in art rather than traditional methods, and I set out excited by the possibilities a computer might offer. Among my expectations were the potential to work more quickly, and the production of intense colours and interesting effects. I set myself two tasks: to produce a cartoon strip; and to do some interior and textile design. The cartoon strip would need the ability to create frames, and to 'paste' or copy bits of the picture between frames before modifying it, as well as trying out different formats. The interior design task required the ability to look at various texture and colour combinations, and to compare several variations of an interior on different screens.

Degas Elite

I chose Degas Elite to create the interior design mainly because it provides access to eight working screens at once; the numeric key pad takes you from one screen to another. It's possible to use the Atari ST in any of the following graphic resolutions: low resolution — 320×200 pixels with 16 colours from a palette of 512; medium resolution

— 640×200 pixels in four colours; and high resolution — 640×400 pixels monochrome. Degas Elite will run in all of these modes.

Degas Elite provides a number of functions which are useful in interior design, including freehand drawing, and block manipulations to cut and paste between different areas of the picture. It's also possible to stretch and rotate a defined block. Most important, however, is the ability to construct complex colour patterns that could be used to 'paint' walls, fabrics, and so on.

Using the line-drawing commands, I produced the basic plan of the room very quickly. In addition to the 'regular lines' function which draws a straight line between two points, the 'ray' function gives a focal point from which to generate lines. Using the ray function it's possible to position walls and objects in perspective, although there's a lot of rubbing out of unwanted lines when the room has been constructed.

Removing parts of the picture can be accomplished using either the 'Undo' function or the customisable eraser. Undo will erase the last line drawn: in fact, it cancels the effect of the last command, whatever it was. It was frustrating that only one level of Undo was available, because you are inevitably going to make mistakes while drawing, and also may want to experiment with a number of things simultaneously. The eraser acts like a

brush except in reverse, and can be created out of a block defined on the screen. The eraser can be as small as one pixel or as large as the whole screen, and to save time there is an 'Erase Screen' function. Annoyingly, the eraser is extremely difficult to see when you're working on a picture with a white background.

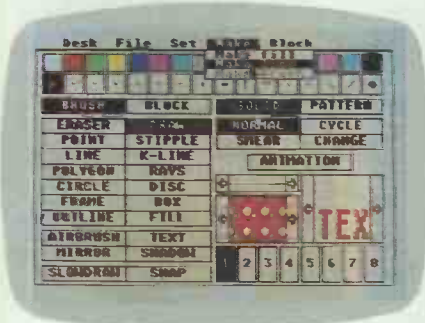
Geometric shapes such as frames, boxes, circles and polygons are easy to generate. You choose the correct option from the command screen, then switch to the drawing screen where you use the mouse to position and draw the required shapes. The shapes drawn this way can be filled with any colour or texture.

Patterns are user-definable and a wide selection is available at any time, and they are made up from any of the 16 colours which are available in the colour palette at any time. The 16-colour palette is made up from the ST's 512 colours. Colours can be chosen from a display showing all 512 colours, or can be individually changed by altering the red, green or blue levels that make up the colour.

The range of possible fill patterns is exciting, and your customised fill patterns can be stored in special 'Fill' files on disk. Additionally, a 'Change' function will change any colour in the picture to another from the palette without having to use the Fill function. This proved to be useful when I was experimenting with different colour combinations.

I produced the interior design in Degas Elite's low-resolution mode in order to be able to use as many colours as possible, but unfortunately there's the inevitable trade-off in terms of pixel size. While the line commands are a quick method of producing a basic perspective drawing, unless they are exactly horizontal or vertical, the lines are very jagged.

Degas Elite features a slow-draw mode which increases accuracy. It makes the cursor move more slowly and smoothly relative to your mouse movements, so you have more control over the lines you draw.



The editor screen in Degas Elite showing the tools available. Other tools can be selected from the menu bar at the top of the screen



A finished interior design which features several pattern fills and a wide range of colours. Details to enhance the image (the technical term is 'finishing'), and other changes, were made using the ordinary drawing facilities which are contained within Degas Elite

The availability of eight screens within Degas Elite proved to be a useful facility. I could create the different elements of the picture in separate frames and then use the block functions to 'grab' the specific areas I wanted to move; these could then be transferred to another place on the same page or onto another screen, and positioned correctly. You can also copy images, leaving the original in place, and reposition the copies. There are commands that can alter the size and shape of blocks in different ways, such as 'stretch', 'rotate', 'distort' and 'skew'.

When using the Fill function, it's extremely important to ensure that the area being worked on is enclosed, otherwise the colour/pattern leaks over the whole screen. In this situation the Undo function is essential, enabling you to test whether an area is enclosed or not.

As I progressed with Degas Elite, the potential for a computer-based design system revealed itself. By using either the whole or a reduced palette I could 'animate' the interiors, enabling me to place a number of colours into a sequence. When activated, all the chosen colours in the picture run through the colour cycle. In this way, I could easily view a variety of colour combinations for the room. The animation speed can be adjusted, but unfortunately there is

no way to freeze the cycle at a particular point.

Degas Elite is useful for experimentation with colours, patterns and variations, especially with its colour animation capability, but it can't produce sufficiently precise graphics or a finished drawing.

Problems & reservations

The low-resolution screen is the most limiting 'feature' of the Atari ST, followed closely by the difficulty of clearing a filled area if the fill isn't the immediately previous operation. Using another fill, or a brush with a colour or pattern, will eventually cover the area, but this is not entirely satisfactory.

In drawings with perspective, I had to be careful which fill patterns I used in certain areas. As the pattern fills are two-dimensional and flat, they can't be used satisfactorily when a three-dimensional representation is required as they can't be tilted or made smaller. To do this you have to pre-draw the area, and then tilt and stretch it to match — which negates the advantage of being able to fill areas and paint with patterns. The textures of a fill pattern are constant, and I would have appreciated some method of stretching them while still keeping them as fill patterns.



A basic room plan which has been drawn with rayed lines: note that the lines are jagged, which makes it easy to see the screen pixels



An interior which has been drawn using a different set of colours and fill patterns. It has not been 'cleaned up' with the zoom facility

Art Director

I hoped that Art Director would enable me to create cartoon characters and copy them from one frame to the next. Art Director only works in low resolution, which is an important factor to consider if you are interested in buying the package.

Many of the facilities of Art Director are identical to those of Degas Elite, but most notable among the differences is the enormous range of facilities for modifying brushes that have been defined (similar to the blocks in Degas Elite). Art Director also has size and speed meters to control the size of brushes and the speed of drawing — these are much more flexible than the slow-draw mode in Degas Elite. A window can be defined onscreen so that only a certain area will be affected by any actions performed.

Art Director allows up to eight colour palettes at once, but only two pictures (in comparison with Degas Elite's eight pictures and one palette). The screen can be scrolled in all directions, with edges of the screen wrapping around to the other side.

The extra brush commands available on Art Director are: 'rescale' — this changes the size of a brush but keeps the sides in proportion; 'bulge' — this bulges a circular brush in a convex or concave way; 'perspect' — this puts a rectangular brush into perspective; 'oval' — this cuts an oval-shaped brush rather than a rectangular one; and 'assimilate' — this tries to match colours on a brush which uses one palette, to colours in another palette. Other commands are 'smear', which smears pixels around in an area; 'scrape', which



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scrapes pixels away; 'melt', which randomly mixes colours on a canvas; 'shade', which changes colours on a small area of the screen; and 'patch', which fills in small gaps, and several other less important features.

The Toolbox sits in a narrow window across the main screen, and while it can be moved around and removed completely, I often found that I could not retrieve it, even using the methods described in the manual. This is a fairly serious bug, since it means that the picture has to be saved and the program restarted before you can return to your original place — a great inconvenience. If the Toolbox is left on the screen however, it gets in the way and functions can easily be activated by mistake.

To create a brush you define an area of the screen, and whatever area is selected — colours and all — becomes the brush. This can be used to create quite stunning effects, and is a really useful technique in computer-based art which is unparalleled in manual forms of drawing.

A brush can be used to pick up and modify parts of a frame for the final cartoon strip; these parts can be saved to disk as a 'library' of pieces to use in other cartoon strips. The same applies to backgrounds, and so on. Brushes can operate in different modes — 'transparent', 'solid' or 'silhouette'.

In transparent mode, the back-

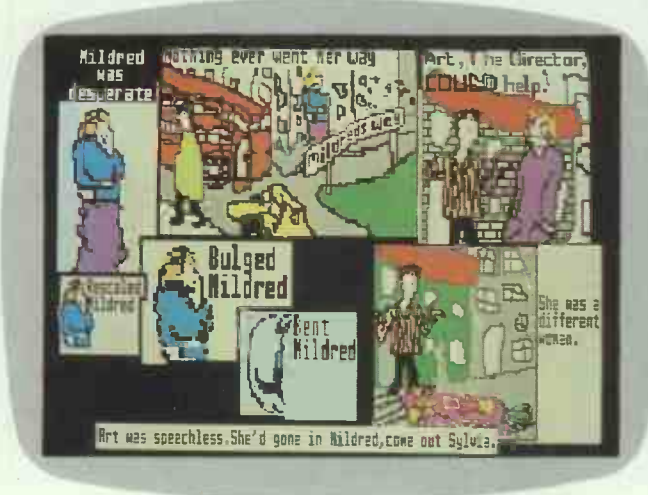
ground part of the brush acts as if it were transparent, so the underlying area where the brush is used to draw, shows through. In solid mode, the whole brush is used and the background part of the brush covers up what is underneath it. Silhouette mode makes the brush into a solid block of one colour.

Text can be produced in a number of fonts and sizes, although changing fonts and adding new ones is difficult. When the text has been typed in, it appears as a defined block that can be positioned anywhere in the picture, and can even be used as a brush for special effects.

Art Director's cut functions are excellent, easy to use and an amazing time saver. Special features like 'bulge' and 'distort' offer extra opportunities for modifying parts of a frame before pasting it into a strip. Similarly, 'smear', 'melt', 'shade' and 'patch' seem to offer extra possibilities, but in practice turn out to be rather gimmicky.

'Rescale' is a very useful brush facility. Using this tool it's possible to change the shape and size of a rectangle; I was able to use it to great effect to size the different frames of the cartoon to fit onto one picture. Commands are also provided to automatically modify a block in specific proportions — namely, to halve or double vertically or horizontally.

Additionally, Art Director offers a 'fat bits'-type magnification tool which enables individual pixels to be edited; this is good for tidying up stray parts of a picture. The outline function can be used to help finish a drawing, clarifying and defining certain areas, although you often have to put outlines around things as you go, rather than at the end.



This cartoon illustrates the brush modification facilities of Art Director. Each frame has been drawn separately, copied into the picture and resized to fit the space. Very little 'touching up', to improve the image's appearance, was needed



This cartoon was created in a very different way. The box outlines were drawn first, then parts of their background. The individual bits were drawn on the second screen and copied in later, after careful, detailed improvements had been made



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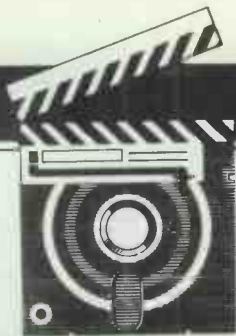
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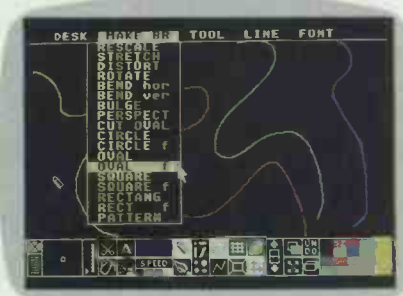
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Limitations

One of Art Director's main limitations compared with Degas Elite is that it provides only two editing screens, but its range of basic drawing tools is much broader. There are two types of pencil lead — rough and smooth — and a brush with a definable shape. The drawing pen has eight nib sizes. You have to get used to the various functions that work with some of these tools, but once the package has been mastered, Art Director gives you a great deal of flexibility in the drawing mode.



The Art Director Toolbox from which most of the basic functions are selected. The advanced brush modification menu is also shown

While these tools enabled me to produce drawings very much like my own — combining heavy lines with fine lines and shading — the result was nowhere near as good as I could produce using a real pen or brush and a sheet of paper. As with Degas Elite, the lines are jagged and unsatisfactory, and undermine the versatility and scope of Art Director.

Similarities

Both Degas Elite and Art Director comprise roughly the same tools, albeit in a different form. However, Art Director is more complex and has a few functions which Degas Elite lacks. That said, both packages are basically capable of very similar things and, indeed, there are at least three other art packages available for the ST with comparable functions. Consequently, the operation of the tools and functions becomes more important than the tools themselves.

One important thing to note is that it's possible to some extent to convert pictures so that they can be transferred between Degas Elite and Art Director, and other art packages. If you owned all the programs, you could have the best of all worlds and take selective advantage of all the facilities available, although this would be rather expensive. (I should point out that the criticisms of Degas Elite and Art Director unfortunately apply to all similar packages, and, in

fact, only a couple of other programs are as good as these.)

Documentation

The Art Director manual was unfinished and its approach was unhelpful, but hopefully this will have changed in the final version. The Degas Elite documentation however, was comprehensive and friendly.

Conclusion

I found using a computer to create art to be a fast way of working because it enabled me to play with and edit my drawings easily and quickly. In addition, there was none of the mess or deterioration in quality usually associated with hand-drawn work where it's difficult to hide evidence of changes. Often, major changes can't be effected, and the artist has to destroy much of the work or start again. Using the computer with care can avoid some of this hassle.

Despite these significant advantages, the stepped nature of the shapes is a major disadvantage. The low resolution results in jagged lines and poor quality, and gives you unsatisfactory artwork. Art Director's manuals promise a 'round-off' function to smooth the edges, but the drawback is that this rubs out most of the drawing and is smudgy.

The one area where Degas Elite and Art Director score heavily over manual methods is in the field of animation. Using a Super-8 camera, it would be possible to take still images of the screen as characters and colours were changed. This would provide a fast, cheap and easy way to make an animated film by drastically reducing the time needed to draw each new frame.

Another possibility would be to use a digitiser to import images from photographs, and then modify them. But digitisers of this capability cost at least £500, and the tools available may not provide the level of sophistication many users would expect.

Reviewers of art packages are consistently impressed by the new functions and possibilities of computer art packages, but the main limitation is the computer's resolution. I have heard many accounts of artists —

graphic designers included — initially thinking that computer graphics had great potential, but soon rejecting them and going back to their old methods.

A final caution concerns the use of colour. Most computer users have a monochrome printer and would have to produce their output in shades of grey. The only alternatives are to take photographs of the screen, or to buy an additional, expensive colour printer.

If I had an Atari ST, I would buy one of these packages. Of the two, Degas Elite comes out on top because it has eight editing screens, it has a less irritating method of handling the Toolbox, and it comes in three resolutions. Art Director would be better for advanced manipulations of simple images and for parts of the drawing process — it's also cheaper.

Certainly for a home user, art packages like this provide a way in for people new to graphics who want to explore their creative abilities. When someone has become accustomed to what the computer can and can't do, then they will be able to make better use of the machine's versatility and range of possibilities. But anyone who thinks that using a computer will turn them into a great artist will be badly disappointed.

When a user has gained some skill, he or she may well find themselves irritated with the mouse as an input device. I found it coarse and less sensitive than my own hand. Cheaper touch tablets are available for Atari STs which will enable novices to trace over existing photographs and diagrams, and so copy them onto the screen. For myself, I would use one of these packages to produce working drawings rather than finished artwork.

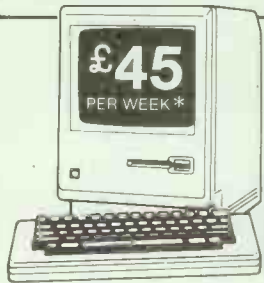
The potential of art packages like Art Director and Degas Elite is uncertain. If the resolution were better, then perhaps greater things might be achieved. I wasn't impressed with many of the special functions on either package — I found them too gimmicky. I had to adapt my style too much to the computer, partly because I wasn't experienced at using it. The most important thing to remember is that the extra functions are not as important as the basic drawing ability: if you can't control the tools accurately, it's irrelevant how versatile or impressive a package is in other ways. If you're thinking of buying a computer art package, try it out first to see if you're comfortable with it.

Degas Elite costs £79.95 and Art Director costs £49.95. Ariolasoft is on (01) 836 3411; Mirrorsoft is on (01) 377 4837.

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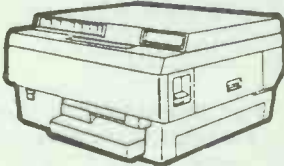


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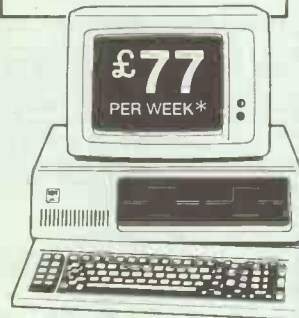


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Leave it to the experts

The use of expert systems on mainframes and in Artificial Intelligence has led to speculation that they may also find a niche in micro programming and, more practically, in the fields of research, development and diagnosis. Owen Linderholm examines these pseudo 'experts' in detail and suggests possible areas for their implementation.

An expert system is a computer program/system that models and replaces a human expert's knowledge in their area of expertise. The program can answer questions within this area of knowledge, and can back up its judgement or opinion by correctly showing and explaining its reasoning to the user. In order to do this, the program usually has to obtain data from the user, who may *not* be an expert, and it has to be able to question the user carefully to obtain the data it needs. The program must then be able to provide the same answer that a human expert would have provided, and must be able to arrive at a conclusion by using knowledge and experience that a human expert has given it in the past, or that it has derived from experience in similar problems. It must also be able to justify its answer to the user, and prove that it is right.

Expert systems have been at the forefront of Artificial Intelligence's move into the commercial and microcomputer sections of industry. For several years, people have been predicting the impact that they will have and how they will usher in a new age of cheap computer power, and many expert system shells are now available for micros — especially IBM clones.

An expert system shell is a program that claims to be able to create an expert system on any subject for which you can provide an expert. Expert system shells also provide the environment for complete development of an expert system. The expert system can be debugged and modified under the shell very easily. When one has been finished, you will usually be given the option to

produce a final 'compiled' or run-time version: you design a structure, set up the rules carefully, and unleash your silicon expert on a world demanding answers.

Unfortunately, this dream of instant electronic information and advice for all has yet to materialise. Somewhere between the program, the press release, the publicity and the public, it ran into reality and came off worse.

Despite the claims, most of the so-called 'expert system' programs that have appeared for micros are not what they set out to be. They could

'An expert system shell is a program that claims to be able to create an expert system on any subject for which you can provide an expert.'

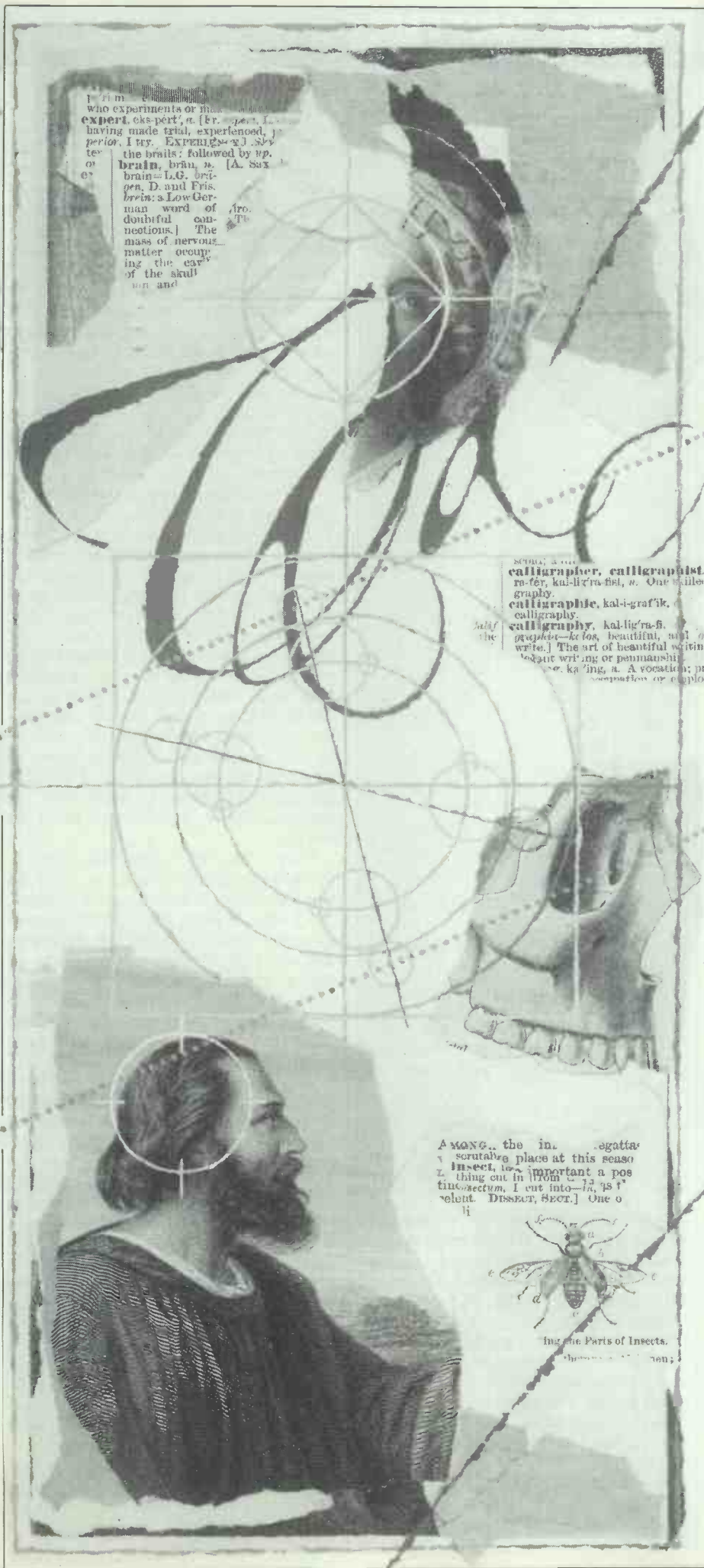
be described in several ways — as thought organisers, or structured databases with rules, or whatever — but not as expert systems, and it is misleading to think of them as such, although most of the programs are useful in their own right.

Real expert systems have appeared, but only on computer systems that are much larger and more powerful than the office micro. These programs have proved their worth many times, but they have also been extremely expensive to create; not necessarily in strict financial terms but in terms of manpower, since they have generally been the product of academic research.

All this may sound rather complex; after all, it's usually quite easy to find a human expert who'll give you advice quickly and easily, so why bother with a computer? (This question crops up a lot in all fields, not just with expert systems, and very often the answer is that you *shouldn't* bother with a computer!) Unfortunately, in some fields, there are only a couple of experts in the world; or the experts charge huge sums of money for their time; or the field of knowledge to be covered is so large that one human expert cannot possibly know everything within the area.

In these situations expert systems have a lot to offer, but the way they are used and set up is of extreme importance. A badly designed expert system could cause a great deal of damage if its advice were taken seriously. It is also important that users realise the limitations of the particular expert system they are using before they get involved with it — bad advice can be worse than ignorance.

Expert systems apply knowledge and reasoning to data they have been supplied with; explain and justify the conclusions they have drawn; communicate these conclusions to the user; as well as request any other detailed information they require. They are limited to rigorously defined situations where the data is of manageable size and strict rules, and where the conditions for dealing with such data can be defined. Expert systems cannot model: the restructure and reorganisation of information and rules they know about; the selective breaking of rules when the situation requires it; the



who experiments or has
expert, eks-pert, *n*. [Fr. *expert*, *l.*
 having made trial, experienced, *per-*
perior, I try. EXPERTISE, *n*. Skill
 the traits; followed by *sp.*
brain, brayn, *n*. [*A. Sax.*
brain; *L.G.* *brin-*
gen, *D.* and *Fris.*
brin; a Low Ger-
 man word of *pro-*
 doubtful con-
 nections.] The
 mass of nervous
 matter occup-
 ying the cav-
 ity of the skull
 and

calligrapher, calligraphist,
 ka-li-gra-fer, ka-li-gra-fist, *n*. One who
 writes in calligraphy.
calligraphic, ka-li-graf-ik,
 ka-li-graf-ik, *adj*.
calligraphy, ka-li-gra-fi,
 ka-li-gra-fi, *n*. The art of beautiful
 writing; the art of beautiful writing;
 the art of beautiful writing or penmanship.
See *ka'ling*, *n*. A vocation; or
 occupation of a copyist.

AMONG the in-
 sects, the in-
 sects, a place at this season
 is important a pos-
 sible insectum, I cut into—*in*, *is* *f*
 silent. DISSECT, SECT.] One o



Fig. 1. The Parts of Insects.

determination of the relevance of information; and, finally, the awareness of the limits of their knowledge. These are all human traits requiring intelligence of the kind that computers cannot yet match.

How they work

The simplest example of an expert system is a decision tree that can be followed while dealing with a problem. Such a tree is often created by an expert and is intended for others to follow. All the user has to do is start at the top and follow the paths specified by the expert as the user comes to stages of the problem. Good examples are fault-finding manuals for cars or motorbikes: such 'expert systems' enable the novice with little mechanical experience to repair minor faults easily.

A very simple example of a computer expert system is the 'animals' program. This tries to deduce which animal you are thinking of by asking questions like: 'Is the animal warm-blooded?'. The answer helps the system proceed along an internal tree structure of questions which eventually end in the name of a particular animal.

There are many versions of the animals program, some written in simple Basic. The program illustrates a simple rule-based expert system which is controlled by a tree of IF... THEN commands. Each stage is a question, the answer to which is used by the IF... THEN command to move on to the next stage.

One important feature of the animals program that isn't usually available in such simple expert systems is the ability to learn. If the animal is one the system doesn't know, the program asks for a new question to distinguish the animal from the one it has guessed, and adds this to the structure.

At this point it's worth considering the value of having a good structure and a sensible set of questions. If the questions are carefully set up to break down animals into species, groups, and so on, then the program will be able to lead the user down sensible channels to add the animal if it's new, and will not be too far off itself when it takes a guess. On the other hand, if the questions are entered in a random order, the program will be hard to use and build up. For example, if the first question is: 'Is the animal green?', then one answer 'yes' will lead to few possibilities (frogs, perhaps) whereas the answer 'no' will lead nowhere.

Example application

An example expert system can be used to illustrate a lot of the considerations outlined above. The one I have chosen fails on some points, but adequately illustrates the advan-

EXPERT SYSTEMS

tages and failings of expert systems in general. It is an expert system to advise potential purchasers on which microcomputer, software and additional hardware to buy to meet their requirements.

One immediate problem is how to deal with people who say, for example: 'I have been using package xyz at work, and whatever I buy must be able to run xyz.' The problem is that package xyz may be obscure or even purpose-written. The program won't know, because a human expert wouldn't, which computer is suitable for running the software, and it will need to know how to extract this information from the user. Skilful 'programming' of the expert system can overcome this problem by asking detailed questions about the type of computer being used at work, and so on, but nevertheless it is unlikely to come up with an entirely satisfactory answer.

To illustrate this point, suppose that the computer at work is a powerful mainframe. No microcomputer purchaser is going to be able to — or would want to — buy a mainframe. The expert system comes to the conclusion that the person is going to have to do without their pet program at home.

A more flexible human expert might, however, be able to discover whether the high-level source code for the program is still in existence, and whether or not this could be easily converted and recompiled on a micro. After exploring this detour as it leads into other areas, the expert could then recommend a computer, the software, and a source of help for porting program xyz to the micro. It's this kind of unusual circumstance where a human expert can do things that an expert system cannot.

The box on this page shows a very simplified version of the structure of the expert system. (Please note that this is only an idea, and has not been seriously considered for long enough to make it a complete structure specification.)

The list of questions and answers in the box is the minimum needed to make a basic recommendation about the type of computer system someone should buy. It isn't good enough to enable the system to pick out a particular computer or piece of hardware (especially in the dot-matrix printer market, where there are innumerable printers all priced the same and all doing the same things), but it's enough to suggest a range of possibilities. What is needed beyond this list of questions and selected answers is a structure, and a decision-making set of rules which lead to different pieces of advice.

There are several things to be

Example expert system structure

Question 1: Do you really need one?

Question 2: What do you want to use it for?

Games
Programming
Home word processing, accounts, and so on

Serious programming
Serious word processing
Accounting

Small-business general use
Heavy business use

Question 3: What extra hardware will you need?

Printer
Disk drives
Monitor
Modem
Hard disk
Laser Printer

Question 4: What extra software will you need?

Word processing
Database
Spreadsheet
Accounts
Programming language
Utilities
Graphics
Specialised/custom software

Question 5: How often will you use it?

Question 6: How much money can you spend?

Question 7: Do you want a warranty?

Question 8: Do you want to take out a service contract?

Question 9: Are you reasonably computer-literate?

Question 10: Will you need training?

Question 11: Will you have to use 'user-friendly' packages or be able to dive straight into particular products?

Question 12: Does the computer have to be compatible in any way with ones at work or ones that other people own?

taken into account here. The order in which questions are asked is important, and the information gained from the answers should affect the other questions asked, as well as the answers. Different kinds of answers can be expected, ranging from simple 'yes/no' through numerical values and items selected from a list, to open-ended questions. (The last category should be avoided because the computer can't categorise the answer properly.)

The underlying structure of the expert system can be constructed in several ways, but almost all micro-based expert systems use a tree of IF

... THEN ... ELSE rules to determine the expert system's path. Questions are part of this structure and provide answers for the IF ... THEN structure to work with. The simplest expert systems consist of a series of IF ... THEN statements, either nested or listed one after another, or both. Many commercial products really consist of no more than this with a pretty interface, and some of the more advanced ones work with sets of rules and IF ... THEN structures which are more cleverly combined. The very best ones make use of other control structures and allow more flexibility, even as far as modifying themselves or pushing for a better answer in response to specific questions.

The example given above could be given as a sequential set of IF ... THEN statements (see the diagram). Each answer to a question should then modify a list of possible answers, which initially would be a list of all the popular home and small-business micros. At each stage, this would be adjusted according to the answers until all the questions had been answered. It's quite possible at this point that the list of possible machines would contain a selection of several computers or none at all. This reflects the kind of choices people really have to make and the answers they would get from an expert.

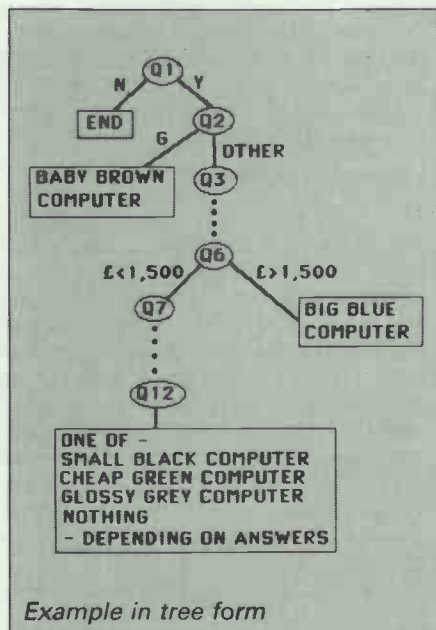
Most of the available expert-system programs could be used on this problem; examples are Crystal, Xi, ESIE or even the expert system program published in the February '86 issue of 'Program File'. None of these, however, are any more than programs to help design a decision tree and present it nicely. More advanced programs, such as Expert-Ease, are unnecessarily powerful.

When the expert system is being constructed, the list of machines as possible choices will have to be indexed by the answers to each question; then, as the questions are answered, those that don't match can be removed. Some questions cover similar ground, and these can be used as a cross-check on how consistent the expert system's user is and so as a check on whether he really knows what he wants. For example, if a user says that he wants to use the computer for word processing and then doesn't want a printer or specialised word-processing software, he will either be so unknowledgeable that he needs more help than the program can give, or he is simply forgetful and needs prompting. Either way, the program has to be able to detect this and come up with an appropriate response.

The hypothetical consultation table

opposite is a drastically shortened version of what would actually be used. It does, however, reflect real life in that the full range of possibilities is *not* represented, since there are only a limited number of computer manufacturers. The expert system would be told to check answers against the table and cross any off the list that didn't match; at the same time, it would be building up a list of desired features that didn't match any of the computers available.

There are still a lot of questions to be answered — the examples described here barely begin to explore structuring the expert system, but they are already leading to ideas. Personally, I would tabulate the machines and indexing data, but cross-index with the answers to help find inconsistencies. There should



Example in tree form

type structures and simple rules entered into the system by a person, although some have started to use the more flexible methods involving probabilities and other control structures. Mainframe-based expert systems explore a problem by using previous knowledge stored elsewhere and then deducing new information by analogy, reasoning and example. They also handle knowledge or information that isn't clear-cut but is expressed in terms of probabilities. When a certain level of probability/possibility is reached, the program acts as if that particular piece of information is true. If that is subsequently found not to be true, the program assigns that piece of information as false and continues.

This reflects real-life decision-making in that there are usually several possibilities at any one point, each of which is more or less likely than the others. Finding more information changes these probabilities until eventually one of the possibilities hardens into certainty.

For many purposes, programs other than expert system shells should be used to create expert systems. In many cases, a database programming language like dBaselll (with which many people will be familiar) would be a better choice for making an 'expert system' than an expert systems shell. dBaselll is, essentially, a programming language, and as such has more flexibility than an expert system shell.

As an expert system is a program in which you are going to invest a lot of time and effort, you might be better off programming it directly. Although this involves much more work, it is likely to result in a more powerful and flexible expert system.

tem is one that will work well, and you'll also need to have easy access to the expert or source of information that is to be the basis for the system. Mainframe and mini-based expert systems are likely to be 'real' expert systems and, as such, powerful enough to be able to simulate a real expert. But the cost of using these is great enough that serious consideration should be given to whether or not you can afford to create, maintain and use the expert system.

Some fields, such as mineral exploration, are good candidates for expert systems and have already been successfully implemented. This is because mineral exploration is a field in which a few experts have limited ranges of knowledge, and such experts (usually companies) charge heavily for their services.

The final piece in the jigsaw is that successful prediction of areas good for mineral exploitation can be highly lucrative for the company that eventually exploits rights to the minerals. An expert system that can successfully predict areas suitable for mineral exploitation has, for example, already pinpointed a molybdenum deposit worth over \$100 million.

Another successful (and famous) expert system is used to diagnose infections and suggest treatment. This can be done by any doctor, of course, but the expert system comes into its own when diagnosing complex multiple illnesses and obscure illnesses that occur infrequently. In these cases, the expert system can, in collaboration with a doctor, sort out and separate the different symptoms, and suggest drug treatments that will not affect the other illnesses. This expert system, called MYCIN, is one of the earliest expert systems to show real sophistication.

These expert systems are mainframe-based and are large, complex programs based on a great deal of Artificial Intelligence research and programmed in languages like Lisp. The code includes special routines that attempt to carefully emulate human thought processes — these can be difficult even for AI researchers to understand, and even the authors have difficulty implementing them on other computer systems. Consequently, such programs have not yet found their way onto micros and are still rare, although some micro-based programs such as Expert-Ease are based on high-level research.

It's interesting to note that nearly all the best expert systems are *not* constructed using an expert system shell, since these inevitably put restrictions on what the expert system can achieve. Therefore, it's sensible to only consider using an expert system for solving problems when there are difficulties in consulting a human expert, or where the expert system

Hypothetical consultation table

	Use	Software	Hardware	Cost
Big Blue Computer	B	All	All	High
Small Black Computer	H	Limited	Disks	Low
Cheap Green Computer	S	Limited	Disk Printers	Low
Baby Brown Computer	G	Games	Disks	Low
Glossy Grey Computer	A	Limited	All	Medium

Note:

B — Business; H — Home; S — Small business; G — Games; A — All

also be two lists: one of machines that still match all the criteria; and another of criteria that none of the machines match. This second group would then allow the program to advise on closest matches, even if no machines matched everything.

The questions could be embedded in a control structure that asked them in order, and then used the answers to monitor what actions the control structure performed on the two lists and the table, as well as what it did in the way of modifying exactly which questions were asked.

Micro-based expert systems are still generally based on IF ... THEN-

The problem with this method is the extra time and costs involved in the programming, development and debugging, which must be weighed against expert system shells that are quicker and easier to use. In particular, expert system shells already have a built-in mechanism for querying their decisions. This is the most important facility that an expert system should have, and it's one of the hardest parts to program independently into an expert system.

Implementation

It's important to ensure that the application you have for an expert sys-

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can add considerably to the expertise a human expert can bring to bear on a problem. Another possibility is using expert systems in situations where an expert has to be consulted so often that a full-time expert is needed, but is not available.

There are many fields where human knowledge and judgement cannot be quantified or defined precisely. In such cases an expert system would be useless, as it would be impossible to provide it with the information it would need to arrive at a reasonable conclusion. For an expert system to be useful in a particular situation, the problem it has to solve must be easy to define and must have definite rules that can be applied to its solution.

Opportunity

Having decided that you have an application that you *could* use with an expert system, there are still other points to consider before creating the expert system. The structuring of information is very important, but even more important is being sure that you can insert an expert's opinions and rules into the expert system in a coherent and useful form.

It's surprisingly difficult to persuade experts to express this knowledge in a structured and reasonable way, not least because many experts are jealous of their specialised position and don't want to reveal their knowledge to the world. Expert systems have become so widespread that an industry has grown up around the difficulties in representing and structuring experts' knowledge. 'Knowledge engineering' companies specialise in coaxing information out of experts, structure it and pass it on to the expert system in a sensible form.

This process is the most difficult and important part of setting up an expert system. If it is incomplete or flawed, then the final expert system will be useless. In fact, a poorly constructed expert system may seem to be fine for certain problems, but will be useless when it has to concentrate on areas where the information has been incorrectly entered. This could be very dangerous, and shows why it is necessary for an expert system to justify its decisions.

In practice, a good approach is to ask the expert to write down all that he can express of his knowledge in terms of rules and experience, then have someone else structure this information and use it to start building the expert system. Any inadequacies of the expert system will force the expert to express his knowledge in a clearer form which can then be used to modify the expert system, and the process will be repeated. Eventually

the expert will be satisfied with the performance of the system, and it can be considered finished or exposed to another expert's scrutiny for further refinement. When you are satisfied that you understand the finer points of preparation, you can be fairly confident that your application is one that is suitable to be an expert system.



'For an expert system to be useful, the problem it has to solve must be easy to define...'

There is only one other thing to consider — time. Planning an expert system can take a long time, and this is the point where you realise that creating and using a reliable expert system is not as easy as software companies would like you to think.

Taking the 'animals' program as an example, the tree-based structure is a good one in this case since it reflects the branching structure of animal classification very well. One advantage of this program is that the subject is already familiar to people. Therefore, the questions and structure of the expert system do not need to be so carefully formulated

since the users won't be too confused, even by misleading questions.

A point in expert systems' favour is that when a good expert system is available in any given field, human experts in that field are freed to work in more advanced areas — research, and so on — that will increase their knowledge and expertise. Also, expert systems make experts themselves redundant to some extent. Although this sounds like a bad idea, it does guard against human accidents which might cause a disaster.

The very best expert systems can be given raw data from a subject and can then extract their own rules.

Expert-Ease is one such program, but it uses only one method to extract its own rules and can miss relatively simple ones. This ability gives expert systems far more flexibility and enables them to find rules that human experts might miss — making them in some cases, better 'experts' than humans.

Conclusion

The most important thing to remember when investigating expert systems is to be *careful*. There are a large number of questions whose answers boil down to whether or not it's worth constructing an expert system. The most important points are: whether a real expert can provide knowledge and rules on a subject; whether you can put that knowledge into a structured form; whether the expertise is necessary to warrant making the system; and whether the system will be used at all.

You should consider how you want to put the expert system together. For fairly simple applications where it's important that it should be easy to make the expert system, a micro-based expert system shell would be adequate. For more advanced expert systems, it would be a good idea to experiment with an expert system shell before writing a program to implement the final version. For large and important expert systems, it might be worth investigating mainframe-based expert systems.

If you want to explore the expert systems market to see the kind of program you want to use, there are several options. There are numerous public-domain expert system shells that are nearly as powerful as those on sale for considerable amounts of money; these are for the IBM PC or compatibles and would be an extremely good way to find out what currently available programs can do. Moving up the scale, Borland's Turbo Prolog would help you to program your own expert system. Alternatively, an excellent version of Lisp, called XLisp, is available in the public domain for several machines. **END**

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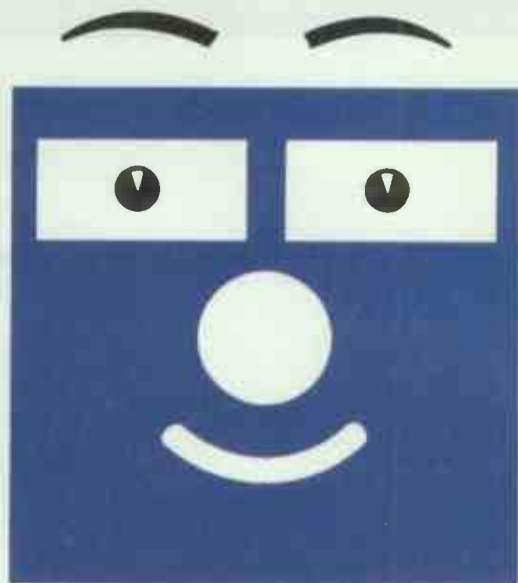
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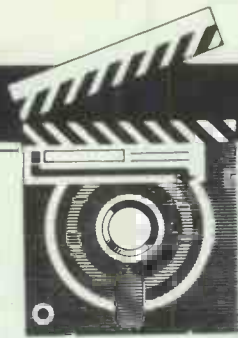
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Ability

Ability is a fully integrated software package for the IBM PC and compatibles which offers a variety of functions at a knock-down price. But how substantial are its facilities? Robert Schifreen finds out.

According to its packaging, Ability is a fully integrated software package for the IBM PC and compatibles. It comprises a word processor, a spreadsheet, a database, a communications facility, a graph-drawing system and presentation graphics. Such facilities are certainly not unique among PC software, even when bundled together as an integrated package, though you'd normally have to pay at least £400 for them. So how can Migent afford to sell Ability for £99.95, and include free telephone support?

The Ability box contains four disks, only three of which actually contain the Ability programs. The fourth is a self-contained interactive tutorial which, although well put together, is not really necessary.

Included in the box is a fold-out piece of card which I assumed to be full of useless information and immediately threw away. It was only after spending half an hour scouring the manual for installation instructions that I turned, in desperation, to the card. On it was a section headed 'Installation instructions', which informed me how to install Ability for use on a hard or floppy disk system.

Installing the software on a hard disk is just a matter of creating a directory called \ABILITY and copying the contents of the three program disks to it. Installation on a floppy disk system is slightly harder, as you can't fit a complete Ability system on a single disk. Starting up requires a disk change half-way through, while another change is required to enter the presentation graphics module.

Ability requires an IBM PC or compatible, with at least 384k of memory. In order to display graphics, a colour graphics adaptor and colour monitor are needed. If you have a

monochrome system, you can use the text-based applications only. The system supports a Hercules card, and if one is installed, it is used by default and the system powers up in 43-line mode.

Getting started

When the software has been installed, you type ABILITY at the MS-DOS prompt. Ability uses only the unshifted function keys, and allows you to assign a string of up to 30 characters to each of the ten function keys used with Shift, Ctrl and Alt. These characters are stored in a file, and are loaded when you start, after the configuration details.

When these details have been loaded, you are presented with a library screen. This is the top-level screen from which all applications are loaded, and from where you can run external MS-DOS commands. There are seven columns, labelled: Database, Spreadsheet, Graph, Write, Communicate, Other Programs and Other Files. The presentation graphics module is a separate program and, therefore, appears in the Other Programs column.

Unless you indicate otherwise, or do not have a graphics monitor, the screen starts up in graphics mode. This allows you to have graphics and text displayed at the same time. The first word in each column is «NEW», under which is a list of all the files that exist in the specified categories. For example, any word-processing documents are listed in the Write column.

The names of files do not contain the files' extensions, as the extension is used by Ability to decide which application created it. Consequently, you can't specify an extension on a file when you save it. Any files con-

taining extensions that are not recognised as having been created by Ability, appear in the Other Files column (these files can still be accessed from within Ability). As the file extension is used to group files, there's no need to have separate directories for different types of files.

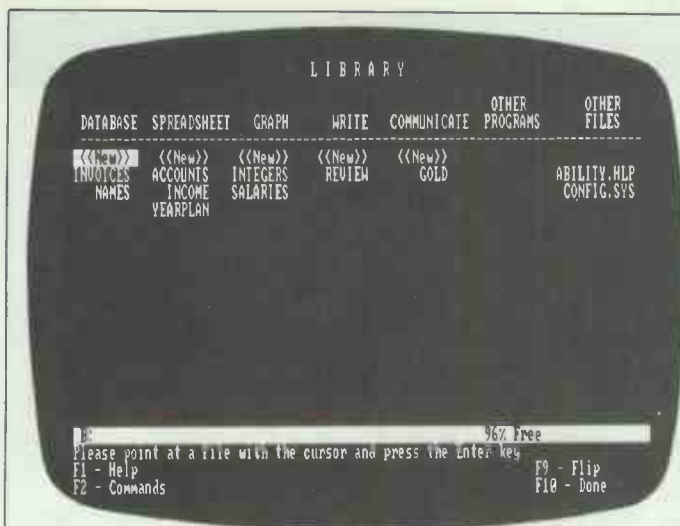
At the bottom of the screen is the status line, which displays the name of the currently selected drive and also the amount of free memory. All applications are RAM-based, so if memory goes down to 0%, you can't make the current file any larger.

If the Caps Lock or Num Lock functions of the keyboard are active, the words CAPS or NUM appear on the status line. Below the status line is a list of the function keys that are currently available. Pressing F2 brings up a list of commands, any of which can be activated by typing its first letter, or highlighting it with the cursor and pressing Return. Highlighting a command and pressing F1 produces a help screen referring to that particular command.

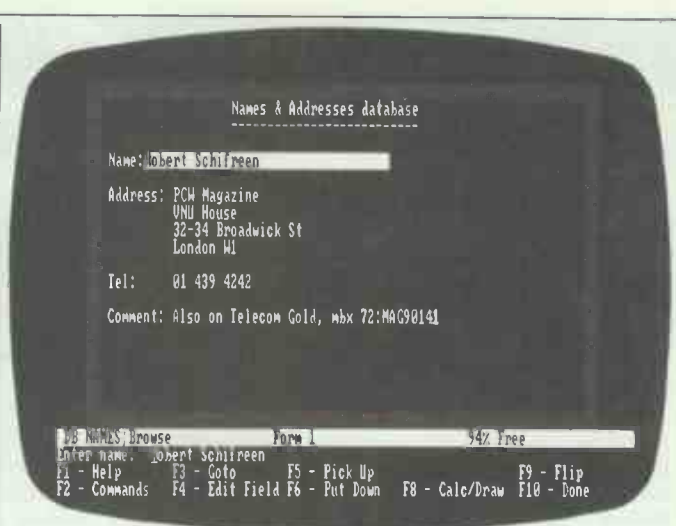
Every command in every part of Ability has a screen of related help information. Most commands are executed by pressing F2 which displays a list of commands, and a command can then be selected by typing the first letter of its name. These menus are sometimes two or three levels deep, but you don't have to learn any commands — everything that Ability can do is listed onscreen in one menu or another.

To use an existing file, you just move the cursor so that the file's name is highlighted and press Return. According to which column the file's name is in, the correct application will be started and the specified file loaded.

Whenever you load or save a file, a



Creating a new file or using an existing one is simply a matter of selecting an option from the library screen. The column heading tells Ability which application program you want to load



Ability's database system is a glorified, though highly configurable, card index box. Blocks of records can easily be copied to the word processor for amendment, then copied back to the database

copy is kept in memory. If you select the same file again, it can be loaded more quickly from memory than if it were stored on disk. Files which exist in memory are marked on the library screen with an asterisk after their name. When the indicator on the status line shows that you are running out of memory, you have to return to the library screen and ask for any unwanted files to be removed from memory (the copies on disk are not affected). Normally, putting away a resident file takes just a couple of seconds. However, if you only have 1% of memory left, it seems to take forever — I gave up after 10 minutes and rebooted the machine.

If memory permits, you can load two applications simultaneously. Flipping between them, as it's called, is accomplished by pressing F9. If only one application is loaded, pressing F9 takes you to the library screen from where you can load another. The two active applications can be of the same type (spreadsheet, word processor, database, and so on) or they can be different. Such a facility makes for an easy method of moving data between files, as you can pick up a block of data from a file, flip to another application and put it down. Keys F5 and F6 are helpfully labelled Pick Up and Put Down. If you flip to a second application and, from that second application, try to exit to DOS, the first application that has been suspended automatically will be saved before Ability is exited.

The display in Ability is all one colour — normally green. When you flip to a new application, the screen changes to cyan to remind you that you have changed applications. These colours can be changed through an option on the library screen, and your chosen colours will then be permanently recorded in the configuration file.

Word processor

Ability's word processor is called Write. It has all the functions of a basic word processor, but lacks some of the features found in more expensive packages. What Ability does, though, it does well. It's also incredibly easy to use.

You start the word processor in one of two ways. If you select a file from the Write column on the library screen, the word-processing program appears and the selected file is loaded. Alternatively, you can select «NEW» from the library screen if you want to create a new file. You will then be prompted for an eight-character filename before you can enter text.

When the word-processing module has been powered up, the familiar status line appears at the bottom of the screen. This tells you the name of the file being edited, and has indicators to show the current page, line and column number. There's also a note of the amount of free memory, which starts at around 96% and varies according to the number of files held on the library screen. With a page length of 60 lines, I managed to enter a 78-page document before getting down to 1% of remaining memory on a 640k PC.

The format of the page onscreen is rather strange. Each page is surrounded by a border made up from block graphics characters. At the end of a page is a horizontal row of block characters, then a couple of blank lines appear before a new frame starts.

Below the status line is a list of the available function keys. As always F1 is used for help, and F2 produces a list of commands — for example, Centre, Typestyle, Print, Spreadsheet and Graph. The Spreadsheet and Graph options are used to insert

another file into the document. When you have selected the option, you are prompted for a filename. The specified spreadsheet or graph is then loaded and, if you're in graphics mode, is displayed onscreen.

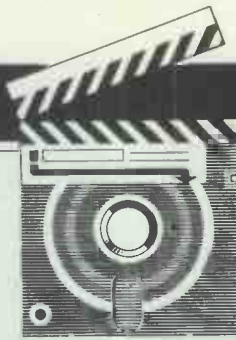
The other options are fairly self-explanatory. You can select a menu option by positioning the cursor over it and pressing Return, or by typing its first letter. Selecting the Typestyle option produces another menu from where you choose bold, italic or underlined text. Because everything is done in graphics mode, the image you see onscreen is made to look as much as possible like the final, printed output.

As with all functions, the Typestyle commands operate on a block of text if one is currently marked. If not, the command operates on any text you type after selecting it.

A number of key combinations are used to move around the file. The cursor keys by themselves move the cursor in steps of one character; pressed with the Ctrl key, they move in steps of a word. The Home and End keys move to the start and end of the current line, while PgUp and PgDn move up and Dn by a Pg at a time. Ctrl-home and Ctrl-end move straight to the top and bottom of the document, respectively.

As everything is based in RAM, movement is very fast. Block operations are performed using the F7 key, to highlight a block. This key, known as the Shade key, is used to highlight a portion of the screen and is used in every part of Ability, not just the word processor.

To delete a block of text, you shade it with F7 and then press Delete. To move a block you shade it and pick it up with F5, then move the cursor to where you want the text to be, and put it down with F6. You can also put text down in any other Abil-



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ity application as long as it's in the correct format.

Being able to flip between applications made it easy to write this review. I kept the text that I was writing in the word processor, but could look at any other part of Ability by flipping to it.

Inserting a graph in a word-processing document is easy. A graph option on the menu lets you insert a graph at the current cursor position; the graph is then displayed onscreen as part of the document. When you save the document, though, the graph is *not* saved. Instead, the document contains a special pointer which indicates the name of the graph to be included. With this method, if you update the graph, the changes will be reflected in the document. It also saves disk space, as you can have the same graph in 30 different documents, although only one copy of the graph will be kept on disk.

The F3 key is called Goto, and it leads to two commands. The first is called Search, and lets you go to a specified word in the document. As in MS-DOS and CP/M, the wildcard characters * and ? can be used to represent one or more unknown characters when searching for a string. The other option on the Goto menu lets you go to any page which you specify by its number. This is useful if you are editing a long document. The word processor's pages are normally set to a length of 54 lines, with margins of 10 and 75. These can be changed through a menu option. Headers, footers and page numbers are all supported.

Although the onscreen text is in graphics mode, Ability was intelligent enough to drive my Epson printer in text mode. If you have a graph included in the document, the printer switches into graphics mode to produce the graph, then back to text mode for the plain text.

There is an option on the Print menu that will print a file to disk. The only problem I had with printing was with the pound sign (£) — or rather the lack of it. Ability is an American product, and while it would happily print dollar signs, it would not print pound signs. Migent has now fixed this, and has released a European version of the software. As well as providing a pound sign, it also allows you to use all 255 ASCII characters, including the box-drawing ones. Make sure that your copy is version 1.2E and not 1.2. If it's 1.2, call Migent and ask for an upgrade.

Write will cope with existing Word-Star files, and will even convert them to Ability format so that the fonts display correctly onscreen.

When you have input a document, you press F10; this is the 'Done' key, which tells Ability to save the current task and return to the library screen. It's worth noting that Ability doesn't make back-up files of edited documents. If you want a back-up, you can use the Copy option from the library screen to create one before you edit a file.

Generally, I found the word processor easy to use, though the screen updating often falls behind if you are typing fast. The lack of a spelling checker is a problem, but one has been promised for version 2.

Spreadsheet

As long as you have enough spare memory, Ability can handle a spreadsheet of 9999 rows by 702 columns. Like all Ability applications, you start the spreadsheet from the library screen: the spreadsheet grid appears and the cursor is at cell A1. The status line gives you the name of the current file and the amount of memory remaining.

Below the status line is the prompt area, where you enter or edit the contents of a cell. Below this is the list of function keys, some of which perform functions of their own, while others lead to further menus.

Again pressing F1 brings up a help screen related to the selected menu option.

Moving around the spreadsheet involves the same key combinations as the word processor. Pressing F2 leads to a menu of commands. Commands which apply to cells normally operate on the current cell — that is, the one which the cursor is on. However, if you use F7 to shade a block of cells (as in the word processor), any command will operate on the block. You can pick up a block of cells and put them down in another application.

The Data-fill command fills a marked block of empty cells with a sequence of values. When the block has been marked, you specify the starting value and the increment, and Ability does the rest. There is a Sort command, which will sort any row or column into ascending or descending order. Sort works with numeric fields or alphabetic labels. The Transpose command rotates a marked block of cells by 90 degrees.

Formulas must start with a plus sign or any other symbol which makes them uniquely identifiable as a formula. If you enter the contents of a cell as A1+A2, the text 'A1+A2' will be put in a cell. To put the sum of A1 and A2 in a cell, you have to specify the formula as +A1+A2.

If a cell contains a formula which can't be evaluated, the symbol «N/A» appears where the result should be. If, in the above example, I had not put a value in cell A1, the result of A1+A2 would display as «N/A».

As well as standard maths symbols, there are 46 functions that can be used in formulas and — believe it or not — other Ability applications. There are functions to calculate interest rates, averages, trig functions, and so on. Write includes a command to create an area on a line known as a field, into which you can enter a function just like a cell on a spreadsheet. Fields are allocated a unique number when you define them, and you can use these numbers to refer to other fields. There's also a full recalculation facility which will update any affected fields if a value changes — nothing new when it comes to spreadsheets, but a wonderful facility for a word processor to provide.

Printing the spreadsheet is simply a matter of selecting a menu option. There's a built-in sideways option which will print a spreadsheet sideways if the selected printer has a graphics mode.

My only major gripe about the spreadsheet is, again, the lack of a pound sign. Because Ability is American, everything works in dollars. Typing a pound sign in a value produces a strange graphics character and an error message. Apparently, this omission will be remedied in Ability 2.

Database

The Ability database works like a card index. To create a database you first create a master form; then, to add records to the database, you fill in the form on the screen. To start a new database, you select «NEW» from the Database column on the library screen and you are then presented with a blank screen on which to create the master form. The form is created in exactly the same way as creating a document with the word processor, so it's easy to get everything looking right. The only extra command is one to define where the fields go (these are the areas that will be filled in when you start to put information into the database). To enter a field, you select an option from the menu and use the cursor keys to mark out the length of the

required field.

When the form is complete you press F10 to save it, which puts you into Add Forms mode. Your master form appears onscreen, with the first field highlighted. Entering information is done by typing into the space marked out by the field; the cursor keys move the cursor around so that each field can be filled in. When the form is complete, pressing F10 stores the data on disk and presents you with another blank form to start adding the second record. This process will continue until you press F10 again, which puts the system into Browse mode.

In Browse mode, you can look through your newly-created database. The standard cursor key combinations are used to move around the database in increments of a character, a field or a complete form. The sequence number of the record you are looking at is displayed on the status line.

As in all Ability modules, commands are executed by menu selection. F3 is the Search command: if you know the number of the record you want to examine, you can go straight there by typing its number; if you don't, the search process involves filling in one or more fields on a form. The system then searches for records that match the partial form you have filled in. You can use the * and ? pattern-matching characters in searches, as well as the =, < and > characters to specify ranges of values to look for. Also, AND, OR and NOT can be specified in searches by the use of special characters.

When the information has been put into a database and saved, you can retrieve it with the Report command. There are three types of reports. If you select a Forms report, the information will be printed in the same format as it appears onscreen. The Summary option enables you to

have columns of output, with each column being one field from the database. To produce a summary report, you fill in a blank copy of the master form, but, instead of putting data in the fields, you put a number there. The summary report will then be printed, with the columns appearing in the order specified by the numbers you put in the fields.

The database system contains a number of commands for manipulating the data in forms; one of the most useful being the ability to sort the forms in a database, with the sort taking place against any specified field.

Deleting a form involves pressing the Delete key when you are looking at the form you want to delete. Ability keeps a copy of all deleted records, so it's possible to retrieve them if you change your mind. When memory is running low, you can permanently delete those 'deleted' records which are still being stored.

Ability will quite happily let you edit the master form of a database, and will even let you add or delete fields. The old database will then be copied into the new one. If the new database contains fields that were not in the old one, the new fields will be left blank. If you delete a field, the information will not be copied into the new database.

The Pick Up and Put Down options allow you to pick up records from a spreadsheet and, as long as the fields are wide enough, put them down in a database form.

Graph

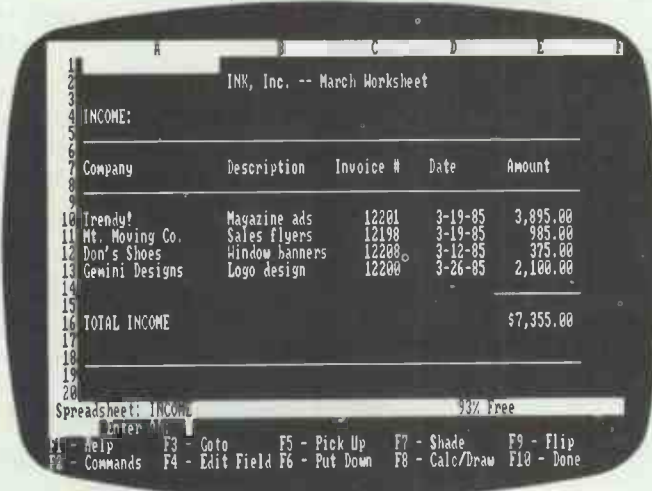
The graph utility allows you to draw graphs onscreen and print them to a printer or HP plotter. The values for the graphs can come from the keyboard or an Ability spreadsheet. When the graph has been drawn, it can be included in a word-processing document.

The graph module is started from the library screen like all other applications; the status line and function key list then appear. When the graph program has been loaded, you can type in a list of numbers separated by commas. A bar chart is then drawn, with scales automatically generated. If you don't like the program's choice of scale, you can change it.

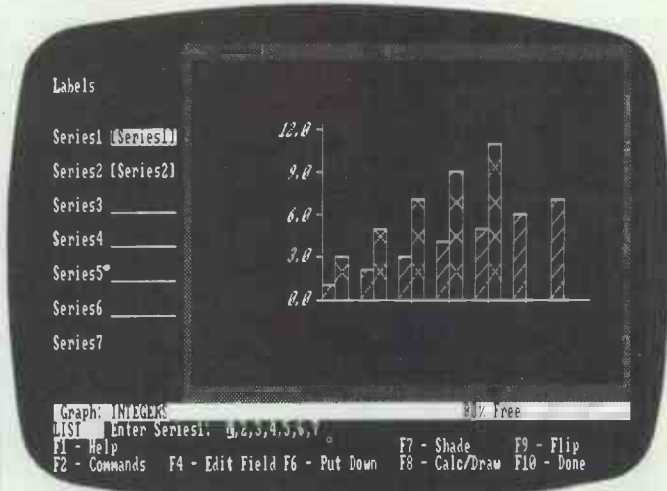
Ability can draw a graph with up to seven series of numbers. Each series is a separate set of numbers, whose graph can be superimposed on another set. For example, if you were graphing half-yearly sales and profit figures, you would have one series for each month's sales and another for the profits. When the graph is drawn, all the numbers from the first series are plotted, followed by those from the second series. For example, all January's data will be drawn first, then February's, and so on.

There are four graph styles available. A bar chart is the default, which plots numbers in different series next to each other. The stacked bar chart shows numbers in different series on top of each other, so, in the above example, there would be six columns with each month's sales and profits on top of each other. The bars are shaded to show where one value ends and another begins.

You can also opt for a line graph or a pie chart. Pie charts can show only one series. Selected segments from a pie chart can be 'exploded', pulling them away from the remaining segments. It's easy to graph values from a spreadsheet. You tell Ability which cells in a spreadsheet are to be graphed, and the values are extracted and the graph is drawn. This is done by specifying what are known as linked fields. Printing a graph is done from a menu, like any other Ability file — and you can print the graph sideways if you wish.



If memory permits, Ability will handle a spreadsheet of 9999 rows by 702 columns. Sideways printing is built in. Functions and formulas can be included in word-processing documents



The graphics module will graph up to seven sets of values. Sets can be superimposed onscreen and need not all be drawn in the same mode. Updating a graph automatically updates exported copies



SCREENTEST

Communications

The communications facility is a terminal emulation program for connecting to services like Telecom Gold. Viewdata graphics as used by Prestel are not supported. For each service that you will be calling with Ability, you have to specify a screen of information. This is entered on a form just like entering information into a database. You can specify the emulation required (dumb terminal, VT-100 or VT-52), and baud rates and other parameters. Ability will work perfectly with a Hayes-compatible modem or any other dumb modem. If you have a Hayes type, you can specify the phone number of the service and have it dialled automatically for you.

There is a facility to upload ASCII files to a remote computer, and another that allows incoming data to be captured to a file. The captured data is automatically put in a file with the extension .CAP. Unfortunately, this means that it doesn't end up in the Write column on the library screen, as it isn't classed as a Write document (such documents have an .XTX extension). To load the captured data into Write, you have to rename it so that it appears in the correct column. Alternatively, you can include it into a document with an Include command and then save the file from within Write, which will assign the correct extension.

In addition to the terminal emulation, there's also a mode that allows files to be sent automatically between two computers that are both running Ability. You can specify a password that will be sent to the other micro before file transfer, and you can also specify the password you expect to receive from the other micro before proceeding with the transfer.

For remote services which have a lengthy log-in procedure, you can

put the required commands into a file called a log-in file which contains commands that instruct Ability to send your log-in commands to the service at the correct time. In the case of Telecom Gold, for example, you could set up a log-in file that instructs Ability to wait for a PAD prompt, before typing CALL 81. Then, when a 'Please Sign On' prompt appears, the file would send your ID.

Despite operating the screen in graphics mode, Ability had no problems keeping up with incoming data at 1200 baud and displaying it. Each character was displayed as it arrived, compared with, say, Gem Comm, which waits for an entire line and then displays it all at once.

Presentation

Ability features a presentation graphics module. This does not appear in its own column on the library screen, but exists as an option on the Other Programs column. The program can be run from the library screen, as can any other MS-DOS program; or it can be run from the MS-DOS prompt, independent of Ability.

Within every Ability application, you can take a snapshot of the screen display by pressing the large, grey '+' key. The presentation program lets you play back these snapshots to form an automatic display. When you take the first snapshot, you are asked for the name of the snapshot library file; when this has been given, all subsequent snapshots

for the session go to the named file. Taking a snapshot is done by pressing the single '+' key, and the snap is added to the current library. The presentation program allows you to re-order the snapshots in the library at a later date.

When you have saved some snapshots in a library, you load up the presentation program and tell it which library you are using. Within the presentation program are options to add, re-order and delete snapshots from the library, as well as play back the current selection onscreen. A contents list of the current library is shown, and you can specify the time that each slide will appear onscreen before being replaced by the next in the sequence. You can also put captions on slides, or create blank slides that just contain captions.

Most novel among the snapshot features is the music. The program has a built-in repertoire containing snippets from a selection of popular tunes, as well as the odd fanfare. Each snapshot can be allocated a tune, which will be played through the PC's internal speaker when the snap is displayed. Although it isn't the most useful of Ability's applications, the presentation graphics could be put to good use in sales demos.

Documentation

The Ability package includes a 200-page manual bound like a paperback book. Trying to learn about software by reading manuals is never a good idea; but Ability is so easy to install and use that you can easily get by without opening the manual.

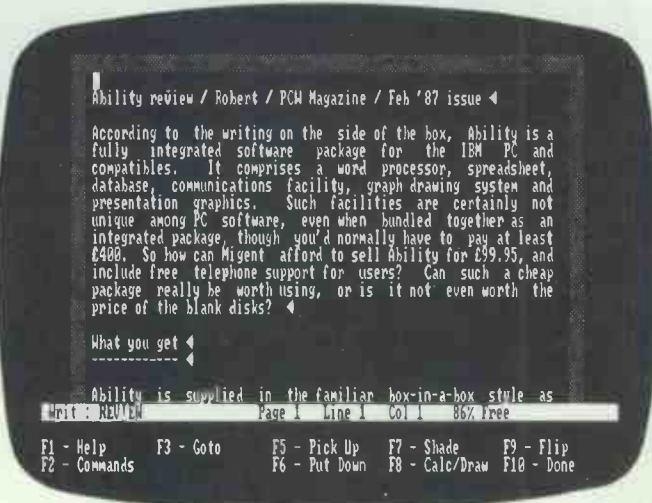
Conclusion

Would I recommend Ability? The answer is a definite yes. Although I would have to admit that it lacks some of the more advanced features found in expensive software packages, it does cope well within its limitations. For the money it's an excellent introduction to integrated software, and should be able to deal satisfactorily with the requirements of a small business.

My main criticism is the lack of a spelling checker for the word processor, but Ability 2 (which should be available by the time you read this) will include one. The manual is also being completely rewritten. If you can't wait for version 2, there will be a free (or almost) upgrade policy for users of version 1.

If you have any problems with Ability, Migent, the supplier, is also handling the support side.

Ability version 1.2E costs £99.95. Migent is at 37 Dover Street, London W1. Tel: (01) 409 1343. **END**



Ability's word processor is RAM-based with a maximum document size of around 80 pages. Underlined, italic and bold text are shown on the screen as they will appear on the hard copy. Unfortunately there is no spelling checker, although one will be included on version 2

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Musical interlude

Although musicians may be shocked to discover that musical composition by dice-throwing has its roots back in the 18th century, computer enthusiasts will understand that the very 'random' nature of the computer lends itself easily to this style of musical composition. David Levy does some fine tuning.

The composition of music by computers has its origins in the late 18th century, when various authors showed how it was possible to compose melodies using dice. The technique was based on the use of printed tables; for example, the *Ever-ready composer of Polonaises and Minuets* published by Bach's pupil Johann Philipp Kirnberger required dice to assist in making certain random choices. Similar publications made it possible for anyone to 'compose' an almost unlimited number of musical works, and some of these were of sufficient quality to pass for the genuine article — the Haydn composition *Gioco filarmonico* (Philharmonic joke) was only recently found to be a fake.

In 1792, one year after the death of Mozart, a book was published and attributed to the great composer explaining how the reader could use a pair of dice to compose as many German waltzes as desired — without the slightest knowledge of music. Mozart's *Musikalisches Würfelspiel* has been reprinted in many languages and it provides a system which could easily be emulated by any personal computer enthusiast. (Interested readers should obtain a copy of the *Melody Dicer*, Carousel Publishing, Brighton, Massachusetts).

Whether or not this particular method was invented by Mozart is doubtful, but it does allow the creation of musical works that have a distinctly Mozart flavour. The system consists of a set of 176 measures, each of which is eight bars long. Tables are provided which have eight columns, each column containing the eleven numbers 2-12. A pair of dice are thrown eight times, and the total obtained from each throw of the dice is used as an index into the corresponding column in the table. Thus, if the first throw of the dice shows '4' and '3', the reader refers to entry '7' in column '1' of the table; if the second throw shows '2' and '6', the reader next refers to entry '8' in col-

umn '2'; and so on. Each table entry contains one bar of music, and having thrown the dice eight times, the reader has the first eight bars of his 'composition'. Remember that the totals 2, 3, 4...12 do not occur with the same probability, so some bars are more likely than others to be chosen. Exactly the same procedure is adopted for the next eight bars, but using a different table.

The tables are constructed in such a way that the 'waltz' opens with the keynote (or tonic), changes to the dominant key and then changes back to the keynote at the end. The eighth and final column of each table contains the same bar in each of the 11 table entries, and so the eleven choices are available for only 14 of the 16 bars, which restricts the number of different waltzes that can be created to 11^{14} . Dr Tom O'Bierne, of the Computer Science Department at Glasgow University, programmed a SOLIDAC computer more than 25 years ago to create and perform Mozart waltzes based on these tables, and he even published a commercial recording of some of the music.

Origins

The Mozart dice was the forerunner of present day computerised composition. The principle of selecting musical bars on a pseudo-random basis may readily be extended to the selection of the other musical variables — the notes themselves, the rhythms, the melodies. In 1956 Lejaren Hiller, who was a research chemist at the University of Illinois, conceived the idea of adapting some of his chemistry research to the creation of counterpoint in music! He had been working on the statistical computation of polymer molecules in solution, in which he had used Monte Carlo (or Markov) methods controlled by the geometric conditions that are applicable in this type of chemical research. (These methods are based on generating

random numbers in such a way that each number, or each part of the range, occurs with a specific predetermined probability. Throwing a pair of dice is a good example: the totals are randomly created but they occur with the probabilities 2/36 (for 2), 2/36 (for 3), 3/36 (for 4), 4/36 (for 5) and so on.

Hiller's idea was to change the controlling conditions from geometric to contrapunctal, and then to use the same computer program to write counterpoint exercises. He discussed the idea with Leonard Isaacson, another chemist working on the same research project, who was interested in the idea. So the two of them started some experiments which led to a string quartet called the *Illiac Suite* — the first musical work created by a computer to receive recognition using a Markov process. The use of Markov methods was examined further by Brooks and his colleagues in 1957, when they analysed church hymns. This analysis resulted in probabilities which were used to generate many new hymns, with varying degrees of success. The method by itself appeared to be insufficient to create good hymns, but with human judgement to make the final selection, it is adequate.

Composition

It is possible to extend the use of Markov processes in music composition to make use of certain rules of composition and other heuristics. Gary Rader, from the Moore School of Engineering at the University of Pennsylvania, investigated the use of such rules during the mid-1970s to compose musical 'rounds'. Rader's program used some music theory together with various heuristics. He devised a number of production rules together with other rules which determined when they *could be* applied, and he also used a set of weight rules to determine how often these rules *should be* applied.

Rader's composition method was



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divided into two parts. Starting with an empty set of staves his program first generated a harmonic framework, and then it superimposed its own composed melody on this framework. The methods for creating the harmonic framework and the melody were similar, and were both based on sets of rules which stated how notes or chords could be put together. The method is iterative in the sense that a set of production rules specify the choice for the next chord or note. The program also contains a set of applicability rules which govern when a particular production rule may or may not be used, and there is a set of weight rules which indicate the probability that a particular applicable production rule is used. These weights are variable and may be changed before any composition.

The harmonic framework of the composition is the sequence of chords that will occur on each beat. This harmony does not indicate the exact position of the chords, which is something determined later by the melody generator.

The harmony generator consists of the following rules (in what follows, chords are denoted by I, II, III, IV, V and VI, and are the tonic, supertonic, mediant, subdominant, dominant and submediant, respectively. Appoggiaturas are denoted by I, II, III, IV, V and VI, and are dissonant notes which move one step while the non-dissonant notes remain stationary. Do not worry about the terminology. You will soon understand the idea, even if the details confuse you.)

PRODUCTION RULES

- H1** I may follow any sequence of chords (even the null sequence)
- H2** A chord may be followed by the chord a 'third' below (a third is an interval of two steps, a second is an interval of one step, and a fourth is an interval of three steps)
- H3** A chord may be followed by the chord a 'second' above
- H4** A chord may be followed by the chord a 'fourth' above
- H5** A chord may be followed by itself
- H6** I and IV may be followed by V and I respectively
- H7** V and I may be followed by V and I respectively
- H8** I may precede any chord except V and I

APPLICABILITY RULES

- H9** No rule is applicable after the chord pattern reaches an initially specified length
- H10** The first chord must be I
- H11** The last two chords must be I
- H12** I and V cannot occur on the

second and fourth beats
H13 IV, I and VI may not follow VI, III and III respectively

WEIGHT RULES

There is only one weight rule for each production rule, which assigns a fixed weight to that production rule.

Rader's program generates the notes of the melody within the constraints of a chord pattern and according to various accepted rules of music and a collection of heuristic rules of melody. The program accepts all notes from the 'g' below middle c to the 'g' two octaves above it, and it accepts the 'rest' (a null note). Each computer-generated note has a fixed duration of an eighth or a musical note, and the program may indicate notes of longer duration.

To generate a round the melody generator is first supplied with a chord pattern, the maximum permissible number of octave jumps and the maximum permissible spread between the highest and lowest notes in the round. The program also has the following rules:

PRODUCTION RULES

- M1-M2** An eighth note on middle c, or an octave above it, may be added to any sequence of notes (even to a null note)
- M3** The last note of the round may be increased in duration by a quarter note
- M4-M13** The last note may be increased in duration by an eighth note and followed by an eighth note which is 1, 2, 3, 4, or 5 steps above or below the last 'stepwise' note' (see rule M37)
- M14-M19** The last note may be increased in duration by an eighth stepwise note 1, 2 or 7 steps above or below the stepwise note
- M20-M21** The last note may be followed by two eighth stepwise notes moving stepwise up or down from the last stepwise note
- M22-M23** The last note may be followed by two eighth notes moving up (or down) one step and then back down (or up) one step from the last stepwise note
- M24-M25** The last note may be increased in duration by an eighth note and followed by an eighth rest or an eighth note in the same position
- M26** The last note may be increased in duration by an eighth note

Rader also used a number of application rules, such as:

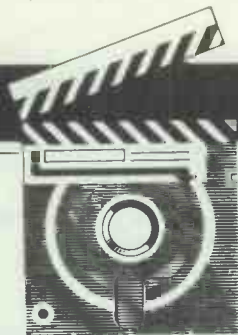
- M28** Rule M1 or M2 must be applied initially and never again
- M29** M26 must be the last production rule applied and never before
- M37** (The most important of these application rules.) The 'Melodic rule' — beginning with the first note, the melody must progress stepwise or, if it jumps, it must either return and continue the stepwise movement from the point at which it jumped, or it must move back towards this point until it does continue the stepwise motion. An octave jump displaces the stepwise motion by a similar amount. An octave jump may occur only when the last note was a stepwise note (that is, part of a stepwise motion). If continuing by two stepwise eighth notes (rules M20 or M21) would result in an unpermitted 'parallel' motion (that is, 'fifths', 'octaves', or 'twelfths' from the first half of a beat to the second half of the same beat, or from the second half of a beat to the first half of the next beat), then the melody may progress by the interval of a stepwise 'third'

Rader's weight rules governed the probability that the length of a note would be changed, and if so, by how much. He employed the three types of rule in an APL program running on an IBM 370/165, and created some 50 short rounds whose quality was mediocre from the point of view of the professional musician, while being 'generally quite acceptable' for the layman.

Conclusion

The concept of a rule-based system for music composition is one which can be applied by any personal computer owner who wishes to compose his or her 'own' works. The programmer may make these rules as simple or as complex as desired, and could even model them on the works of a particular composer.

A computerised analysis of similar questions could easily be programmed, and then fed with the notes and their durations from the work of a particular composer. This technique makes it possible for the reader to create music 'in the style of' any desired composer. **END**



SCREENTEST

PCNX

PCNX conveys the great advantage of Unix — multi-tasking — to the IBM PC and AT. But, considering its lack of programming tools, where can PCNX best be utilised? Alan Solomon tries to discover its ideal niche.

Unix is an operating system, just as DOS is. But Unix has a very different feel to it — for example, Unix is designed to be multi-tasking and multi-user, so one person can make the computer do several things at once. It also means that several people can use the same computer at the same time, without causing each other problems when, for example, they both access the same file.

Multi-tasking is already possible to a limited extent in DOS. The DOS Print command lets a user get on with his work while the slow printer chugs away in the background. Unix generalises this facility, and lets you run *any* task in the background. If you are developing software, you might want a big module to compile; but while it is compiling, you can get on with writing the documentation.

Multi-user operation is not normally possible in DOS. With a multi-user system, several people can be logged on at once, and may even be accessing the same database. The most popular use of this is for accounting systems, where there might be several people putting information into the accounts (bought ledger, sales ledger) and others taking information out (for example, in response to customer enquiries about stock levels). The only way around this in DOS is to have several micros linked together in a network, using software that supports multi-user access.

But with Unix, it's possible to have several people using the same IBM PC or AT at once. Unfortunately, most implementations of Unix are very expensive, and there isn't as much business software for it as there is for DOS. But Unix is very popular in educational establishments, and it is considered by many

programmers to be the ideal program development environment.

Installation

Knowing Unix's need for a large hard disk and lots of CPU power, I installed it on a Walters AT, running an 8MHz 80286 chip. I really needed that extra speed, as even on this fast machine, PCNX ran very slowly.

The installation was unnecessarily lengthy. I had to create a large number of sub-directories and sub-sub-directories, and copy the appropriate files into each one — it's hard to see why Wendin, the author, doesn't provide a simple batch file to do this job. The software comes on four disks, which is a lot of software, but Unix normally comes on a dozen disks.

Wendin has saved a lot of effort by running PCNX under DOS, as it means that the company doesn't have to write all the file-handling that would otherwise be needed. Also, there is no compiler or text-formatting software with the package, but these are not necessities and you can probably use your existing compilers.

In use

PCNX runs under DOS. You start up DOS in the usual way, then type PCUNIX, which starts up PCNX. PCNX asks for your log-in name and password; displays 'Welcome to Wendin multiuser PCUNIX 1.03'; and gives the date and time and then the prompt, which is # for the super-user and \$ for everyone else. The super-user is the user with power over the system: he or she can create and delete user-names, and has the responsibility for looking after the system. Ordinary users have much less power, to prevent them

from accidentally damaging each other's files.

With DOS, you can simply switch off when you've finished. This is not recommended when there are other users on the system, as is liable to be the case in Unix. To get out of PCNX, you type Ctrl-Z at the '\$' prompt and you are logged off. To shut down the system completely, you log-in under the user name 'shutdown'.

PCNX isn't just a simulation of Unix. It would be relatively easy to write a DOS shell that accepts Unix commands and translates them into the equivalent DOS commands, and you could write DOS utilities to do the things that the Unix utilities do. But if you did this, you would not be able to have multiple tasks and multiple users. PCNX does allow other users to be connected at the same time; there can be one person on the main console (the normal PC keyboard and screen), and one or two other users connected via the serial ports. As some software writes directly to the screen, the two users connected on the serial port will not have access to that so there's a limitation on what they can do.

Unix is multi-tasking: you can make something that is time-consuming operate as a background task while you get on with something else in the foreground. If your compiler is invoked by the command 'cc myprog', then you can avoid a long wait by typing 'cc myprog &'. The compilation will then work away while you get on with something else. You can see how the compilation is progressing by typing 'ps' (process status) at the \$ prompt.

You can have .BAT files in DOS, and there is even a primitive kind of loop command — the FOR state-

ment. PCNX allows much more elaborate .BAT commands called shell scripts. The shell is the name given to the thing that reads keyboard input and processes it; it is equivalent to COMMAND.COM in DOS. A shell script can contain any legal Unix command (just like a DOS .BAT file), and also allows variables like the DOS %1, %2, and so on. Variables can be defined at the \$ prompt, and there are some very powerful looping commands: you can use 'while', 'until', 'case' and, of course, 'for'. You can prompt the user for input and take different actions depending on what he types. There is also an 'if'.. 'then'.. 'else' construction, and all of this makes it possible to construct shell scripts that are much more powerful than DOS .BAT files.

Capabilities

PCNX works — in a sense. You can log on as 'root', and create other users. Other users can log on, either on the main console or over the serial ports, and during this review I tried having two users logged on at once. It all worked: the user called 'root' could kill the other user, and both users could send each other mail, and could run processes.

Up to three users can log on at once, one of which is on the console and two are connected via the serial ports. But the manual warns that PC or XT systems might not be able to cope with having the two extra users logged on at 9600 baud, and PCNX is liable to crash — although AT systems should cope.

There is also very little protection of memory areas between users be-

Some shell script commands

shift: like the MS-DOS SHIFT
 if: conditional execution of commands
 case: choose one of the cases below
 while: loop while a condition is true
 until: repeat until a condition is false
 for: like the MS-DOS FOR
 break: premature exit from loop
 continue: do the next loop iteration

cause this is impossible to implement on an 8086 machine, so production and development should be done on two different systems. You can't run Basic or BasicA programs because both of these take over all the interrupts for their own use, which would lock out the two remote users.

But in two other senses, PC-Unix *doesn't* work. Most of the DOS programs I tried crashed the system. It seems that any program which uses the 'traditional' file-handling DOS function calls doesn't work, and makes the system hang. Unfortunately, this problem applies to most programs as there is no good reason for a programmer to avoid using these functions, and sometimes there are good reasons for preferring them. If you want to use PCNX for serious work, you'll have to write your own programs. At the time of this review, the UK distributor, Contractors On Line (COL), was planning a version, two for January release which will run 75 per cent of DOS

programs, support EMS (Aboveboard-type) memory up to 8Mbytes, support the 80386, and cost only £20 to upgrade.

The second sense in which PCNX doesn't work is that it's slow. If you run a program or a DOS utility, it sometimes seems to take forever before PCNX starts to do anything useful. And with more than one person doing something, it seems as if much of PCNX's time is spent in thrashing the disk back and forth.

Applications software

There is very little applications software that runs under PCNX — in fact, COL was unable to supply any. In particular, dBaselll won't work, nor will most word processors. COL says that you shouldn't really expect DOS programs to work, and if they do, this should be regarded as a bonus.

However, most compilers will work. COL also sells the Zorland C compiler for £29.95, which is Lattice-compatible and would be a useful additional purchase — C is the language that traditionally goes with Unix. This C is a good compiler (see the review in PCW, November 1986), but it isn't able to compile PCNX itself — to do that you will need the Microsoft C compiler. But you don't have to use C — I found that Turbo Pascal works.

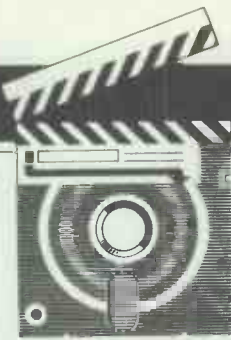
The main practical use of PCNX will be for people who want to write their own multi-user software, using C, Pascal or another language that PCNX supports. You should check with COL before buying PCNX that it supports the language that you intend to write in. I tried the MS-DOS

List of supported commands

at: execute command at a later time
 atrun: background job spooler
 cat: like DOS type, but more general
 cd: change directory
 cmp: compare two files
 cp: copy files
 date: set system date and time
 df: show disk free space
 dstat: show status of devices
 echo: like DOS
 exefix: adjust the space that a program demands
 false: returns 'false'
 file: guess file type
 find: find files
 finger: get information about other users
 grep: find a pattern in files
 group: discover which group you are in
 grppswd: change group password
 head: display first part of file
 kill: terminate process
 line: copy one line from input to output

logname: display log-in name
 lpd: controls the background printer
 lpr: like DOS PRINT
 ls: like DOS DIR
 mail: send and receive electronic mail
 mkdir: like DOS MD
 mkgroup: create new group
 mkuser: create new user
 more: display in screenfuls, like DOS MORE
 mv: rename files, or move between sub-directories
 newgrp: change active group name
 news: display system news
 nice: run command at low priority
 nohup: run command at low priority, with output redirection
 od: octal dump
 passwd: change password
 pr: format document with headers and footers
 ps: show process status

pwd: show current directory
 rev: reverse characters in each line of a file
 rm: delete file
 rmdir: delete sub-directory
 rmgroup: delete group
 rmuser: delete user from system
 sh: the shell
 sleep: sleep for n seconds
 strings: display ASCII strings in executable file
 su: substitute user-name
 tail: display end of file
 tee: create a tee in a pipe
 test: test an expression
 time: stopwatch
 touch: set the date and time on a file to now
 true: true
 tty: show terminal ID
 uniq: report repeated lines in a file
 wc: lines, words and characters count
 who: who is on the system?
 whodo: who is on, and what are they doing?
 write: put a message on someone's screen



SCREENTEST

version of Turbo Pascal 3.01a and it worked fine when installed for a teletype terminal, but I couldn't edit.

Documentation

The manual is very large and quite complete. It presents the various Unix commands and utilities in the first part; and the second part covers the system calls, for people who want to write software that will work under PCNX. These look very like VAX system calls — in fact, it looks as if PCNX is just PC-VMS (the other operating system that Wendin sells) with a different front end.

Both systems have been built from Wendin's Operating System Toolbox, so it's easy to see why they have so much in common. It looks as if Wendin wrote PC-VMS first, then extended out from there.

Conclusion

So what is PCNX useful for? Not as a serious working tool, as there are too many DOS programs that it won't run. Perhaps as a system development tool; you could develop Unix systems on PCNX, then do some final polishing up on the target machine. But again, the lack of programming tools is a serious problem. Probably PC-Unix is most valuable as a way to learn Unix or to teach Unix to other people.

PCNX costs £80 from Contractors On Line. Tel: (01) 351 5585.

```
login:alan
password:
Welcome to Wendin Multiuser PCUNIX 1.03 on 08-Nov-1986 02:14:08.61
```

```
$ ls {list the files}
makeunix.bat bat.prf bin usr etc
tmp src
$ cd d: {go over to drive d}
$ ls
ls: command not found {because it isn't on the default drive}
e:ls {list the files on drive d}
command.com turbo dev light 123
comms sk.com sk.hlp
$ cd /turbo {go to the Turbo subdirectory}
$ e:ls
turbo.com turbo.msg lister.pas
$ turbo {run Turbo}
```

```
-----
TURBO Pascal system Version 3.01A
MS-DOS
```

```
Copyright (C) 1983,84,85 BORLAND Inc.
-----
```

```
Terminal: TTY
```

```
Include error messages (Y/N)Y
```

```
Loading D:\TURBO\turbo.MSG Logged drive: D
```

```
Active directory: \TTY
```

```
Work file:
```

```
Main file:
```

```
Edit Compile Run Save
```

```
Dir Quit compiler Options
```

```
Text: 0 bytes
```

```
Free: 62224 bytes
```

```
>C {compile a program}
```

```
Work file name: lister
```

```
Loading D:\TTY\LISTER.PAS
```

```
Compiling
210 lines
```

```
>
```

```
{we then compiled the program to disk; all that is omitted}
```

```
>Q
```

```
$ lister {we then ran the program}
```

```
Enter filename: lister.pas
```

```
Printing . . .
```

```
$ e:ls
```

```
turbo.com turbo.msg lister.pas lister.com
```

```
$ e:cp lister.com l.com {showing how to copy}
```

```
$ e:ls
```

```
turbo.com turbo.msg lister.pas lister.com l.com
```

```
$ e:rm l.com {and how to delete}
```

```
$ e:ls
```

```
turbo.com turbo.msg lister.pas lister.com
```

```
$ cd e:
```

```
$ ps {process status}
```

```
PID TTY STAT TIME COMMAND
```

```
2 tta0: W 0:40 -/bin/sh {process number 2 on terminal tta0
the process is Waiting, the time is
0:40 and the current executing command
is sh, the shell, in subdirectory /bin/}
```

```
$ ls c:\ssware > l.1 & {kick off a long directory listing, and
redirect the output to a file, and make it
run in the background}
```

```
$ ls {list the files while that is going on}
```

```
makeunix.bat bat.prf bin usr etc
```

```
tmp src
```

```
$ ^Z {tell PCNX that we've finished}
```

```
login:shutdown {shut down PCNX}
```

```
password:
```

```
E> {the DOS prompt}
```


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SCREENTEST

PC-Write

When is a word processor not a word processor? When it lacks basic facilities and can only be described as user-hostile. Robert Schifreen reviews what he considers to be just such a package — PC-Write.

A strange thing happens when you show someone a new word-processing program: within five seconds, they've usually decided whether they love it or hate it. It's hard to explain what makes the ideal word processor — ask a hundred people and you'll get two hundred different answers. Perhaps the most popular opinion is that 'it has to feel right.' All that a software company can do, therefore, is to keep churning out new packages and hope that they 'feel right' to enough people.

For me, PC-Write doesn't 'feel right'. As soon as I loaded it, I felt that it lacked that certain 'something'. After around 40 hours of using it (the loneliness of the long-distance reviewer), I still feel the same way — although, to some extent, my reasons have changed. My original thoughts, particularly that PC-Write doesn't feel like a professionally-written program, remain.

There's no doubt that PC-Write is a complex piece of business software. It was designed to be a word processor, and it does its job fairly well. However, it isn't something that I would use regularly and, when I've finished writing this review, I'll get my copy of Word Perfect out of the cupboard and delete PC-Write from my hard disk.

History

PC-Write began life in the US as a user-supported program. Anyone could copy it, give copies to their friends, put it on bulletin boards or do whatever they liked with it. If you were given a copy and you didn't like it, you just reformatted the disk and no-one said any more about it. If you liked the program, however, and intended to keep it, you were asked to

send a donation of up to \$75 to the author. This bought you proper documentation and two free upgrades, or the Microsoft Pascal source code.

This method of software distribution works well in the US and some people have become very rich as a result. Around 80,000 PC-Write users have registered their copy, and Quicksoft — the company which wrote the program — now employs ten full-time staff to deal with PC-Write alone.

In the UK, though, things are different. There is a huge amount of user-supported software around, but almost all of it comes from the US via bulletin boards. For a number of reasons, American software authors don't make any money out of British users. One reason is that, when you've paid the donation, you are usually entitled to telephone support, which is too expensive from the UK anyway.

Another reason is that the idea of users donating money for products is not something the British public is used to. In the US, for example, there is Public TV, where the existence of the station depends solely on donations from satisfied customers. PC-Write's authors decided to license the program to a UK company, and Sagesoft took up the offer.

Sagesoft is now selling PC-Write version 2.7 in this country, although the product is still distributed by the user-supported method in the US. It's possible to find PC-Write version 2.4 on UK bulletin boards, and this is quite legal; with higher versions, though, it isn't. Although version 2.4 lacks the spelling checker that version 2.7 provides and has fewer facilities, it works in a similar way, and I

strongly recommend that you track down a copy of 2.4 to try, before shelling out for the latest version.

Version 2.7

Version 2.7 of PC-Write is a complete word processor for IBM PCs and compatibles with at least 256k of RAM. The package contains three disks, two of which comprise PC-Write, while the other is an interactive demo disk that gives you a short guided tour of Sagesoft's other products. It's the same disk that Dixon's is using to demonstrate the Amstrad PC in its stores.

Start-up

Installing PC-Write is quite simple, as everything is automated into a single batch file which is activated by typing WORKDISK. This creates either a working PC-Write disk on a single floppy disk, or a directory on a hard disk. It's difficult, though not impossible, to use the program on a machine with just a single floppy drive, but the dictionary will need a separate disk.

Installation is when you tell PC-Write which printer you will be using. The program then configures itself accordingly by creating a printer control file for you (more on this below). You can choose from 350 makes and models, including laser printers such as the HP LaserJet. There is even a Postscript driver.

PC-Write comprises two programs: ED is the editor; and PR is the printer program that prints a file created with ED. You can run PR from within ED if you wish.

To start the program you type ED followed, optionally, by the name of the file you want to edit. If the file already exists, you have a choice of

two keys to press before you can start to edit it: keying F9 will back up the file, while pressing ESC will not.

The initial screen is blank, except for a status line at the top. This contains such information as the current file, whether word-wrap and automatic reformatting are switched on, and the position of the cursor within the file.

A useful feature of the status line is the word Read, which indicates that the file being edited hasn't changed since it was last saved. As soon as it *does* change, the word becomes Edit. (Incidentally, 'Push' stands for Pushright, the name used for 'Insert' mode. The opposite is 'Over', which stands for Overtyping.)

As supplied, the menu at the top of the screen is in green (on a colour monitor) and your text appears as white on blue. These colours can be changed, as I'll explain later. It's also possible to hide the status line by changing its colour to black on black. Doing this gives you a totally clear screen, but doesn't increase the number of lines available for text.

Most functions are accessed through combinations of function keys and the Shift, Ctrl and Alt keys. The majority of function key combinations lead to further menus, which appear at the top of the screen and take up two or more lines. The bottom of the screen is never used by PC-Write and is free for text. Most word processors take up about six lines to show you what's going on; PC-Write doesn't, which is certainly a point in its favour.

Like any word processor, PC-Write allows you to move the cursor round the screen in steps of varying sizes. You can delete, copy and move blocks of text around the current file or into any other. There are also find and replace facilities.

Control files

A working installation of PC-Write

consists of six disk files — the editor program, the printer program, the help text, the dictionary and two control files. These control files are called ED.DEF and PR.DEF, and contain commands governing the way that the editor and printing programs work. The disks supplied by Sagesoft contain short but usable control files, though you can use PC-Write itself to alter these. The basic ED.DEF file contains the default ruler line and tab and margin settings, while a customised PR.DEF file is created when you install a printer.

ED.DEF configures the editor to your exact specifications, and while PC-Write is undoubtedly the most configurable word processor I've ever used, the way that commands are specified in ED.DEF is far from ideal. There are 16 different commands to specify the colour of the screen, for example. The screen is divided into 16 parts including the text, the cursor, the status line, the menus, the help screens, and so on. Using various commands in ED.DEF, each part of the screen can be in a different colour. Moreover, you can — indeed, you have to — specify different colour combinations when the program is used with colour and monochrome monitors.

A variety of control files serve a variety of documents. For example, you can set up the system so that all files with a DOC extension are subject to one edit control file, while those with a BAS extension are governed by another.

Putting the command %D in the ED.DEF file prevents the screen from flickering while the cursor moves. A %G command tells PC-Write not to load the online help file into memory, while %I loads the help text into the spare RAM on the colour graphics board, thus saving 12k. For security, %X sets the editor so that a back-up will always be created when you exit; while %Y prompts the edi-

tor to remind you to back up the file after every 2000 characters that you type. If 2000 is too large or small for your taste, you can change that, too.

The print control file, PR.DEF, controls the way that PC-Write handles your printer. \$P, for example, is used to specify one or more commands that are to be sent to the printer before each document is printed. Equally, \$Z tells the printer what to do after each print run. \$V lets you specify the commands to be placed at the end of each printed line; normally, this would just be a carriage return and a line feed, though you may wish to have more elaborate options.

Any printer character can be redefined so that it becomes another character or a whole series of characters. Whenever PC-Write sends a character to the printer, it checks first to see if that character has been redefined and, if it has, the new definition is sent instead.

There are dozens of commands that can be placed in the control files — some useful, some less so, though all of them are impossible to remember without the aid of the manual. Changing the default pathname for files, for example, is achieved by use of a &428: command.

PC-Write files

Word processors usually work in a form known as 'what you see is what you get', or WYSIWYG. When you use a WYSIWYG word processor, you know that the onscreen display is a vague representation of what will appear on the printer. Of course, there will be differences but, if you want bold print then the text on the screen will appear bolder (brighter, usually) than normal.

PC-Write has none of this. All special effects are achieved by entering special characters in the text, and are interpreted according to how the control files are set up. To initiate bold text, for example, you press Alt-

```

C=02 #27,69-27,7%
C=06 @564n#27,120,0,27,80,15-18
D=16 #27,120,0,27,80,27,87,1-27,87,0
E=03 #18,27,87,0,27,120,0,27,77-R
F=28 #18,27,87,0,27,120,0,27,80-R
H=24 #27,83,0-27,84 (regular monospaced superscripts)
I=21 #27,52-27,53
J=06
L=25 #27,83,1-27,84 (regular monospaced subscripts)
M=07
O=19 /47
P=05 #27,120,1,27,80-R
Q=22 #27,120,1,27,77-R
R=30
S=01 #27,71-27,72
U=23 #27,45,1-27,45,0
U=04 @#360i#27,112,1-27,112,0,R
W=18 #27,45,1-27,45,0/27,83,1,95,27,84
X=13 @#360i#27,83,0-27,84 (proportionally spaced superscripts)
Y=31
Z=15 @#360i#27,83,1-27,84 (proportionally spaced subscripts)
_02= 27,51,90
_03= 27,51,60
_04= 27,51,45

```

PC-Write can be customised for any printer, by including the correct commands in PR.DEF

```

C= Menu:Push:Wrap+Sp- 97% Free, 0% thru, Head "A.ed.ppt"
C (use colour monitor)
M (remind to save document every 2000 characters)
A (printer can do accent characters itself and doesn't need
to overprint for ASCII characters 128-255)
W: 112,112,48 (make top line on screen display as black on cyan)
027:309 (HOME key moves cursor to top of text)
035:298 (END key moves cursor to top of text)
029:308 (PgUp does para up)
037:374 (PgDn does para down)
003:425 (redefine Ctl-C to do word count)
035:156 (redefine shift 3 to do pound sign, not hash)
0 6:315,321,264,324,324 (redefine Ctl-P to print file being edited)
P:027,067,070 (codes to send to printer before each document)
(Sets Epson printer to use 70-line paper)

```

Part of the edit control file. This shows margin, page and colour settings, among others



B which produces a bright, smiling face onscreen, and everything typed thereafter comes out in white on blue. When you turn off bold, again by typing Alt-B, another smiling face appears and the text reverts to its normal colour, leaving your bold text on a blue background accompanied by smiling faces at either end.

The smiling faces don't actually make it as far as the printer, but they do make your screen look rather strange. The allocation of symbols and colour changes to fonts is specified in the control files, so you can produce displays as garish or muted as you wish.

Typing Alt-Space will turn off the smiling faces and any other special characters that surround blocks of text. A symbol on the status line tells you whether special characters are turned off or on, although the manual's explanation of this symbol is something completely different — another example, apparently, of the manual not being updated with the latest version of the software.

If you are producing documents with little or no fancy effects, the PC-Write screen is acceptable. An example of what can happen if you become too daring, though, is provided on the PC-Write disk in a file that is intended to test your printer by printing in a variety of fonts. Displaying the file onscreen shows just how unreadable a screen can be, as shown in the screendump.

Apart from the weird colours and smiling faces, the biggest drawback to PC-Write is that it can only cope with a file of up to 60,000 characters. Unlike other word processors, PC-Write keeps all the text in memory instead of paging in and out of disk files. This makes editing functions work much faster, especially when moving the cursor from top to bot-

tom of a long document, but the limitation of 60,000 characters is ludicrous. (Many people will probably tell you that it's bad practice to have such long files, and that you should split the work up into shorter segments. I agree, but would like the decision of whether to split files to be mine, *not* the software's.) Even if you have a full 640k on your machine, the limit doesn't increase. The clipboard — the area to where deleted text is banished in case you change your mind — is separate, though, and is in addition to the editing workspace. Rumours abound that this limit will be removed in future versions of the program.

It's possible to edit files that are longer than 60k, but the procedure is cumbersome and disconcerting — even more so if disk space is tight.

If all this makes PC-Write sound as though it was only designed for programmers, you may well be right — the manual seems to think so, too. 'The PC can be a useful tool,' it states, 'but only if you know how it works.' There's even a chapter that explains what bits and bytes are, what memory is, and what operating systems do. Surely if an applications program is written properly, the user doesn't have to know all this, or even realise that the items exist?

The keyboard

PC-Write relies on function keys to

get commands from the user; these ten keys are used in conjunction with Ctrl, Alt and Shift in various combinations. To quit the program without saving the current file, for example, you press F1, F9, F2 in that order. No function key overlay is provided, so you'll need to keep the manual handy.

To save time, you can 'record' sequences of keystrokes and play them back into a document at any time. These definitions can be placed in the edit control file, in which case they apply whenever you use PC-Write; or they can be defined locally so that they apply only in the file currently being edited.

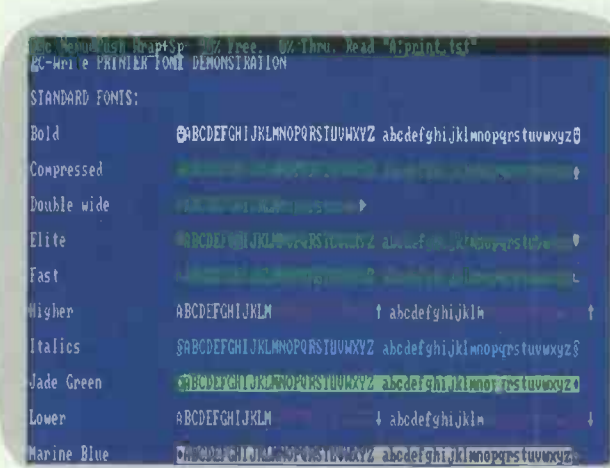
Insert and Overwrite mode are toggled by use of the Scroll Lock key. The Insert key is used to insert a blank space, regardless of which mode you are in. This is useful, but takes some getting used to. I would rather have these two keys used the other way round.

PC-Write recognises a number of WordStar control codes — like Ctrl-K D to save a document. According to the manual's index, a list of other recognised WordStar codes can be found in chapter 15 — although the manual stops at chapter 14.

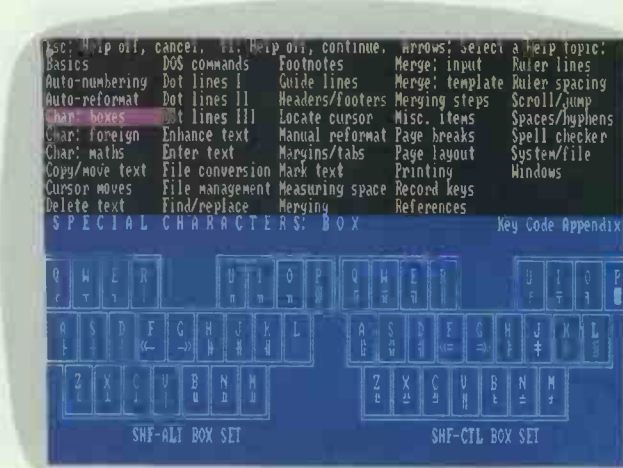
PC-Write can be used with a mouse. Configuration files, which map mouse movement and buttons to certain keys on the keyboard, are provided.

The spelling checker

Version 2.7 of PC-Write includes a spelling checker for the first time. This works in two ways. Firstly, you can check a document as soon as it has been written; alternatively, you can have the dictionary loaded into memory and have your spelling checked as you type. In the latter mode, the computer beeps whenever



Mixing fonts onscreen produces some weird and wonderful character and colour combinations



The online help facility provides half a screen of help text covering 43 aspects of PC-Write

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you type a word it doesn't recognise.

Such a facility is not unique to PC-Write. Turbo Lightning, from Borland, adds similar capabilities to just about any word processor and works much faster. With PC-Write, if you type too fast, misspelled words are not beeped at.

The dictionary is supposed to be an English version, as opposed to American, yet the word 'cheque' isn't recognised. Neither, for some strange reason, is the word 'his'. You can add these words to the dictionary if you wish.

If you ask it to, the spelling checker will suggest a correct spelling for a word that isn't recognised, but I found PC-Write to be a bad guesser. For example, if I typed 'becuase' (deliberate error!), the program guessed the correct spelling as bed, bedazzle, beaches, begs, beaks and beseech, before arriving at the correct word.

If the computer fails to guess the correct word, you have to exit the spelling checker to correct the word, then starting the spelling checker again. An option to correct a word manually and then return to the spelling checker would have been appreciated.

The word counter is very handy. At the touch of Alt-F4, F3, you get a count of the number of letters and words in the current document, as well as the average number of letters per word. Like all of PC-Write's functions, the word counter can be made to operate on a marked block of text instead of the whole file.

Online help

An online help facility presents you with one of 45 help screens, selected from a menu. The help file is loaded into memory when you start PC-Write, unless you specify in the control file that you don't want the help



SCREENTEST

file to be loaded. Most of the things I needed to look up weren't in the help text, but I suppose a selection of 45 screens are better than none at all. I would like to be able to press a function key while in help mode, and have information displayed that tells me what that key does. Unfortunately, PC-Write can't do that.

Documentation

PC-Write's documentation comes in the form of a 300-page paperback manual: however, the information is arranged so badly that it's very hard to locate what you want. Every fact is repeated at least twice, making many complete chapters redundant. There is an index at the back but it's far from perfect, and although the program boasts a spelling checker, it isn't mentioned in the index.

There are mistakes in the manual, too — the main cause being the inaccurate upgrading from the previous version of the program. Although the software has been upgraded, certain sections of the manual have not.

Also supplied is a registration form which you have to return to Sagesoft. This entitles you to 90 days of free telephone support, and registered users are also notified of any updates that arrive from American authors. After 90 days you're on your own, unless you choose to pay £30 to extend the cover period by a year.

Sagesoft includes an appropriate form with the program that you send back with your cheque.

Conclusion

I have already stated that PC-Write is the most configurable and flexible word processor I know. It was written, originally, by a software hacker who seems to have had a bet with a friend as to how many useless features could be crammed into one program. It is evident that, whenever the author had a spare 10 minutes, he would ask himself which feature could be added. If you aren't careful, you'll end up with control files that are enormous and unmaintainable. You could, for example, have complete character sets and width tables for half a dozen fonts in the printer control file. You could also redefine every key on the keyboard, and change the name of all the commands. Although this amount of customisation may produce the perfect word processor for your own particular needs, it also means that no-one else will be able to use your version of PC-Write, and you won't be able to use anyone else's copy.

As the product stands, I couldn't recommend PC-Write to anyone. It doesn't look and feel like a professional product. If you want to try it, obtain a copy of version 2.4 (the free version) and see what you think. If you like that, you'll probably like version 2.7 as well.

It's hard to decide exactly who the product is aimed at. Most of its features will be wasted on someone who just wants to use it for word processing, and doesn't want to have to spend hours setting the various configurations. The high level of configurability may appeal to professional writers and journalists, but the poor quality of the spelling checker and the total absence of a thesaurus should be borne in mind.

It may be assumed, then, that PC-Write is aimed at programmers who are writing source code for input to a compiler. If this is the case, the 60,000-character file limit is a serious problem.

Sagesoft tells me that the product is definitely not aimed at programmers, but at the mass secretarial market: Tom Maxfield, the company's sales manager, said that his secretary was quite happy with it after just three days. But I have my doubts as to whether someone in a non-computer industry would feel comfortable with what really is a very technical and user-hostile piece of software.

PC-Write costs £99 (including VAT) and is published by Sagesoft on (091) 284 7077.

END





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Lotus' HAL

Lotus' HAL is an add-in application which allows large numbers of complex 1-2-3 functions to be carried out via the latter's source code.

Geof Wheelwright conveys his impressions.

It's hard to take a computer software product called HAL very seriously. After all, wasn't HAL the evil, egomaniacal computer in *2001: A Space Odyssey* that set the cause of popular computing back at least 10 years by having the poor taste to murder its users?

These considerations do not, however, seem to have bothered Lotus Development Corporation in releasing its new Human Access Language (otherwise known, of course, as HAL) — the latest (and probably greatest) 'add-in' application for the best-selling Lotus 1-2-3 spreadsheet.

History

Literary allusions aside, you really have to take a quick look at the recent history of Lotus to get an idea of the whys and wherefores of HAL. The company started with a bang in 1982 when it released Lotus 1-2-3 for the IBM PC, and almost immediately gained a permanent place in the

business software Top Ten sellers list.

By 1984 Lotus was busy developing an 'encore' to its hugely successful debut product, and rode the wave of integrated software popularity with its all-in-one word processor/database/spreadsheet/graphics/comms suite, Symphony. Despite the fact that Symphony made a brief appearance in the Top Ten charts and achieved steady sales thereafter, it never gained the popularity of 1-2-3. Users realised the inevitable trade-offs in flexibility and power that were made by shoving so many applications into a single package.

The company's next big splash was made with Jazz — an integrated suite for the Macintosh that promised far more than it eventually delivered. Sales were slow, and Lotus eventually had to admit that Microsoft's Excel graphics/spreadsheet/database application was going to be the winner in the Mac software sweepstakes as it soared

to the top of the Macintosh software sales charts.

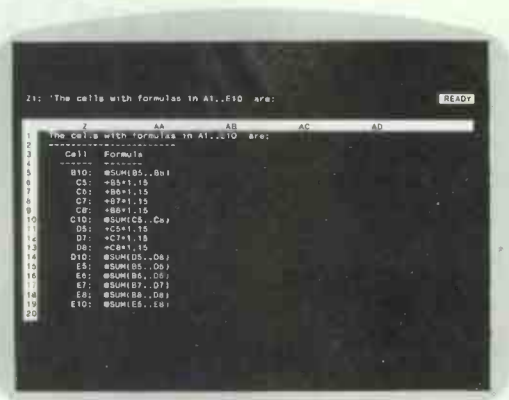
Given the difficulties faced by Jazz — and, to a lesser extent, Symphony — it perhaps isn't surprising that apart from the Manuscript professional word processor which was released in November 1986 at the same time as HAL, Lotus has concentrated on doing what it does best: making excellent spreadsheet and spreadsheet-companion products. The company has accomplished this in recent months by developing its own spelling-checker and micro-mainframe add-ins for Symphony, and by buying-in third-party software (and often the companies which go with them) such as Spotlight, Freelance, GraphWriter — and HAL.

Development

HAL was developed by Californian software engineer Bill Gross, who hit upon the idea that a lot more people would use the full power of 1-2-3 if they could get at it without having to hit



HAL is a great improvement on Lotus 1-2-3. To list all the formulae in a spreadsheet for example, you give the command LIST FORM and then designate where you want to place them (in this case, Z1)



The results of the LIST FORM command are shown here, with the cell formulae listed from left to right, starting with those in column B and moving right to column E (note how neatly this data is presented)



Finding where the formulae reside is all very well, but sometimes you need a way of quickly determining the relationships between various formulae. This is undertaken by the LIST REL command



The LIST REL command is automatically placed directly below the current work, so that you can see both the relationships and the cells they refer to at the same time

hundreds of '/' commands. Unlike other people with the same idea, however, Gross was enterprising enough to 'attach' his 1-2-3 add-on directly to the source code, as opposed to the more common practice of building new Lotus interfaces from Lotus' own macro command language.

The result was an extremely fast system which allowed large numbers of complex functions to be carried out via simple English commands such as 'GRAPH JAN TO FEB AS PIE', instead of the corresponding series of six or seven keystrokes.

Not surprisingly, Lotus took one look at the work Bill Gross had done and decided it had to have the product. In February 1986 Lotus bought HAL and the company that created it, and hired the man who developed it. And on November 28 1986, Lotus started shipping HAL in the US (with the UK shipments starting soon after).

In use

Although Lotus is selling HAL for only £120 (excluding VAT), you shouldn't get the idea that it is in any way a lightweight offering. Here are its main features:

- HAL is an English language-style command system which is accessed via the '^' key (as opposed to the '/' key used by standard Lotus commands). This command system accepts a huge variety of English words (such as 'show', 'this', 'delete', 'clear' and 'average'), and allows you to reference cells and rows by their labels.

- It incorporates an UNDO command which allows you to take back the last change you made to the spreadsheet, thus increasing the degree of flexibility offered in 'what if?' calculations.

- It allows dynamic linking of multiple spreadsheets so that dependencies can — for the first time in Lotus 1-2-3 — be created on sheets that aren't loaded into memory simultaneously.

- It includes commands for highlighting and showing dependencies, formulae and precedents, so that you can immediately see and understand the

structure of a spreadsheet.

- It offers a 'transcript file' system that will record all HAL requests and 1-2-3 commands in a DOS file, which can then be used for creating macros or reviewing work (HAL commands now become part of macros).

All these new facilities are important, but the most crucial are the ones which didn't previously exist in 1-2-3. The huge base of existing 1-2-3 users may be happy to tumble along with shortcuts to existing commands, as they will have perfected their own keystroke dexterity, but even they may be tempted by the worksheet linking, the UNDO command and the ability to easily see formulae and dependencies.

User image

I was initially sceptical about HAL, and thought that it was simply a way of buffering the inexperienced 1-2-3 user from the harsh realities of the program's command structure. But the more I used it, the more I was tempted to move away from tried and true 1-2-3 commands to HAL's simpler requests. To be able to give, for example, the HAL request to 'SORT BY DIRECTOR' my list of videotaped films, instead of the usual procedure of range defining, primary key specification and waiting around, is a real bonus. Even the simple command ENTER JAN TO DEC IN ROW, which sets up a spreadsheet with column labels listed sequentially from January to December, made life a lot easier.

I also began to see the possibilities of how listing formulae, dependencies and relations could help enormously in debugging a complex spreadsheet. If for example, you were getting constant addition errors and used the HIGH-LIGHT FORM command to show all the formulae in a large worksheet, you might find that you had erroneously overwritten a formula with data.

Installing HAL is also quite simple. I ran 1-2-3 on a hard disk and copied the HAL files (which come on two 5 1/4 in disks) onto the hard disk. As Lotus hasn't copy-protected the software

(presumably because it can only be used with bona fide copies of Lotus 1-2-3), I just copied the files and typed 'HAL' at the C> prompt.

HAL then booted itself and 1-2-3, presenting me with the familiar 1-2-3 opening screen in just a few more seconds than I was used to. After that, however, 1-2-3 works in exactly the same way as it always has, except that HAL 'request' commands are available via the '/' key.

Documentation

HAL's documentation is fair, but I found little need for it. The system includes an extensive online help facility which is accessed by hitting F1 at the HAL request prompt (or by typing 'Help'), and includes examples of every command you're likely to need.

Conclusion

You're probably wondering what the catch is. I'm happy to tell you that there isn't one — or, at least, not a big one. You'll need at least 512k of RAM, as HAL is overlaid on 1-2-3 directly in memory, and you will have to use Release 1A, Release 2 or Release 2.1 of 1-2-3. HAL does not currently operate with 1-2-3 on the IBM PCjr, the IBM PC Convertible or Release 1A for the IBM 3270 PC (although the PCjr has not been officially launched in the UK).

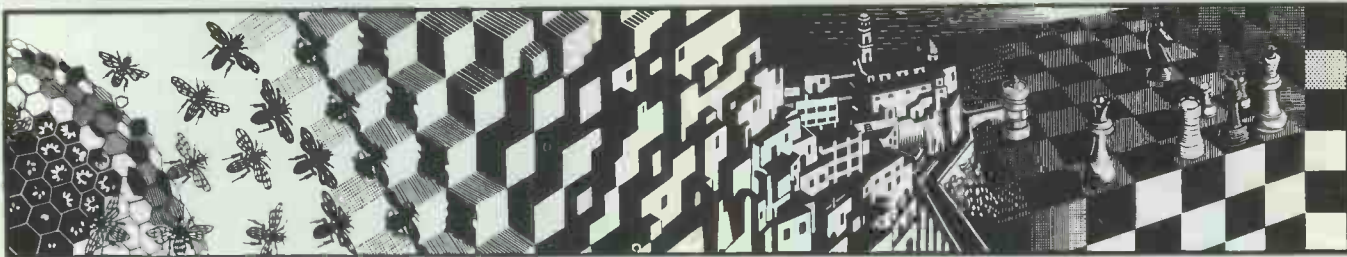
One other incompatibility is that HAL doesn't work with any of the 1-2-3 'clone' spreadsheets. It hooks directly into the 1-2-3 source code, and the clones' source code is (or had better be, if they don't want to be sued) different from that of the original 1-2-3.

It looks as though Lotus has a winner on its hands. I can think of no reason why experienced or novice 1-2-3 users alike wouldn't want this software. At £120, it doesn't cost a great deal, it adds more to 1-2-3 than any other add-in application I've seen, and makes the world's most famous spreadsheet as easy to use as it is powerful.

Lotus is on (0753) 840281.

END

SCREENPLAY



There's no need for a time machine to transport you back into medieval times or forward into a future space-age — this month's games selection caters for both worlds. Stephen Applebaum is your guide.



Thinking of England

Title: Defender Of The Crown
Computer: Amiga (512k); Macintosh;
Atari 520ST
Supplier: Mirrorsoft
Format: Disk
Price: £45.95 (Amiga)

When King Richard was brutally murdered in 1149, his killer must have foreseen the evil seeds he sowed. With one fatal cut of his sword, he not only spilled the lifeblood of a man, but sealed the fate of thousands of others.

At the time, King Richard was the only thing keeping England from being ravaged by civil war. The Normans and the Saxons had, for years, been looking for a new excuse to meet on the battlefield. With Richard out of the way, there was nothing to keep them apart any longer.

As the news of Richard's dreadful death spread throughout the shires, people began to speculate over who had killed him. Most puzzling of all was the disappearance of his crown. Obviously, whoever had dealt Richard the fatal blow had also made off with the royal headgear. But why?

While people spoke of vengeance, six great lords — three Norman and three Saxon — prepared themselves for battle, building armies out of liege-men and their subordinates.

One of the lords, a Saxon, rode out to Sherwood Forest from his castle in the north; and there, finding the

rebel hero Robin Hood, asked him to pledge his loyalty in the fight for the throne. Robin gave him his word gladly, swearing that he and his men would fight by the lord's side when called upon to do so.

Now, put yourself in this lord's position. In front of him is the glittering prize — the throne of England. But between him and his goal stand three Norman lords: men endowed with the fighting spirit and tactical acumen of William the Conqueror. If you were this lord, what dark thoughts would run through your mind as you rode back to your castle and, possibly, death?

Such is the position you find yourself in at the beginning of Defender of the Crown, Mindscape's visually stunning epic of medieval warfare in which you, the player, take the role of the Saxon lord whose singular plight I have just described.

The lord whose persona you adopt is chosen from four characters, each of whom is versed in the skills of leadership, swordplay and jousting, albeit to different proficiency levels. Of the four, a man called Geoffrey Longsword is the best choice when playing for the first time, because he is the most accomplished swordsman of the group. (Why this is such a desirable trait will become clear later.)

The outbreak of civil war finds you in your castle, brooding over a map with your advisors. There are two maps in Defender of the Crown, but the most important one is shaded to indicate the proportion of land — or rather the number of shires — owned

by each lord. It also provides invaluable information such as the pecuniary worth of each shire, the number of vassals living there, and how strong a specific region's army is; information which, were it not at hand, could mean you sending an army into a situation where it had no chance of survival.

In the early stages of war, the shires bordering your own are free from the jurisdiction of an overlord and can be easily taken. When this land has been secured, the only way to strengthen your claim to the throne is to assemble a campaign army and move further afield. A campaign army consists of foot-soldiers, who require only low wages and are relatively dispensable; knights, who although they are much more expensive, make an excellent vanguard; and one or two catapults.

Financing a campaign army is very costly and can empty your coffers quickly, but don't forget that this is the age of feudalism. The greater the number of shires overseen by you, the wealthier you'll be when the monthly taxes come in.

When you *do* send your campaign army into an occupied region, the computer presents you with a chart showing the number of men in both armies, and offers you the choice of attacking ferociously, standing your ground or fleeing. However, such skirmishes seriously deplete an army and hence your financial resources.

Apart from land, though, another way of acquiring money is to raid the coffers of another lord. Raids are where a good swordsman really

shines. They are always carried out at night and invariably meet with resistance from castle guards, which is why a lord who lets his sword sleep in his hand will not last long enough to reap the rewards of these nocturnal forays.

Swordfighting, as far as the player is concerned, is a simple matter of moving the mouse towards your character's attacker, while at the same time pressing and depressing the button. Together, these actions cause your man to walk and thrust with his sword simultaneously. Sound effects add to the realism of this scene, as they do to many of the combat situations.

And it isn't always money that beckons. The cry of a Saxon maiden held hostage by a Norman lord holds promise of a far more precious prize than mere riches (Barbara Cartland, eat your heart out). Should you manage to evade the castle guards and enter the maiden's chamber, you will be rewarded with one of the game's most impressive, and ever so slightly

risque, sequences.

Rescuing a Saxon lady gains you a wife, which in turn raises your morale to greater heights, spurring you on to even more daring deeds.

As the war winds its fatal course, your coffers grow fatter and the poor ever poorer. Wealth gained on the battlefield can be used to build forts to defend your newly acquired estates, or even to finance a joust.

The tournament is the high spot of Defender of the Crown. It opens with trumpeters heralding the arrival of the competitors, before switching to a display that simulates a joustier astride his horse. Your aim is to overcome the movement of the horse, so that you can hold your lance still long enough to strike your opponent's shield with its tip.

Desporting yourself on the fields at Ashby-de-la-Zouche might, if you're lucky, win you land, but won't earn you the throne. To do that, you have to lay siege to each of the three Norman castles in the south of England.

To capture a castle, you first have

to breach its walls by means of a catapult. The siege screen is a beautiful depiction of an army encamped outside the walls of a great castle. In the forefront of the picture is the catapult, as seen from the rear. Using the mouse, the arm of the contraption can be pulled back and then released, hurling a boulder at the castle ramparts. If your aim is good, the boulder will knock a hole in the wall. This continues until your supply of boulders has been depleted, when you should have created a big enough hole for your men to climb through. When all the Norman castles have been taken in this way, you can exercise your right to the throne.

Defender of the Crown is one of those rare games that counterbalances a rare, aesthetic quality with good gameplay — very few games succeed on both levels. Hopefully we'll see more programs like it in the future, as Defender of the Crown is only one of a series of programs Mindscape is distributing under the collective title of 'Cinemaware'.



The punishment of luxury

Title: Temple of Apshai Trilogy
Computer: Commodore Amiga
Supplier: Epyx
Format: Disk
Price: Not available

Far away, in a sequestered corner of the world, there is an ancient door embedded in the rockface of a steep, towering mountain. No-one knows what secrets it conceals behind its awesome aspect, for those who have stepped into the darkness beyond have never returned to tell what they have found there. Some say it's the gateway to Hell; others that it's the entrance to the Temple of Apshai.

Legend has it that in an age long forgotten, before the great flood even, there lived a race of people called Gebites. They were nature's own children, and daily gave thanks to the God of the Earth. The Gebites lived in peace for many centuries, until, dissatisfied with the fruits of their existence, a small group re-

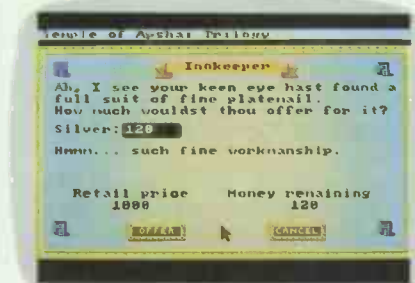


nounced the Gebite God for Apshai, the Insect God. These rebels were banished to the world without.

Even in the depths of their despair, the Apshaians never forsook their Insect God, whom they believed would lead them to a new and better life. And, sure enough, following days of prayer and meditation, the Apshaiian priests were guided to a subterranean world where weird fauna and flora flourished in the darkness.

There the Apshaiians lived, prospered and grew strong. Eventually even the Gebites came to respect them, receiving incense and gems from them yearly. Greedily reaping the rewards of the Apshaiian's success, the Gebites forgot that they had once exiled these people for practising rites tantamount to witchcraft. Little did they know, then, that the gifts they received with open arms were artifices calculated to bring about their doom.

Insect plagues scourged the Gebites, who prayed to the God of the Earth to deliver them from the devilish conditions which had befallen them. After days of suffering, the God replied with an earthquake which, knowing no boundaries, des-



troyed the Gebite village and the Apshaiian homestead.

Years later, a Gebite priest foolhardily ordered the excavation of the Temple of Apshai as a means of recovering the vast quantities of gold and gems buried there. Teams of engineers were sent down into the shadowy caverns, once home to a great people. Many of these engineers failed to emerge, lost in the prevailing darkness.

Realising the terrible mistake they had made, the Gebites set about sealing up the opening in the mountain, leaving it as a monument to the Apshaiians and a reminder of the omnipotence of their own Earth God.

Now, only intrepid adventurers hungry for wealth dare step through the door into the darkness. Those who enter this great portal do so at their own risk, and in the knowledge that they may never again see the light. Such is the danger. Will you accept the challenge?

Acceptance of the enterprise summons forth the Innkeeper who, being more than mortal, holds the key to creation. Through him, adventurers 'build' characters who they think embody all the physical attributes

SCREENPLAY

necessary to succeed in the quest for riches.

With the Innkeeper's help, a player can alter a character's strength, constitution, dexterity, intelligence, intuition and ego. A character so prepared must then be equipped with items purchased from the Innkeeper's store. Fledgling adventurers are poor fellows and are only able to buy the barest minimum, such as light armour, a dagger and a shield.

Being a pauper might make you immune to a beggar's pleas, but it won't save you from the jaws of death. Adventurers must choose the few items they buy wisely, because entering the Temple of Apshai unprepared will result in the adventure being ended very swiftly.

Finally, it's time to say goodbye to

the world of light and enter the fetid depths of the cavernous underworld. Here, the adventurer follows his/her character around a vast, winding maze, like a guardian angel.

Within the confines of this strange world live legions of voracious creatures, ready to attack at the merest glimpse of an intruder. Strewn about the muddy ground are dried bones — the last remains of monsters' victims and a sad reminder of those who have gone before.

Evil lurks in every niche of the Temple, but not everyone there is out for an adventurer's blood. Some merely want gold, and although they won't kill straight away for it, most will certainly threaten to.

Take Olias the Dwarf, for example. This irascible little character will rob

an adventurer of everything. Lowenthal the Wizard, on the other hand, will only steal magical items. And then there's Bendic, the wandering priest. He's the kindest character of them all, promising resurrection if he ever finds his way out of the labyrinth, in return for a small donation to his sect (of course).

The Temple of Apshai is difficult, but is merely a taster for the horrors to come in parts two and three. Those adventurers who get out of the Temple alive, must then investigate the Upper Reaches of Apshai. Then, just when you think you can hang up your sword, the secret of the Curse of Ra must be discovered, so lifting the veil of evil that hangs over Apshai. Only then can you return to your home.

Star bores

Title: Starglider

Computer: Spectrum 48k/128;

Amstrad; Atari ST

Supplier: Rainbird

Format: Cassette; disk

Price: £14.95 (Spectrum cassette)

I'm breaking my self-imposed ban on arcade games by taking a look at Rainbird's Starglider on the Spectrum, which follows the original Atari ST version. That I passed over because, like others of its ilk, it stimulates the senses but leaves the brain for dead.

Much the same can be said about the Spectrum incarnation. But when you consider what the programmer has crammed into the machine's comparatively tiny 48k memory, the result is a laudable achievement that indicates both the power of the Spectrum and the skill of Jeremy San, the program's creator.

Atari Starglider has not been featured in Screenplay, but has been praised in PCW by Guy Kewney, in his Newsprint column. Starglider is, to quote the packaging, a '3D combat flight simulator'; the object being to save the planet of Novenia from invasion by Ergon air and ground forces led by the ruthless Fleet Commander Hermann Krudd, aboard the eponymous Starglider.

The player takes the role of Jaysan, an alcoholic engineer who finds himself led aboard Novenia's last Airborne Ground Attack Vehicle (AGAV) by his friend Katra. After showing Jaysan the craft, she persuades him to pilot it in an offensive against the Ergons.

Knowledge of Starglider's background makes little difference to the game itself, since the action begins



where Jaysan is taking off for the first time. Why Rainbird has included a novella written by James Follett, author of the screenplay for the film *Who Dares Wins*, is therefore something of a mystery. If I didn't know better, I'd be tempted to think it was there to conceal the shallowness of the game.

Flying the AGAV is simple when using a joystick, but operating it via the keyboard is another matter. A mind-boggling 10 keys are needed to access all the craft's functions — even an octopus would have problems. Even so, Starglider is still easier to play on the Spectrum than it is on the Atari ST, but probably only because it's slightly slower on the 8-bit machine.

In a way this decrease in speed is desirable, as it gives you time to appreciate the program's brilliant vector graphics — the likes of which have never been seen on the Spectrum before. For instance, as you soar over the fairly bland landscape of Novenia, vast fighting machines called Stompers and Walkers heave their heavy frames from one side of your field of vision to the other.

These giant fighting machines perambulate across the screen in realistic style, bathing anything that gets in their way in laser light. Just

as impressive as these metallic giants is the Starglider itself — a large, bird-like contraption which flies gracefully through the Novenian atmosphere, beating its metal wings with smooth, rhythmic movements. As it's the star of the piece you'd think the Starglider would be hard to destroy — not true. I've been reliably informed that a missile up the rear is all that's required to put paid to its antics, but I have never beaten it.

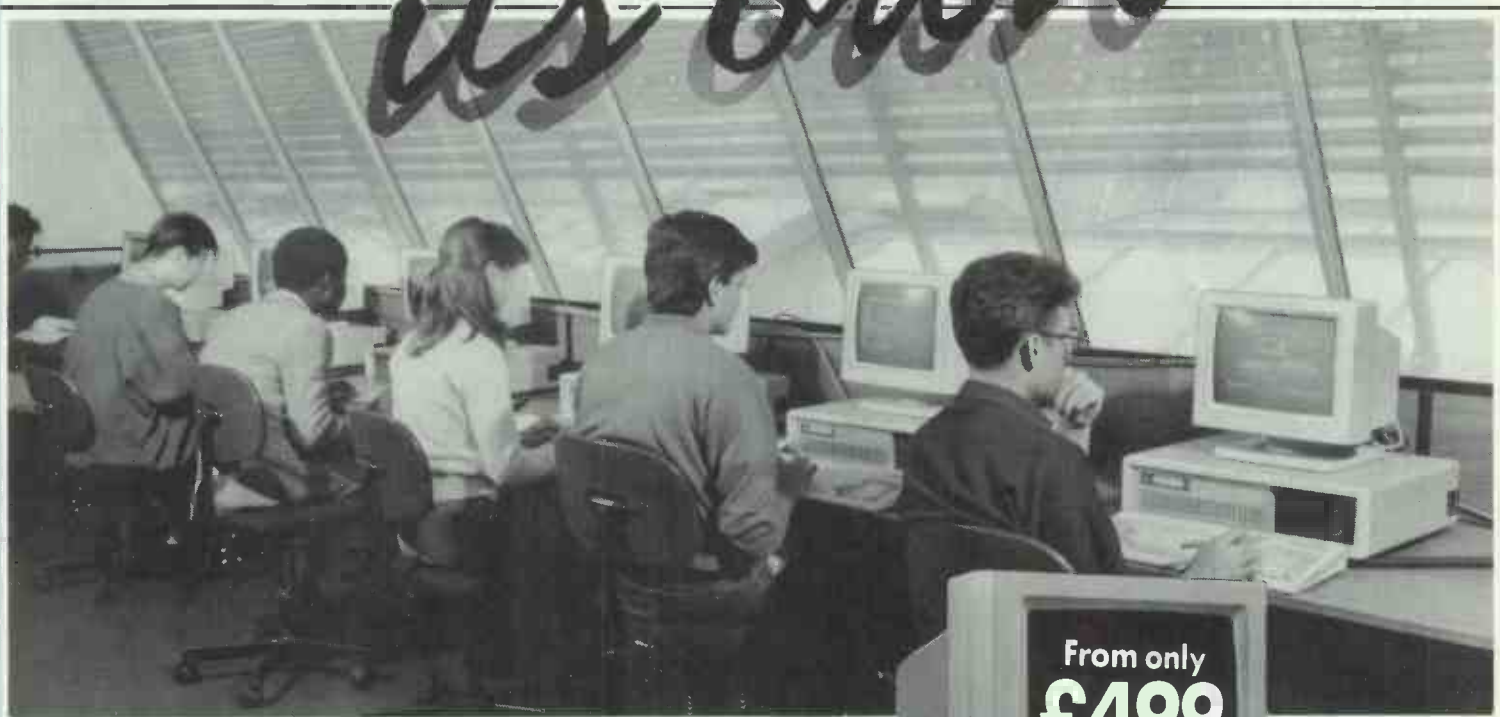
As your flying skills increase, and you learn a little more about your environment either through the game or by ploughing through Follett's novella, you discover certain intrinsic aspects of the game not evident at the beginning. Recharging your lasers, for example, becomes a test of nerves as you fly your AGAV almost down to ground level to pick up the discharge from a power line running between three towers.

One handy morsel of information in the novella advises you to shoot some small, beacon-like objects fixed to the tops of the three towers. Unless these beacons are destroyed, Follett states, the Ergons will gain control of the towers and switch off the power, depriving you of an important source of energy for the AGAV's onboard batteries.

After an unimpressive debut, Starglider has improved by being transported onto a smaller machine. Its price tag is still a little high, although you do get both the 48k and 128k versions for your money; the difference between the two being that the latter contains digitised speech.

Starglider for the Spectrum is an enormous advance on anything else yet seen on the machine. One thing still rubs, though, and that's the gap between the program's excellent visuals and the dismal game plan. **END**

In a Class on its own



This little lot ask more of their IBM-compatibles in a day than most users demand in a year. But then this is London's Polytechnic of the South Bank, one of Britain's leading institutes of science and technology.

Here wordprocessing and data storage, financial management and computer-aided design, networking and terminal emulation are all in a day's work.

So you can be sure that when the Polytechnic chose the PC II Turbo from Opus—almost 200 of them in fact—it was only after a great deal of study.

Even with a starting price of £499 the PC II Turbo faced some cheaper competitors but, when it came to speed, compatibility and expandibility, it proved to be in a class of its own. Now it's in every class from electronic engineering to administrative studies and from computer services to humanities and social sciences.

With its NEC V20 processor the PC II Turbo is up to three times as fast as the IBM PC/XT and its switchable from 4.77 to 8 MHz Turbo processing at the flick of a keyboard. You can choose high resolution monochrome, colour or EGA systems, single or dual disc drives, 1 Megabyte RAM expansion or 20 Megabyte Winchester. And if you think our options could teach the competition a lesson or two, you'll find the PC II Turbo's standard features a real education.

- NEC V20 Super Processor ● 360K Floppy Disk Drive
- Hercules-compatible Graphics Card ● High Resolution
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- Keyboard Security Lock ● Parallel Printer and Joystick Interfaces ● Real Time Clock/Calendar with Battery Back-Up ● 150 Watt UL-Approved Power Supply
- Comprehensive User Manual ● 12-Month Guarantee.



Should you need more than our 12-month free warranty, we'll even offer you a low-cost on-site maintenance option.

Like South Bank Polytechnic we're sure you'll take a close look at the competition, their options and availability. When you have, call Opus on **0737 65080** and hear about our guaranteed 72-hour delivery. We offer special education and government discounts and welcome dealer and export enquiries. Price quoted exclusive of VAT and carriage.

PC II TURBO

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IBM is a trademark of International Business Machines Corporation.



Pace's Series Four

This month Peter Tootill returns to the subject of 'intelligent' modems, and puts the Series Four through its paces.

When we reviewed four-speed modems last year (August 1986), the Series Four was not in production. Although we were able to look at a prototype, we were unable to do a full review at that time. This review now rectifies that situation.

Design

The Series Four, like Miracle Technology's WS3000, is a multi-speed modem that comes in three versions: the basic V21/23 version (that is, 300/300 and 1200/75) called 2123S; a mid range version that adds V22 (1200 full-duplex) called 1200S; and the top of the range version, the 2400S which includes V22bis (2400/2400). The Series Four is Hayes-compatible and features a buffered interface to allow V23 to be used by computers which do not support split rates.

The most striking feature of the Series Four is its appearance. Most modems are black or grey rectangular boxes with a vertical front panel on which there are a number of LEDs, and probably some switches as well — some 'intelligent' modems lack the switches. The Series Four is the exception.

Indeed, it looks as though Pace has set out to make the Series Four as unlike other modems as possible. This modem is a cream wedge shape, measuring about 30cms x 24cms x 4.5cms, with a steep slope to the front panel. The usual LEDs are there, along with a few unusual features.

The usual 10 status indicators are included for such things as power, carrier detect, and so on (the full list is given in the table). Below these is a second row of triangular LEDs labelled 'carrier strength' which tell you the strength of the carrier from a distant modem — much like the signal strength indicator on a radio set.

Also on the front is a small LCD display, underneath which are three

push-buttons. The display normally shows the time and date, but can — in conjunction with the three push-buttons — be used to control a number of the modem's functions. This allows the modem to be used even without a computer or terminal attached.

The rear of the modem houses a socket for the external power supply, a standard 25-way 'D' socket for the RS232 connector, a socket for a telephone handset, a small reset switch, and a printer socket. The printer port is a Centronics parallel port and uses a cable similar to that of the BBC Micro. This enables the modem to be used as a sort of telephone-answering machine, except that the messages come via the callers' modems and are sent to the printer, instead of voices being recorded on tape.

Installation

Installing the Series Four is straightforward; it is just a matter of plugging the telephone lead into the nearest phone socket (if you don't already have one, you will have to ask BT to install one); plugging the telephone handset into the socket on the rear of the modem; connecting the RS232 lead from your computer to the modem — it uses the standard 25-way connector; and, finally, connecting the lead from the external power supply.

At this stage some of the LEDs on the modem will start flashing and the LCD display will show the message 'Self Test in progress wait', which is replaced briefly by 'Series Four ready' and, finally, by the date and time. The instructions contain a separate installation guide which describes the process in detail.

No manual settings are required on the modem itself; all adjustments to its mode of operation can be made from software — that is, by

issuing commands to the modem from your computer. The front panel switches *can*, however, be used to change some of the settings.

Hayes-compatible modems usually have a set of DIP switches which control certain functions, such as whether the modem sends messages as words or numbers; whether the DTR line controls the modem, or not; and so on. Some software (usually of American origin) assumes that your modem has such switches and tells you how to configure them. Most manuals give some indication of what the switches are expected to do and you should be able to work it out for yourself.

The Series Four, like most other Hayes-type modems, doesn't support all the relevant commands. The additional 'AT' commands preceded by '&' were only introduced by Hayes with its Smartmodem 2400 (which is not available yet in the UK) which itself doesn't have DIP switches. Where there isn't an equivalent command to control the modem, the normal method of working should be suitable for most terminal software.

While on the subject of compatibility, the ultimate test at present seems to be Hayes' own Smartcom II. Most compatible modems will work with ProComm, Crosstalk, Mirror and Remote, but Smartcom II requires a different order of compatibility. The original version of Pace's modem, supplied for review, didn't work with Smartcom II, but a new release of the ROM is almost there. Pace says that the problem will soon be sorted out and the Series Four will also be compatible with all the popular packages in normal use, including Smart and Fido as well as Smartcom II.

In use

In use the Series Four modem worked reliably. The constant speed inter-

Size:	30cms×4.5cms× 24cms
Power supply:	External
Major working modes:	V21,V23,V22,V22bis
Command protocols:	Hayes
External controls:	Reset, see text for details of others
Indicators (LED):	On, OL, DTR, RTS, CTS, CD, TD, RD, AA, HS, carrier strength, LCD display (see text)
RS232 signals:	1-10,20,22
Baud rate to terminal:	300, 1200, 2400
Baud rate to setting:	Auto
Baud rate select. orig:	Manual/auto
Baud rate select. ans:	Manual/auto
Dial tone detect:	Yes
No. unob. detect:	Yes
Dial mode:	Pulse or tone
Speaker:	Yes, with software volume control
Other features:	Clock, printer port, constant speed interface
Ratings (max *****):	
Documentation:	****
Ease of use:	****
Orig:	****
Answer:	****
Manufacturer:	Pace Micro Technology, Juniper View, Allerton Rd, Bradford BD15 7AG (0274) 488211
Telephone:	79:PCE001
BT Gold no:	
Prices:	2123S, £305 (£265+VAT); 1200S, £551 (£479+VAT); 2400S, £712 (£619+VAT);
Upgrades:	2123S to 2400S, £482; 2123S to 1200S, £280; 1200S to 2400S, £265 (all inc VAT)
<i>Series Four modem specification and general details</i>	

face and speed-seeking facility mean that you can set your terminal to 1200 or 2400 bits/sec and dial the system you want to call without worrying about having to set it each time. The modem will scan the available speeds and eventually it should lock on.

However, a problem may arise if the modem at the other end is also a speed-seeking modem, in which case you may find that they lock onto each other at an inappropriate speed. I could call V21/23/22 systems and

the result always seemed to be a V22 call, but when I called a V21/23 system, I usually ended up at V21 when I would have preferred V23. To make sure of a V23 call, I had to set the modem manually and turn off the speed-seeking feature.

Earlier versions of the modem didn't allow the computer to use software (X-on/X-off) flow control or handshaking with the buffer, relying instead on hardware-handshaking using the CTS line. However, most terminal software uses the former and doesn't support CTS control. I had no problems when using the modem to download software with the constant speed interface in operation — even using Xmodem protocols.

As mentioned above, one of the modem's unusual features is the 'carrier strength' indicator. This functions in much the same way as a signal strength indicator on a radio tuner. If the carrier is not very strong, you can expect a lot of errors; and it may well be worth dialling again to see if you can get a better line next time. Another unusual feature is the small control section on the left of the front panel.

The LCD display normally shows the time and date, but under it are three buttons marked with left and right arrows and the word 'set'. If you press the set button, the words 'Select function' appear. You can now step through various functions such as setting S registers, LCD contrast, speaker volume, time and date, and even dialling one of the numbers in the modem's memory. I'm not convinced that this is no more than a gimmick, but the manufacturer assures me that some people may want to store numbers in this way or want to use the modem without a computer, but with a printer connected to the printer port. If you're one of these people, then no doubt this will be a useful feature.

Auto-dialling

These days most modem users have access to smart terminal software that handles such things as auto-dialling without recourse to a list of subscribers stored in the modem; hence the battery-backed store for 64 phone numbers in the Series Four will be unnecessary. I used ProComm (see 'Networks', November 1986) for most of this review, and found that ProComm's auto-dial system worked best if I told it that all the systems I needed to call were 2400 bits/sec and left the speed-seeking/buffered interface to do the work.

I have ProComm set to power up at 2400 bits/sec and I found that when I told it that a system worked at 1200 bits/sec, the modem became confused when ProComm 'changed down' prior to issuing the dial com-

mand. The result was that I had to cancel the command, manually reconfigure to 2400 to regain control of the modem, switch to 1200 manually and then tell ProComm to dial. After I had done this, all went well.

The only other problem with using the modem in this way is with V21/23 systems (as mentioned above). The Series Four is not alone in this respect, however; I have found that most Hayes-type modems are a bit 'fiddly' when you want to use them in 1200/75 mode. This is because this mode is not used in the States, and there is no provision in the protocols for it.

One very nice feature of the Series Four is a built-in quick reference card. If you type AT?, the modem produces a list of the Hayes AT commands, with descriptions on your terminal. ATS? does the same for the S registers used to control many of the modem's parameters.

Even more helpful, the current S register setting is displayed, in some cases with its interpretation. For example, in the list you will find something like 'S53=3 V.23 1200 RX/75 TX'. This tells you that the modem is set to use V23, receiving data at 1200 bits/sec, transmitting at 75.

Documentation

The documentation supplied with Pace's Series Four is adequate; it comes in a small (A5-size) ring-binder and is properly typeset. There is a separate installation guide, and a tutorial section (although this would not be comprehensive enough for the complete novice). The bulk of the manual is taken up with descriptions of the Hayes AT command set and the S registers.

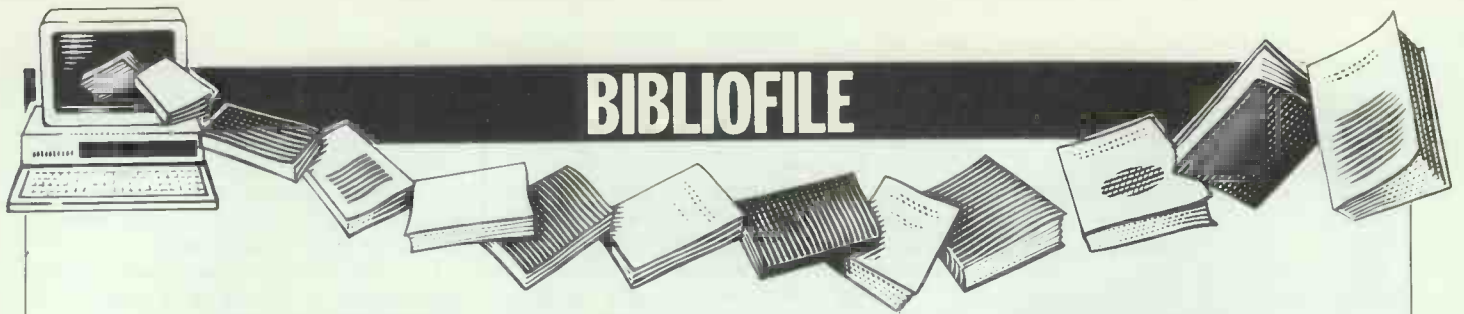
I would prefer to see such descriptions relegated to appendices and for the main part of the manual to deal with using the modem for various tasks. There were no page numbers and no index on my review documentation, although this may be rectified in later editions. Overall, however, this documentation compares well with that for other modems on the market.

Conclusion

All in all, the Series Four is a very nice modem. It works reliably and is easy to use; its main competition being the WS3000 range from Miracle Technology. Like the WS3000, you can start with the basic modem and upgrade.

However, that said, the Series Four has a few nice features (such as the constant speed interface) and the built-in 'quick reference cards'. **END**

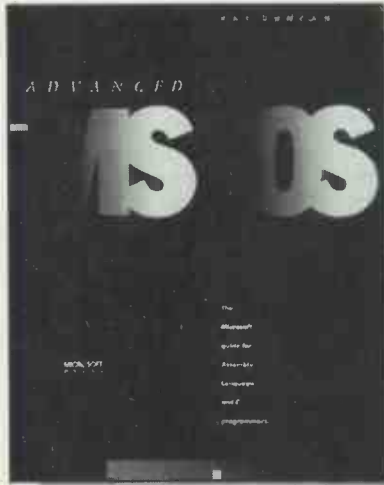
The revised list of UK bulletin boards (BBSs) has a new spot in 'End Zone'.



BIBLIOFILE

Higher education in MS-DOS, computing as a cult and managing your micro take the stage in this month's book selection.

Great aspirations



Title: Advanced MSDOS
Author: Ray Duncan
Publisher: Microsoft Press
Price: £19.95 (paperback)

'We assume a certain level of familiarity with the architecture and instruction set of the Intel 8086 micro-processor family, and with assembly language programming in general.'

That sentence really does set the pace for this book. If you can `C:\TEMPS>cd c:\` with the best of them, fine; if you can quite happily `A:\TEMPS>COPY TEST.* C:\TEMPS,` super; but this book is to the true programmer what a Silver Cloud Rolls Royce is to a rag-and-bone-man. For example, there is a five-page description on how MS-DOS is loaded! *'Then it moves the DOS kernel, MSDOS.SYS, from its original load location to its final memory location, overlaying the original SYSINIT code and any other expendable initialisation code that was contained in the IO.SYS file.'* It's pretty heady stuff.

Altogether, there are over 400 packed pages of detailed MS-DOS, with complete chapters devoted to using MS-DOS programming tools: disk internals, memory allocation, interrupt handlers and installable device drivers. While hardly bedtime reading, it is a detailed and absorbing reference book for the 'advanced' programmer, with clear diagrams, plenty of program listings and exam-

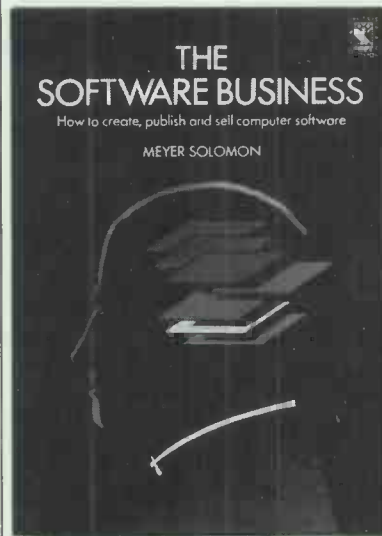
ples, and chapters sectioned into logical reading blocks.

Section II is devoted entirely to MS-DOS programming references, describing every interrupt from 20H through to 2FH, while the remaining two reference sections cover the IBM PC BIOS and the Lotus/Intel Microsoft Expanded Memory Specification.

At £19.95, the book does not come cheap, but if you are pushing at the boundaries of your 'elementary' MS-DOS manual, it might well be worth investing in.

Lorna Kyle

The wisdom of Solomon



Title: The Software Business
Author: Meyer Solomon
Publisher: BBC
Price: £5.50 (paperback)

As Mr Solomon was the founding editor of *PCW*, it goes without saying that his contribution to the micro-processing culture has been immense. On the other hand, he believes, as did Samuel Johnson, that: *'There are few ways in which a man can be more innocently employed than in getting money.'* He sees no reason to separate the two.

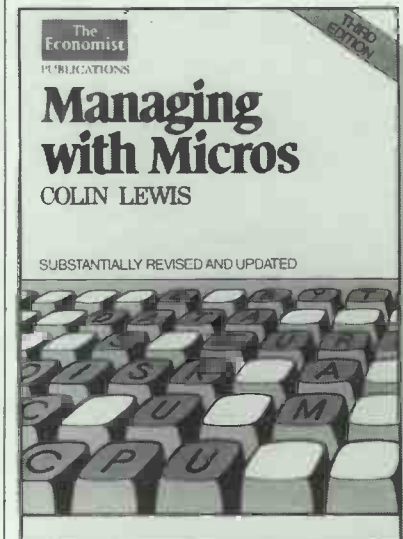
On current estimates there are about a million PC users in the UK, as many again in Europe and four times as many in the US. Instead of just

using software, they could write it and make themselves a bob or two. They should identify a commercial need, work backwards towards a solution, test it, do it, write the documentation, pester publishers and go for it, dodging the Data Protection Act as they go.

This is a sensible and lucid summary of the art, if too condensed to do more than point out the way and chivvy up a passion to succeed. No amount of cogent advice could rescue a duff idea, but if you *do* have the talent and lack only the detailed know-how, Mr Solomon's primer is a useful impetus. At £5.50, it could prove venture capital well spent.

David Taylor

You can do it!



Title: Managing with Micros
Author: Colin Lewis
Publisher: Basic Blackwell & The Economist Publications
Price: £7.95 (paperback)

This is the third edition of the book, and it claims to be substantially revised and updated. It certainly is very informative, and wouldn't look out of place on any computer user's bookshelf. Indeed, I found more useful and succinct information in the first chapter than in a host of other micro books that I've read. Professor Lewis

dives straight in, explaining terms such as CPU, ROM, RAM, buses, disk storage and onto a brief, although adequate, synopsis of various micro-computer systems and printers. That's just Chapter 1.

He then moves on to explain the structure of the micro industry; the meaning of system houses, service contractors and software houses; how to select the right micro for your business requirements — stressing the importance of carrying out your own feasibility study before you go out and buy: *'Hardware is becoming more standard in performance, the choice of software should come before the choice of hardware.'* Section A ties up with an outline of Local Area Networks (LANs) and the increasing use of the micro as a communications device.

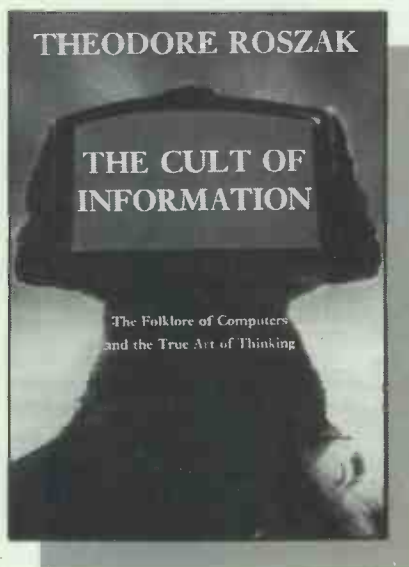
Section B has separate chapters on word processing, spreadsheet and database packages, and the pitfalls and heights of the all-singing, all-dancing integrated business package.

The final section of the book deals with popular accounting applications for the micro, namely payroll; sales, purchase and nominal ledger; and stock control. Professor Lewis explains simply and clearly what the terms mean, how to set up the packages and how to use them.

All in all, Professor Lewis knows his onions. His style is straightforward, practical and comprehensible. Recommended for anyone dealing with micros: *Managing with Micros* brings it all into perspective.

Lorna Kyle

I think, therefore I publish



Title: The Cult of Information
Author: Theodore Roszak
Publisher: Lutterworth Press
Price: £12.95

Listen, you know what? Computers aren't so smart. Oh, sure, they can stash data and process it some. But what do they know about God? Are equality and justice the kind of ideas any computer understands? Could a computer have figured out that $e=mc^2$ or written a Bach cantata? There you are, then. The things are overrated.

You may have gathered that Theodore Roszak, acclaimed author of *The Making of a Counter Culture*, is very computer-smart, very thoughtful, very academically intense and very American. He does not believe computers can think — not what he'd call 'thought'. And that's that.

But we should all watch out. Far too many people think computers do know everything. It's a cult, insists Theodore, and he isn't half convincing once you get accustomed to his languid style.

Theodore is a Professor of History and General Studies at California State University, but he word-processes the same as the next man. When he does, it bothers him a lot that people go on and on about information technology, manipulating data and the wonders of what computers can do, or will be able to do, any day now. It's a cult of bemused excitement at their ingenuity *'which makes every computer around us what the relics of the True Cross were in the Age of Faith: emblems of salvation.'*

You may have problems with his imagery, but the sentiment is sound enough. It has such a civilised ring.

Fact is, we're dizzied by the pace of technological change, Theodore continues; we are too ready to believe whatever apologists for computer power say. Words like 'information' are now up for grabs, used so liberally as to lay aside all concern for the quality or character of what is being communicated, blurring intellectual distinction.

Most artificial intelligence experiments to date, in highly contrived laboratory conditions, may seem ludicrous, but *'The domineering exponents of pure reason are still with us today in the form of computer scientists, wielding the age-old mystique of mathematics for all it is worth. And having invented a machine that embodies that mystique, they have found the social forces that have the power to make their utopia a political proposition.'*

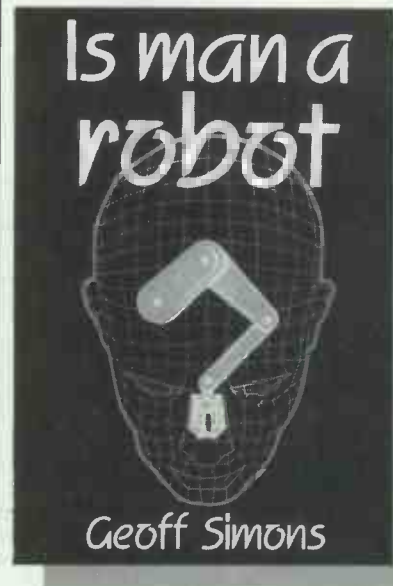
In short, we have here the quiet voice of humanist reason, kicking against what he sees increasingly as a sinister cult of admiration for IT.

Professor Roszak presents a plausible nightmare of a new generation who might be tempted to bypass the methods of original, creative thought and insightful ideas because we have been so steeped in procedural, mechanistic analysis.

'The art of thinking,' he re-asserts, *'is grounded in the mind's astonishing capacity to create beyond what it intends, beyond what it can foresee.'* A computer would not understand what he means.

David Taylor

All done by numbers



Title: Is Man a Robot?
Author: Geoff Simons
Publisher: John Wiley & Sons
Price: £14.95

It's to be hoped that Geoff Simons never takes a stroll across the Californian campus and bumps into Theodore Roszak. The two would not get on. Is man a robot? That is to say, can the human brain be understood as an extraordinarily clever cybernetic system, a piece of super-smart engineering? The short answer, according to Mr Simons, is 'yes'. The long one is argued via a potted history of robotic concepts and wild conjecture.

He's quite a prophet of the New Dawn, and thinks nothing of plunging into mind-boggling summaries like this:

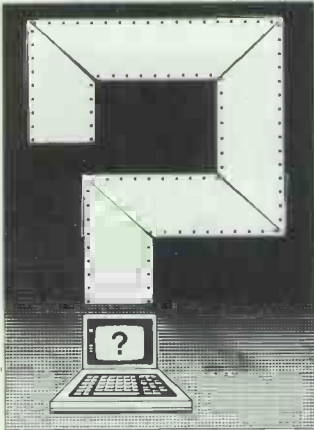
'We have seen that, at all stages, from initial perception to the development of intimate sexual relations, human behaviour is defined in terms of such obvious cybernetic categories as information processing, discrimination using feedback, and the realisation of desirable objectives by establishing sustainable homeostatic conditions.'

That's what he's seen, right enough, but I'm not sure 'we have seen' is justified. Geoff Simons is the realisation of Theodore Roszak's worst fears — a technophile so steeped in bemusement with computerised wizardry that he does not hesitate to put Descartes before the horse with ludicrous results.

David Taylor

COMPUTER ANSWERS

*Simon Goodwin takes his toolkit to your problems.
The address to write to is Computer Answers, PCW,
32-34 Broadwick Street, London W1A 2HG.*



Computer Answers is PCW's help column. We offer advice about all kinds of specific hardware and software problems through the pages of the magazine. We also welcome further information in response to published queries.

WordStar configuration

My printer is the Shinwa CP80, but while running WordStar I am unable to utilise any of its different print styles. From the WordStar help screens it appears as though there are some user-definable print codes, but as my micro is second-hand and I don't have any software manuals, I have no idea how to install these. Can you offer any advice?

IC Hayes, Godalming, Surrey

Every month brings a new crop of WordStar-configuration questions, so I'm pleased to have found a fairly general answer. The Public Domain Software Library produces a CP/M 'Install pack' which consists of a 40-page booklet and a disk full of software tools.

The booklet is a guide to program installation for 'the not-too-technical' — no programming experience is assumed. It contains information about relevant CP/M utilities, display configurations, and WordStar, Supercalc and dBasell patch areas.

The disk contains a patch

for WordStar which allows any printer code to be sent to a document. This gives you unlimited access to the facilities of your printer, as long as you can find out the correct codes — these should be in the printer manual. You also get text and disk editors, a utility to convert CP/M 2.2 programs for CP/M Plus, assemblers, disassemblers and debuggers, plus lots of other useful bits and pieces.

All of this software is in the public domain, and the whole pack costs just £9, or £6.50 for members of the Public Domain Software Library (see the October 1986 issue for details). Postage in the UK costs 34p. The price does not include the media for the software, which you supply. Send enough disks (usually just one) to hold 250k of data. Format the disks, and record PIP.COM and a text file of at least 30k on them. This makes it easy for the group to work out what kind of disk system you're using — it can handle any CP/M format other than Cypher, Commodore and hard-sectored disks.

The CP/M User Group Library is situated at 72 Mill Road, Hawley, Dartford, Kent DA2 7RZ.

Word power

I am working on a word processor for the Commodore 128, and would like to know if it is possible to program the machine to display 80 columns on a TV screen. I am working in both 64 and 128 mode.

Dane Young, Hallstahammar, Sweden

As you must realise, the 80-column display built into the 128 will only drive an expensive RGB monitor. The normal TV display only produces 40 characters on each line, but it is possible to increase this with some fairly simple machine code software. Basic is fast enough for experimentation but is unlikely to be able to keep up with a typist.

Normally, each character is displayed in an eight by eight 'pixel' grid of points.

The machine can show 320 pixels across each line of the screen, so resolution is limited to $320/8 = 40$ characters. To get more characters, you must reduce the width of each one.

You need a gap of at least one point between one letter and the next, and three points is an absolute minimum width to represent the entire character set recognisably. You can fit 80 characters on a line if you use four pixels per character, squashing two re-defined characters into one space on the 40-column screen. It is quite practical to mix the two formats.

You must define a new narrow character set, and write a small machine code program to mask groups of patterns corresponding to text into the display memory. This technique is used to give many Spectrum word processors a 64-column display with only 256 points on a line. The characters will look a little ragged, but they should be clearly readable as the TV is displaying no more points than usual.

Apricot info

Could you give me the address of the Apricot User magazine mentioned in the September 1986 issue of PCW, and subscription details.

ZAB Creaser, Istanbul, Turkey

Apricot User used to be published by VNU (PCW's publisher), but it closed when Apricot abandoned its own range and decided to sell ersatz IBM computers instead. As you're doubtless aware, many of Apricot's older models ended up in Turkey, particularly in colleges.

There is still one title supporting users of 'real' Apricot computers — *Apricot File* is a monthly newsletter published by staff from the magazine *16-bit Computing*. The content is fairly technical. A year's subscription costs £50 within the UK, £60 in Europe and £65 anywhere else.

Sample copies are available free from *Apricot*

File, PO Box 509, London N1 1YL. Tel: (01) 833 3501.

Cryptic clue

Could you please tell me if the following algorithm about cryptography is a new one, or a reinvention of the wheel?

The sender and receiver each have an identical large array with the alphabet, plus a 'garbage' character, randomly distributed throughout. In other words, the array contains 27 disjoint sets. To encipher a message the sender picks symbols as required from the array, deleting entries as they are used and transmitting the array index for each entry. The indices of 'garbage' characters are scattered through the data at random. To decipher the message, the receiver simply uses the indices to look up letters at corresponding positions in the array. Garbage characters are ignored. With this method, there is no frequency distribution of any kind.

G Costopoulos, Athens, Greece

This is a well-known technique, I'm afraid, although the idea of the 'garbage character' does add a little spice. Your array plays the part of a conventional code book, as used by diplomats and soldiers for centuries. It is a fairly effective system as long as the books are kept secret and the users have plenty of time to encode and decode messages.

Your computerised solution speeds up the technique, as did the German Enigma code machine (see the article 'Enigma variations', *PCW* May 1986). Enigma was a clever mechanical implementation of your ideas: its mechanism simulated several small code books used in succession. The Enigma code was cracked at Bletchley Park during the Second World War by people who helped to develop the modern computer.

Your final statement is correct, but only if the

random function which you refer to is unpredictable. Most computer 'random number generators', although good enough for games and simple probabilistic programming, would let you down.

There are many other ways to encypher data. Two classic books about code are *Elementary Cryptanalysis* by Abraham Sinkov, and *Cryptanalysis* by Helen Gaines. But if you can't find these, there's no shortage of other titles.

CP/M on the PC

I am considering buying an Amstrad PC, but I don't want to lose the software investment I have in CP/M applications.
C H Whitford, Horston Hill, Leicester

Has anyone written a CP/M Plus emulator for the PC1512? Can I attach a 3in disk drive to the RS232C port on the PC to read and write disks from the Amstrad 8512 word processor?
John S David, Camberwell, London

Early business micros used a program called CP/M, later refined into CP/M Plus, to control displays, disks, printers, and so on, so that these could be treated alike by business programs, whatever their exact specification. CP/M was small, slow and simple. It only worked with early microprocessors — in particular the 8080 and the 8085 from Intel (which subsidised early development work) and the cheap and popular Zilog Z80, which is used in Amstrad's word processors and home computers.

In 1981 IBM, and many manufacturers since, decided to use a different range of chips, starting with components numbered 8088 and 8086. These were developments of the 8080 but had several differences — they would not run the same programs. IBM chose a different, although similar, operating system for its machines, called MS-DOS or PC-DOS.

Programs for CP/M systems will not run on MS-DOS computers because CP/M is not present and the processor is wrong. You must fix both of these problems if you want to run CP/M on a PC. There are two options: either you give the

software what it wants, by adding a second processor and CP/M software to your system; or you use a program that makes the PC pretend to be a CP/M system. The first approach is expensive; the second doesn't always work.

Programs that use both approaches are available from the Public Domain Software Interest Group (PDSIG) — see 'WordStar configuration' opposite. Z80MU is a complicated program that impersonates a CP/M computer with a Z80 processor. It can run many machine code compilers and assemblers, plus later versions of business software such as dBasell and WordStar.

The first snag is that emulated programs run slowly. The full power of the PC is not being used, and sometimes the need for precise emulation slows things down further because the 8086 and the Z80 work rather differently.

Secondly, some programs don't work at all. Some CP/M packages try to interact directly with the system hardware, or rely upon the machine running at a certain speed. These badly-behaved programs will not run on an emulator.

If greater compatibility is required, you need a processor which can run CP/M programs directly.

The electronics company NEC has come to the rescue with a chip called a V20. This plugs into the 8086 socket inside a PC, speeding things up a little and — more importantly, from the point of view of CP/M — adding a facility to run programs for the 8080 processor.

Also on the Z80MU disk, the PDSIG supplies a program which impersonates CP/M while using the V20 to run programs. This speeds things up and increases compatibility, although there are a few instructions which only the Z80 can handle directly. CP/M software is not meant to use such instructions, but in practise some packages use them to gain extra speed — the result will be quite the reverse if an emulator is used.

NEC has promised a Z80 version of the V20 — the V25 — but there's no sign of it yet. The authors of Z80MU hope to write a new version when the chip becomes available.

Several commercial emulators are available, of mixed quality, but I haven't had direct experience of

these. It's a good idea to try the public domain ones first, as they work with many CP/M programs and copies cost just £2 per disk — the software itself is free.

The PDSIG has recently changed its address. For more details of the group; send an *sae* or International Reply Coupon to Winscome House, Beacon Road, Crowborough, East Sussex TN6 1UL. Details of the basic version of Z80MU can be found in the October 1986 issue of the American magazine, *Byte* (page 203).

There are several ways to transfer software from a 3in disk to a PC. Plugging a 3in drive into the PC is probably the more costly and difficult. If you have an RS232 interface on your word processor, you can transfer data or programs down a wire to the RS232 interface of the PC, although this may involve some fiddling around.

You may prefer to pay the PDSIG or a company such as Grey Matter ((0364) 53499) to transfer the data onto a PC disk for you. This is not very expensive and often quicker than working out how to do it yourself.

If you need to transfer lots of information, your best bet is to put a PC-compatible 5¼in drive on your word processor. Kits to do this cost £100-£200, depending upon whether or not you already have a spare drive. Several firms advertise these, including Timatic Systems of Fareham ((0329) 239953). Software to read and write PC disks is generally included. As ever you should explain exactly what you want, and get a guarantee that the equipment will do the job before you part with any money.

Breaking and entering

Is it possible for a specialist engineer to obtain information from a computer store which is protected by password access, by circuit manipulation or other means, when he or she is not authorised?
Desmond Cox, Dublin

In a word — yes. However, system designers know this, and can make unauthorised access to a system difficult or almost impossible.

Most fraud or theft of

information from computer systems occurs because of human error rather than poor software or hardware design. For instance, a print-out of confidential data may be stolen, a password may be disclosed, or someone with access to the required information might be bribed or blackmailed into disclosing it. In general, this is much easier than obtaining information through technical effort.

Technical 'hacking' is still possible, despite all the efforts of system designers. It is generally very difficult and requires a good deal of time, luck and skill. Such an approach is rarely attractive to criminals — technical hacking is usually performed by naive enthusiasts with benign, or at least non-criminal, intentions.

Often a system will be able to detect hacking even it can't stop it. In such cases the perpetrators are either told off, charged in the High Court or hired by their targets — depending, it seems, upon the publicity involved.

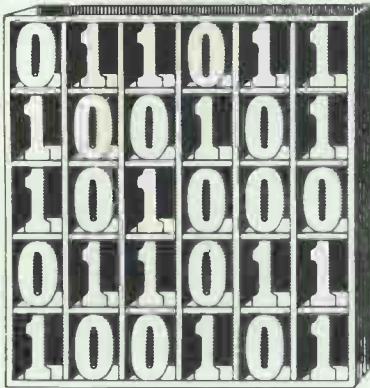
There is one especially easy way to obtain confidential data — you can 'snoop' on data displayed in a report on a working screen. All TV-type displays generate an electric and magnetic field as they paint the screen. This happens with TVs, monitors, oscilloscopes and anything else with a cathode-ray display.

The field varies in direct relation to the display, and can be detected with simple hardware at a range of up to 100 metres. All you have to do is get a second display running in sympathy with the field of the first, and you can see anything that the original operator can read.

I can confirm how easy this is from personal experience. When I was at university five years ago I used to intercept the display of a friendly hacker with a home-made computer, 13 storeys below me. The same is possible in any office block or from the street outside.

One way to stop this kind of snooping is to install costly and inconvenient metal screens between the display and the putative receiver. These screens stop the field leaking out.

Alternatively you can use perimeter fences and security guards to keep snoopers out of range of sensitive data — the problem, in both cases, is guessing the sensitivity of receiving equipment. **END**



David Barrow presents more documented machine code routines and useful information for the assembly language programmer. If you have a good routine, an improvement or conversion of one already printed, or just a helpful programming hint, then send it in and share it with other programmers. Subroutines for any of the popular processors and computers are welcome but please include full documentation. All published code will be paid for. Send your contributions to SubSet, PCW, 32-34 Broadwick Street, London W1A 2HG.

Z80 RADIX CONVERSION

CONVHL (Datasheet 1) from John Kerr of Glasgow will convert a 16-bit value to an ASCII string in any of several different bases.

The routine is part of a 1094-byte Z80 disassembler that John has written for his PCW8256. Because of the need to pack a lot of processing power into a compact program, CONVHL is heavily optimised for brevity and the input parameters are of a completely non-standard form. Not only is the radix, or base, limited to an even

number between 2 and 16, but it must also be input-halved and two-complemented for the optimised algorithm that John uses. CONVHL also fails to check for, and abort on, invalid input.

These faults are not serious if CONVHL is considered only as a subroutine of one program that does pass a correctly formatted radix on each of the few calls made to the routine. However, if you want to use CONVHL as a standalone routine, it would be wise to include a preparatory sequence to validate input and convert from a standard form of radix to that required by the algorithm.

DATASHEET 1

```
CALL : CONVHL
      Base conversion of a 16-bit value to an ASCII string
      of even radix < 16, suppressing leading zeros and
      appending one leading zero where the a.s. digit > 9.
```

STRUCTURAL CONCEPTS

```
PROGRAM digit = terminator.
UNTIL number = 0
(
  STACK digit.
  digit = number MOD radix.
  number = number DIV radix.
)
IF digit > 9
(
  STACK digit.
  digit = 0.
)
UNTIL digit = terminator
(
  digit = ASCII digit.
  STORE digit.
  DE-STACK digit.
)
```

SYSTEM REQUIREMENTS

```
PROCESSOR Z80
HARDWARE None.
SOFTWARE Written as a local subroutine for a Z80 disassembler.
```

PROGRAMMING DETAILS

```
INPUT HL contains unsigned 16-bit number.
      DE indexes output buffer.
      C = twos complement of the required "half-radix",
      (0FCH = octal, 0FBH = decimal, 0F0H = hex, etc.).
OUTPUT ASCII string in output buffer.
      DE indexes next free buffer byte (string + 1).
STATE CHANGES DE updated. AF, BC and HL changed.
I/O ERRORS Unflagged invalid result if input is for an odd
            number radix or radix greater than 16.
OPTIMISATION The input radix must have been pre-adjusted to the
            form required by the routine.
            A "half-radix" is used for subtraction before
            dividend is shifted to remainder accumulator in
            the conversion division.
            The twos complement of the divisor is used to
```

```
remove the need to complement each result bit.
A leading zero is appended by performing one
extra iteration of the radix conversion.
Conversion of hex to ASCII depends on the action
of the Decimal Adjust Accumulator instruction.
; INTERRUPT EFFECT May be interrupted and re-entered.
; LOCATION NEEDS Not specific. Relocatable and PROMable.
; PROGRAM BYTES 32
; STACK BYTES 10 maximum.
; CLOCK CYCLES 4277 maximum.
```

```
CONVHL SUB A ;Initially stack Z terminator. 97
;...Radix conversion loop - repeatedly divide by radix until zero.
CVHL1 PUSH AF ;Stack terminator or remainder F5
      SUB A ;digit. Clear accumulator. 97
      LD B,16 ;Set 16-bit division count. 06 10
;...Radix division loop - find next remaining digit.
CVHL2 ADD A,C ;Long division by adding twos 01
      JR C,CVHL3 ;complement of half-radix to 30 01
      SUB C ;remainder accumulator before 91
CVHL3 ADC HL,HL ;shifting (if it goes), then ED 0A
      RLA ;shifting quotient bit into 17
      DJNZ CVHL2 ;HL. Repeat for 16 bits. 10 F7
;
      JR NZ,CVHL1 ;Repeat until quotient HL = 0. 20 F1
;
      CP 10 ;If most significant digit is FE 0A
      INC B ;a letter then (clearing Z) 04
      JR NC,CVHL1 ;iterate for a leading zero. 30 EC
;...De-stack, convert to ASCII and store to buffer.
CVHL4 CP 10 ;Set Cy if 0-9, SBC sets half FE 0A
      SBC A,69H ;carry flag if 0-9, DAA DE 69
      DAA ;completes ASCII conversion. 27
      LD (DE),A ;Store ASCII to buffer and 12
      INC DE ;bump pointer. 13
      POP AF ;Retrieve next digit, repeat F1
      JR NZ,CVHL4 ;until terminator. 20 F6
;
      RET ;Exit, ASCII in buffer. C9
```

CONVERSION TO ASCII

Have a look at the tricky method John uses in CONVHL to convert the raw digits (0-9 and A-F) to ASCII (30H-39H and 41H-46H) at label CVHL4.

CP 10 and SBC A,69H are used to pre-adjust the value in the accumulator and to set the carry and half-carry flags

correctly. The final adjustment relies on the Z80's DAA instruction subtracting a 6 from each digit, depending on the state of the flags.

The method is quite ingenious and saves 3 bytes and 8 or 10 clock cycles (time states) on the normal method of testing for the break between digits 9 and A, adding 7 if the digit is a letter. Unfortunately, it cannot cope with any base higher than hexadecimal.

8086 BLOCK TRANSFER

Datasheet 2, IBT86, from Terry Browning of Wells, almost solves the problems,

discussed in the October 1986 SubSet, of shifting overlapping blocks of data in segmented 8086 memory.

Both source and destination addresses are standardised so that each segment register has the highest possible value, and

the offset in SI and DI is no more than 000FH. This method makes comparison easy, but does not entirely eliminate the problem of segment wrap-around. It will occur if offset plus byte count exceeds the segment size (64k). IBT86 is intelligent enough to abort in these few cases — but should it abort or find some way to move these few awkward bytes?

The 8086 can address 1Mbyte of memory in 64k segments at any 16-byte

boundary. Is it too much to expect a routine capable of moving a complete 64k segment? And why limit the move to just one segment? There is still room for a great deal of improvement to be made to IBT86.

The documentation of Datasheet 2 was devised by Terry and is based on previous SubSet datasheet formats. No format is sacred: the only object is to provide clear and necessary information about a routine.

DATASHEET 2

```

;DATA MOVEMENT
;INTELLIGENT BLOCK TRANSFER
;IBT86

;OBJECTIVES
JOB          Move a block of bytes from source to destination
              without overwriting the source before moving it.
ALGORITHM    Standardise then compare the source and destination
              addresses, moving the data accordingly.

;SOFTWARE DEPENDANCE
LANGUAGE     Intel iAPX assembly language.
DIALECT      8086.

;HARDWARE DEPENDANCE
MACHINE      Intel iAPX processor.
MODEL        8086, 80286 or 80386.

;RESOURCES CONSUMED
MEMORY/TIME  Bytes: 135 program; 20 (22 for 80386) stack.
              Cycles: (n = number of bytes moved), (approximate).
              8086: Unknown.
              80286: 251 + 191fdown + 2.51fodd + 4.5 * n.
              80386: 242 + 191fdown + 4.51fodd + 4.5 * n.

OTHER        None.

;INTERFACES
HOW TO USE:  3 inputs; 1 output.
INPUTS       CX = number of bytes.
              SI = source block start address.
              DI = destination block start address.
OUTPUT       Flag   OK      Error
              OV      Clear   Set
SUPPORT      The call MUST be FAR.

;ERRORS
TRAPPED      Either block exceeding the limits of the addressing
              range (00000H to 0FFFFFH); attempting to move too
              many bytes (the limit is between 65520 bytes and
              65535 bytes, depending on the exact value of the
              bottom nibble of source and destination indexes).
UNTRAPPED    If run on an 80386, the top word of ECX must be
              zero; the top words of ESI and EDI must either be
              the same, or the source and destination indexes
              must be at least 1MB apart.

```

```

IBT86 PROC FAR ;Intersegment calls.

PUSH AX ;Save the contents of 58
PUSH BX ;all registers to be 53
PUSH CX ;used in IBT86. 51
PUSH DX ; 52
PUSH SI ; 56
PUSH DI ; 57
PUSH DS ; 1E
PUSH ES ; 05
PUSH BP ; 55
PUSHF ;Push flags. 9C

```

```

MOV DX,CX ;Save count in DX. 8BD1
MOV BP,SP ;Index stacked flags. 8BEC
MOV CH,4 ;Nibble shift count template. B5 84
OR CBP1,0000H ;Set overflow flag on stack. 814E 88 0000

```

...Source address = DS * 16 + SI. Compute highest Segment value...
 ...Standardise: DS = DS + (SI \ 16). SI = SI AND 000FH

```

MOV AX,SI ;Get source offset 8BC6
MOV CL,CH ;and divide by 16 to 8ACD
SHR AX,CL ;find segment component. D3E8
MOV BX,DS ;Get source segment and add 8CDB
ADD AX,BX ;to new component, DS is now 83C3
MOV DS,AX ;highest possible segment of 8ED8
JC ABORT ;source. Abort if memory wrap. 72 59

```

```

AND SI,0FH ;Source offset now in 1st 16 81E6 0F00
MOV AX,SI ;bytes of segment. Check if 8BC6
ADD AX,DX ;offset + count wraps around 83C2
JC ABORT ;segment and abort if so. 72 4F

```

...Destination address = ES * 16 + DI. Compute highest Segment value...
 ...Standardise: ES = ES + (DI \ 16). DI = DI AND 000FH

```

MOV AX,DI ;Get destination offset 8BC7
MOV CL,CH ;and divide by 16 to find 8ACD
SHR AX,CL ;new segment component. D3E8
MOV BX,ES ;Add input segment value to 8CC3
ADD AX,BX ;new component, making ES 83C3
MOV ES,AX ;highest possible segment of 8ED8
JC ABORT ;dest. Abort if memory wrap. 72 41

```

```

AND DI,0FH ;Dest. offset now in 1st 16 81E7 0F00
MOV AX,DI ;bytes of segment. Check if 8BC7
ADD AX,DX ;offset + count wraps around 83C2
JC ABORT ;segment and abort if so. 72 37

```

...Form addresses into 20-bit sequences in DS,AL and ES,BL for easy
 ...comparison with any carry out of lowest nibbles subtraction.

```

MOV AX,SI ;Get source offset (= 8 to F) 8BC6
MOV CL,CH ;and move it into high order 8ACD
SHL AX,CL ;nibble of AL, clearing low D3E8
MOV BX,DI ;order nibble. 8BD5
MOV CL,CH ;Repeat for destination 8ACD
SHL BX,CL ;offset into high order D3E3
MOV CX,DX ;nibble of BL. 8BCA

```

```

SUB AL,BL ;Subtract (src - dst) lowest 2AC3
MOV AX,DS ;digits first, then highest 8CD8
MOV BX,ES ;four digits, setting C only 8CC3
SBB AX,BX ;if source address is lower 1BC3
JNC UPBT ;than destination address. 73 11

```

...Source lower than dest. so move from highest addresses downwards.

```

ADD SI,CX ;Set offset pointers to 03F1
DEC SI ;highest bytes by adding 4E
ADD DI,CX ;byte count, subtracting 1. 03F9
DEC DI ; 4F

```

```

STD ;Set D for auto-dec MOVs. FD
SHR CX,1 ;CX = word count, C = odd D1E9
JNC DNEVEN ;byte, skip if no odd byte. 73 02

```

```

INC CX ;Add 1 for byte move and 41
MOVSB ;move odd byte. A4

```

```

DNEVEN DEC SI ;Set offset pointers to low 4E
DEC DI ;bytes of 1st word to move 4F
JMPB EVENMV ;then go move by words. EB 02

```

...Source >= dest. so move from lowest addresses upwards.

```

UPBT CLD ;Clear D for auto-inc MOVs. FC
SHR CX,1 ;CX = word count, C = odd D1E9
JNC EVENMV ;byte, skip if no odd byte. 73 02

```

```

INC CX ;Add 1 for byte move and 41
MOVSB ;move odd byte. A4

```

...Move majority of data by word move, up or down on state of D flag.

```

EVENMV REP MOVSW ;move remaining words, then F3A5
XOR CBP1,0000H ;clear OV to show move done. 8176 00 0000

```

```

ABORT POPF ;Restore Flags, with overflow 9D
POP BP ;clear if move occurred. 5D
POP ES ;Restore all registers 07
POP DS ;to entry state. 1F
POP DI ; 5F
POP SI ; 5E
POP DX ; 5A
POP CX ; 59
POP BX ; 5B
POP AX ; 58
RET ;Intersegment return. CB

```

IBT86 ENDP

6502 STRAIGHT LINES

LINE16 (Datasheet 3) from Mario Camilleri of B'Kara in Malta calculates all intermediate points between start and end coordinates — both taken as 16-bit signed values. Mario estimates that the routine is capable of generating about 13000 points a second at 2MHz.

The routine will not plot the actual points to screen, nor will it convert the signed values to valid screen coordinates. Both of these activities are hardware, dependent and slow down the plotting rate considerably. However, in a

dedicated system, the routine could be adapted to work directly with valid screen coordinates — even to the extent of having a preceding routine to clip the line to the current window size, and this would regain some of the lost time. As it stands, LINE16 is a good, general-purpose, line-drawing routine.

Mario gives two references for the algorithm he uses: (i) Bresenham JE (1965); *Algorithm for Computer Control of Digital Plotter*. (IBM System Journal 4(1) 1965, pp25ff). (ii) Cesa L, Kellerman E, Hitchcock R (1978); *An Algorithm for Drawing Lines* (quoted in Liffick BW (ed) (1979) *Bits and Pieces, Byte Publications*).

SUBSET

DATASHEET 3

CALL : LINE16
Plot a straight line segment given signed 16-bit start and end coordinates.

STRUCTURAL CONCEPTS

```
PROGRAM IF startx > endx
[
  SWAP startx,endx.
  SWAP starty,endy.
]
diffx = endx - startx.
diffy = ABS (endy - starty).
stepy = SGN (endy - starty) OR 1.
stepcount = GREATER (diffx,diffy) \ 2.
UNTIL endtest = 0
(
  PLOT (startx,starty).
  IF diffx > diffy
  [
    endtest = endx - startx.
    startx = startx + 1.
    stepcount = stepcount - diffy.
    IF stepcount <= 0
    [
      stepcount = stepcount + diffx.
      starty = starty + stepy.
    ]
  ]
  endtest = endy - starty.
  starty = starty + stepy.
  stepcount = stepcount - diffx.
  IF stepcount <= 0
  [
    stepcount = stepcount + diffy.
    startx = startx + 1.
  ]
]
)
```

SYSTEM REQUIREMENTS

PROCESSOR 6502
HARDWARE Bit mapped display.
SOFTWARE "PLOT" - Plot a pixel on a bit mapped display, using 16-bit coordinates (M0,1 = x, M2,3 = y).
"INCR" - local subroutine to adjust y coordinate.

PROGRAMMING DETAILS

INPUT M0,1 = Start x coordinate.
M2,3 = Start y coordinate.
M4,5 = End x coordinate.
M6,7 = End y coordinate.
OUTPUT Line plotted.
STATE CHANGES M0 to MF, registers A, X and Y changed. P preserved.
I/O ERRORS None known.
OPTIMISATION Depends on PLOT to filter out off-screen pixels.
INTERRUPT EFFECT May be interrupted. May be reentered only if registers and M0 to MF are saved by interrupting routine.
LOCATION NEEDS Not specific. Not relocatable. PROMable.
PROGRAM BYTES 204
STACK BYTES 3
CLOCK CYCLES approx. (98 to 248) → (62 to 147) * pixels.

...Define page zero input and workspace.

```
STRX = M0 ;Word input, start x coordinate.
STRY = M2 ;Word input, start y coordinate.
ENDX = M4 ;Word input, end x coordinate.
ENDY = M6 ;Word input, end y coordinate.
DX = M8 ;Word w/space, end x - start x.
DY = M8 ;Word w/space, magnitude (end y - start y).
COUNT = MC ;Word w/space, step counter.
STEP = ME ;Byte w/space, y step hi-byte (00 or FF).
AXIS = MF ;Byte w/space, index to x or y parameters.
```

```
LINE16 PHP ;Save flags and clear decimal 00
CLD ;flag to ensure binary arithmetic. 00
```

...Calculate parameters.

```
CALCDX LDX #0 ;Clear for later indexing. A2 00
SEC ;Prepare to subtract. 30
LDA ENDX ;Calculate difference between A5 M4
SBC STRX ;start x and end x, storing the E5 M0
STA DX ;result in DX. 85 M0
LDA ENDX+1 ; A5 M5
SBC STRX+1 ;LINE16 needs positive DX E5 M1
STA DX+1 ;so test for signed overflow or 85 M9
BVC NOOV1 ;negative values. 50 01
ROR A ;If overflow, get sign to sign bit A. 6A
NOOV1 BPL CALCDY ;If positive, calc DY, else... 10 0F
SWAP LDY STRX,X ;indexing all 4 bytes of x & y coords. 84 M0
LDA ENDX,X ;exchange start and end 85 M4
STA STRX,X ;coordinates (draw line in reverse 95 M0
STY ENDX,X ;direction) so that DX will be 94 M4
INX ;positive. E0
CPX #4 ; 00 04
BNE SWAP ; D0 F3
BEQ CALCDX ;With ends reversed, recalculate DX. F0 DD
CALCDY SEC ;Prepare to subtract. 30
LDA ENDY ;Calculate difference between A5 M6
```

```
SBC STRY ;start y and end y, storing the E5 M2
STA DY ;result in DY. 85 M0
LDA ENDY+1 ; A5 M7
SBC STRY+1 ;LINE16 needs magnitude of DY E5 M3
STA DY+1 ;so test for signed overflow or 85 M8
BVC NOOV2 ;negative values. 50 01
ROR A ;If overflow, get C as sign in A. 6A
NOOV2 BPL DYPOS ;If positive, do STEP = 0, else... 10 0C
TXA ;(using X=0 from routine start) 0A
SEC ;find 2s complement of difference 30
SBC DY ;to give magnitude, i.e. the number E5 M0
STA DY ;of points between y start and end. 85 M0
TXA ;Direction of movement will be 0A
SBC DY+1 ;achieved by incrementing or E5 M8
STA DY+1 ;decrementing by adding STEP. 85 M8
DEX ;Set X = -1 for negative STEP. CA
DYPOS STX STEP ;y coord STEP (hi-byte) = 0 or -1. 86 ME
LDA DY+1 ;Find greater of DY,DX. A5 M8
CMP DX+1 ;if DX>DY then x is stepped every loop C5 M9
BNE C1 ;else y is stepped every loop. D0 04
LDA DY ; A5 M0
CMP DX ;Shift comparison result to bit 1, A C5 M8
ROL A ;so that A=0 if DX>DY and x is the 2A
ROL A ;control coord, else A=2 if DX<DY 2A
AND #2 ;and y is the control coord. 29 02
STA AXIS ;Store A in AXIS as index to x or y. 85 MF
TAX ;Using x or y index. AA
LDA DX+1,X ;get (greater of DX or DY) / 2 B5 M9
LSR A ;as initial value of count. 4A
STA COUNT+1 ; whenever count goes below 1, it will 85 MD
LDA DX,X ;be incremented by control coord 85 M8
ROR A ;difference. This initialisation gives 6A
STA COUNT ;a half step at both ends of the line. 85 MC
; ...Begin plotting.
LOOP JSR PLOT ;Plot pixel at (M0,1 = x, M2,3 = y). 20 10 hi
LDX AXIS ;Using x or y index. A6 MF
LDA STRX+1,X ;test if current point (just plotted) B5 M1
CMP ENDX+1,X ;equals last point to plot. D5 M5
BNE C2 ; D0 06
LDA STRX,X ; B5 M0
CMP ENDX,X ; D5 M4
BEQ EXIT ;Exit LINE16 if last point plotted. F0 59
C2 TXA ;Complement the x or y index so that 0A
EOR #2 ;it indexes the lesser difference. 49 02
TAX ; AA
SEC ;Prepare to subtract. 30
LDA COUNT ;At each point plotted, the count A5 MC
SBC DX,X ;goes down by the lesser of DX or DY F5 M8
STA COUNT ; 85 MC
LDA COUNT+1 ; A5 MD
SBC DX+1,X ; F5 M9
STA COUNT+1 ; 85 MD
ORA COUNT ;Test count. 85 MC
BEQ INCCMP ;If count <= 0 then step the coord F0 07
BCC INCCMP ;with lesser difference. 90 05
DEX ;Else test which is control coord CA
BPL INCCTX ;(stepped every time) and go inc x 10 17
BMI INCCTY ;or step (inc or dec) y. 30 24
INCCMP LDX AXIS ;Using x or y index. A6 MF
CLC ;prepare to add. 10
LDA COUNT ;and add greater of DX or DY to A5 MC
ADC DX,X ;count that has gone below 1. 75 M8
STA COUNT ; 85 MC
LDA COUNT+1 ; A5 MD
ADC DX+1,X ; 75 M9
STA COUNT+1 ;Test which is complementary coord 85 MD
DEX ;(stepped only when count incremented) CA
BPL INCCPX ;and inc comp-x then control-y. 10 0C
JSR INCR Y ;or comp-y then control-x. 20 10 hi
INCCTX INC STRX ;Inc every iteration when E6 M0
BNE LOOP ;DX > DY D0 0A
INC STRX+1 ;then loop back to plot point E6 M1
JMP LOOP ;and repeat until end of line. 4C 10 hi
INCCPX INC STRX ;Inc only when count adjusted E6 M0
BNE INCCTY ;(since DX <= DY) D0 02
INC STRX+1 ;then ... E6 M1
INCCTY JSR INCR Y ;Inc every iteration (DX <= DY) and 20 10 hi
JMP LOOP ;repeat, plotting point, until end. 4C 10 hi
; ...Local subroutine to increment/decrement y coordinate.
INCR Y LDA #1 ;inc or dec y coordinate by adding YA. A9 01
LDY STEP ;Set lo-byte A = 1 for inc and get A4 M0
BEQ ADD ;hi-byte Y. If hi-byte Y negative then F0 02
LDA #FF ;set A = $FF, YA = -1, for dec. A9 FF
ADD CLC ;Prepare to add 1 or -1 to y coordinate. 10
ADC STRY ;Add lo-byte B5 M2
STA STRY ; 85 M2
TYA ;and 90
ADC STRY+1 ;hi-byte. 85 M3
STA STRY+1 ;addressing next point on line. 85 M3
RTS ;Return to main routine. 60
EXIT PLP ;Restore flags 20
RTS ;and exit main routine, line drawn. 60
```


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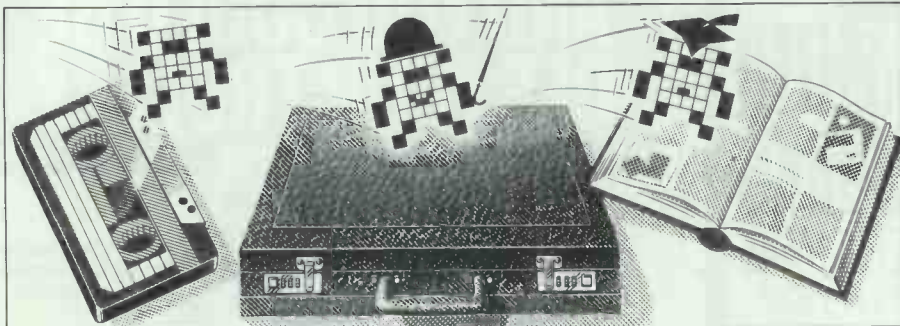
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PROGRAM FILE



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PCW is interested in programs written in any of the major programming languages for all home and small business micros. When submitting programs please include a cassette or disk version of your program, brief but comprehensive documentation, and a listing on plain white paper — typed if you have no printer.

Please ensure that the software itself, the documentation and the listing are all marked with your name, address, program title, machine (along with any minimum requirements) and — if possible — a daytime phone number.

Check through the previous Program Files to see the kind of programs we prefer. As a rough guide, original ideas are always welcome, as are good implementations of utilities and applications.

Obviously the programs should be well-written, easy to understand, and preferably not too long (remember that other readers have to type them in).

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We prefer to receive programs with a maximum 80-column width printed in emphasised typeface.

We will try to return submissions if they are accompanied by a stamped, addressed envelope of the appropriate size, but please keep a copy of everything.

Programs are paid for at the rate of £50 per page of published listing, plus a £50 bonus for the Program of the Month. Send your contributions to Owen Linderholm, Program File, PCW, 32-34 Broadwick Street, London W1A 2HG.

Oh frabjous day! Callooh! Callay! QL programs are back! PCW still doesn't own a machine, but because of our wide-ranging contacts and our extremely rapid problem-solving ability, we eventually managed to borrow one. However, my initial delirious delight was soon turned to a sobering sense of reality when I looked at the backlog of QL programs.

But, as usual, the huge number rapidly thinned out to a core group of real contenders, the majority of which have made it into this month's Program File.

Some readers may have noticed the changes in Program File that have been occurring over recent months. I have been trying to persuade authors to include more documentation and explanation with their programs. Although this means that fewer programs are published each month due to the extra space taken up by text, their quality has im-

proved. Consequently, programs will be easier to understand and convert to other machines.

A new section on programming algorithms and techniques, and how to use them, is being planned. I hope to receive contributions for this section, as well as comments, improvements, and so on. The algorithms and techniques are intended to be general, and applicable to all machines. I'll supply the routines in pseudo-code and Modula-2, and provide conversion tips for using the routines in Basic.

Program File will continue to supply the usual range of high-quality programs and hints and tips, hopefully with much-improved documentation.

Guidelines

Each month I explain the procedure for submitting programs to Program File, but it obviously has had little

effect. I still receive huge numbers of submissions with inadequate documentation, no listing or no disk copies, no stamped, addressed envelope... So, once again, here are some general rules.

Always include a stamped, addressed envelope with submissions or you won't get them back (or, indeed, ever hear of them again).

Please include twice as much documentation as you think necessary. Documentation *must* be double spaced (a blank line between each line of text) and should preferably be on disk, too. If possible, include diagrams. Listings should be as dark as possible on white A4 paper; they should also be carefully commented. A listing which consists of many short lines and a few long lines will be photo-reduced so that the long lines fit. Therefore, the listing will be condensed and hard to read, so ideally it should consist of lines of

similar lengths which should contain between 60 and 70 characters.

Finally, *always* include a listing and a cassette or disk copy of the program, and source code if any.

This month's programs

The Program of the Month is for the QL. The program is called QL Windows and extends the QL's existing windows to allow them to overlap non-destructively. The basic parts of the program are in 68000 code and could probably be adapted to other 68000-based systems.

The program effectively adds extensions to the QL's Superbasic and comes in several forms. There is a Basic program that loads in the extensions as hex, an assembler listing, and a demonstration Basic program which shows how to make use of the new windowing facilities.

The second program also deals with windowing, and adds this and other facilities to Commodore 64 computers. Unfortunately, the program consists mostly of data statements to be loaded into memory by a loader program, so it will be difficult to type in.

The third program allows one-key macros on the QL, and enables users to set up key combinations to represent any string. It has been initially set up to provide a set of common Basic keywords, but it could be altered to provide different strings for use within other programs.

The fourth program is also for the QL, although this one could, with a little effort, be converted for other computers. It produces landscapes by a pseudo-fractal method to produce results similar to those produced by the program MacFractal by

Jack Weber, published in Program File (PCW, March 1986). The author is Spanish, so please bear with his rather poor English within the program. His variable names are rather confusing, but the program itself produces some excellent results.

There's a reasonably intelligent game for the Spectrum called Triplets. This is a variation on noughts and crosses, played on an eight by eight board, and scoring the total number of times that three pieces in a row occur. The program uses some of the standard intelligent game-playing techniques, but could doubtless be improved.

Tips included this month are a screenswap tip for the Amstrad CPC464/664, a tip for recovering text from BBC Wordwise if a crash accidentally occurs, and a number-base conversion definition.



Program of the Month QL Windows

by Jonathon Bowring

One of the QL's major failings is that its windows can't be overlapped, so displays are restricted and the implementation of pop-up or pull-down menus is prevented. This program adds overlapping in the form of additional 68000 routines, which are added to the Superbasic procedure list and can be treated as additional, standard commands. A Superbasic procedure is included to add pull-down menus.

The QL owner can define the shape, position, colour and border of a channel's window in a single line. The window will not destroy what is beneath it and the screen can be restored at will. The user can then use pull-down menus or 'pop-up' displays of microdrive directories.

The listings consist of a hex dump, a hex loader, an assembler listing, a

1	43FA0014	347B0110	4E9245FA	01C8254A	0565
2	FFFC7000	4E750002	0020094F	50454E5F	04EA
3	57494E44	011A0A43	4C4F5345	5F57494E	041A
4	44000000	00000000	307B0112	4E900C43	022C
5	00096600	00F63036	9B00C0FC	002B206E	04D5
6	0030D1C0	B1EE0034	6C0000DC	2036B800	05BA
7	6D0000D0	20404BFA	01542AB6	98062B76	0556
8	98020004	2B769B0A	000B2B76	980E000C	033C
9	2B480010	342D0004	362D0006	3B153A2D	0205
10	000242B0	3002B0FC	000B4240	4B40D044	049B
11	06400007	80FC000B	3205C2C0	C2FC0002	054A
12	2B7C0002	0000C6FC	00B0D9C3	84FC000B	060C
13	C4FC0002	D9C245FA	010B2A52	2B4C0004	059C
14	3B40000B	3B76980B	000A0692	0000000C	02B2
15	701B74FF	4E412ABB	0C40FFFD	67000042	062D
16	6100009E	4BFA00C6	206D0010	43FA00BE	05A2
17	322D000C	342D000E	700D76FF	4E430C40	03A9
18	FFFC6700	001C7029	322D000B	4E437027	04A6
19	322D000A	4E43702B	4E437020	76FF4E43	04B9
20	4E7570FA	4E7570F9	4E7570F1	4E752A7A	07EA
21	00909BFC	0000000C	49FA00BA	BBCC6D00	05F4
22	FFE62055	226D0004	302D000B	342D000A	03BD
23	04420001	04400001	32002449	34D851C9	0351
24	FFFCD3FC	000000B0	51CAFFEE	20557019	0850
25	74FF4E41	43FA004A	04910000	000C4E75	04ED
26	2055226D	0004302D	000B342D	000A0442	021E
27	00010440	00013200	244930DA	51C9FFFC	0504
28	D3FC0000	00B051CA	FFEE4E75	00000000	061A

```

100 B=RESPR(580)
110 FOR Row=1 TO 28
120   a=B+(Row-1)*16
130   PRINT Row;TO 5;
140   Check=0
150   FOR Col=1 TO 4
160     INPUT N$;" ";
170     FOR Group=1 TO 8 STEP 2
180       N=Hexa(N$(Group TO Group+1))
190       POKE a,N
200       a=a+1
210       Check=Check+N
220     END FOR Group
230   END FOR Col
240   INPUT Check$
250   IF (Row DIV 5) THEN PRINT
260   IF Hexa(Check$)<>Check THEN BEEP 1000,10 : PRINT #0,"BAD LINE" : Row=Row-
1:PRINT #0,Hexa(Check$),Check
270 END FOR Row
280 SBYTES mdv1_WIN_CDE,B,580
290 STOP
300 :
310 DEFine FuNction Hexa(D$)
320 P=LEN(D$)
330 E=0
340 FOR F=1 TO LEN(D$)
350   COD=CODE(D$(F))
360   S=16^(P-F)
370   E=E+(COD-48)*1D$(F)<="9")+S*((COD-55)*D$(F)>="A")+8
380 END FOR F
390 RETURN E
400 END DEFine Hexa

```

listing of the menus procedure and a demonstration program.

The two extra commands are **OPEN_WINDOW** and **CLOSE_WINDOW**. When a channel's window is opened using **OPEN_WINDOW**, the screen area to be covered up is saved, and on calling **CLOSE_WINDOW** it is restored. **OPEN_WINDOW** can be treated like any other Superbasic command and takes nine parameters — **OPEN_WINDOW #channel, x,y,width,depth,ink,paper, borcol and borwid,where: channel** — channel number of a

PROGRAM FILE

screen or console device which has previously been opened

x — x coord of top left corner of window

y — y coord of top left corner

width — window width in pixels

depth — window depth

ink — initial ink colour

paper — initial paper colour

borcol — border colour

borwid — border width

This procedure sets up the specified window for the given channel and displays it after saving whatever was underneath. Up to ten such windows can be open at once. The procedure also returns the following standard errors:

'Not found' — an invalid channel number has been supplied

'Bad parameter' — a mistake has been made in the given parameters

'Out of range' — the window will not fit on the screen

Channel not open' — the channel supplied is not open

'Out of memory' — not enough memory is available to save the overwritten screen area

CLOSE_WINDOW takes no parameters and simply closes the most recently opened window, restoring what was underneath it. It returns the following error:

'Not found' — no temporary windows are currently open

OPEN_WINDOW and **CLOSE_WINDOW** do not open and close channels, but only set up and close windows associated with specified channels.

The pull-down menu routine, **PULL_DOWN**, is a Superbasic procedure designed to be merged with a program. It is used in conjunction with **OPEN_WINDOW** and **CLOSE_WINDOW** to provide true pull-down windows. When it is called, a temporary window appears with several specified entries displayed. Menu entries are chosen with the up and down cursor keys, with Esc used to quit the menu and Enter to select an entry. The procedure takes four parameters: **PULL_DOWN** #channel, x,y and data_line, where:

#channel — a free channel to be used as a console device by the routine

x — x coord of the top left corner

y — y coord of the top left corner

data_line — the first line number of a block of data specifying the window and supplying the text for the entries. The data should be in the format:

xxxx DATA, width,depth,ink,paper, borcol,borwid,chwid,chggt

xxxx DATA entries,length

xxxx DATA text for entries, where:

chwid — CSIZE character width number

chggt — CSIZE character height number

entries — number of entries in menu length — number of characters in longest entry

On exiting the menu, 'choices\$' will contain the selected entry and 'pointer' will hold a number corresponding to its position in the list.

To use the program, enter the assembler listing into an assembler or use the basic hex loader program

and type in the hex bytes. When the code is in memory, save it to microdrive as a file **mdv1_win_cde**.

Before this code can be used, it must be loaded into memory and initialised either manually or by a program as follows:

a=respr(580)

Lbytes mdv1_win_cde,a
call a

```

● SCR_TOP          equ      $20000
● BV_CHBAS         equ      $30
● BV_CHP           equ      $34
● BP_INIT          equ      $110
● CA_GTINT         equ      $112
● SD_WDEF          equ      $0d
● SD_CLEAR         equ      $20
● SD_SETPA        equ      $27
● SD_SETST        equ      $28
● SD_SETIN        equ      $29
● MT_ALCHP        equ      $18
● MT_RECHP        equ      $19

● START
                                ;Initializes procedures
                                ;Add procs to name table
    lea.l          proc_block,a1
    move.w        BP_INIT,a2
    jsr           (a2)
    lea.l          store,a2      ;Initialize data pointer
    move.l        a2,-4(a2)
    moveq         #0,d0
    rts           ;End initialization

● proc_block
    dc.w          2
    dc.w          OPEN_WINDOW-*
    dc.b          9,'OPEN_WIND'
    align
    dc.w          CLOSE_WINDOW-*
    dc.b          10,'CLOSE_WIND'
    align
    dc.w          0,0,0

● OPEN_WINDOW
                                ;Opens window with parameters:
                                ;channel,x,y,width,depth,paper,ink,border
    move.w        CA_GTINT,a0    ;Get parameters
    jsr           (a0)
    cmpi.w        #9,d3
    bne          BAD_PARAM
    move.w        0(a6,a1.1),d0  ;Get channel no.
    mulu         #40,d0
    move.l        BV_CHBAS(a6),a0
    adda.l        d0,a0
    cmp.l         BV_CHP(a6),a0
    bge          NO_CHAN        ;Channel not found
    move.l        0(a6,a0.1),d0
    blt          NOT_OPEN      ;Channel not open
    move.l        d0,a0         ;A0 holds channel ID
    lea.l         wind_def,a5   ;Set up window definition block
    move.l        6(a6,a1.1),(a5)
    move.l        2(a6,a1.1),4(a5)
    move.l        10(a6,a1.1),8(a5)
    move.l        14(a6,a1.1),12(a5)
    move.l        a0,16(a5)

    move.w        4(a5),d2      ;d2-x, d3-y, d4-width, d5-depth
    move.w        6(a5),d3
    move.w        (a5),d4
    move.w        2(a5),d5
    clr.l         d0
    move.w        d2,d0        ;Calculate no. of words needed
    divu         #8,d0        ;across (rounded up)
    clr.w        d0
    swap         d0
    add.w        d4,d0
    addi.w        #7,d0
    divu         #8,d0
    move.w        d5,d1        ;Calculate total bytes required
    mulu         d0,d1
    mulu         #2,d1
    move.l        #SCR_TOP,a4   ;Calculate address of top left
    mulu         #128,d3       ;of window.
    adda.l        d3,a4
    divu         #8,d2
    mulu         #2,d2
    adda.l        d2,a4

    lea.l         pointer,a2
    move.l        (a2),a5      ;a4- screen addr, d0-words across
    move.l        a4,4(a5)    ;d1- bytes, d5- lines down
    move.w        d0,8(a5)    ;Store parameters
    move.w        8(a6,a1.1),10(a5)
    addi.l        #12,(a2)    ;Update pointer

    moveq         #MT_ALCHP,d0 ;Allocate storage space
    moveq         #-1,d2
    trap         #1
    move.l        a0,(a5)    ;Store base of area
    cmpi         #-3,d0
    beq          OUT

```


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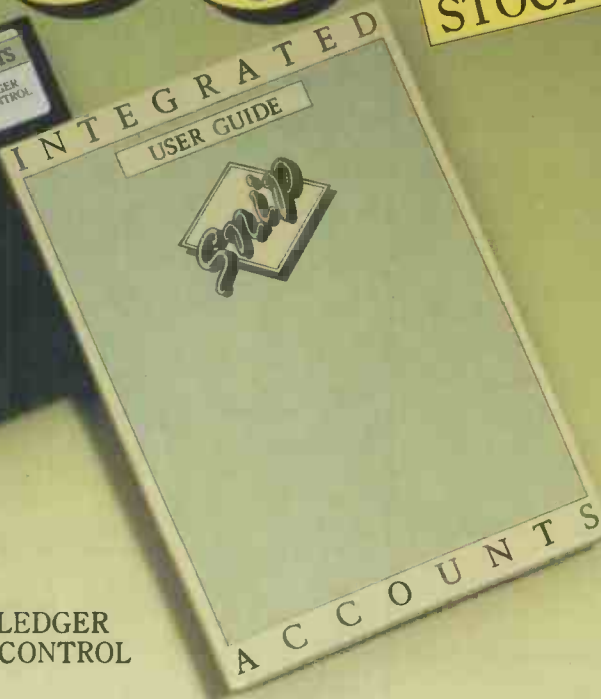


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```

move.l 4(a5),a1 ;Save screen under window
move.w 8(a5),d0
move.w 10(a5),d2
subi.w #1,d2 ;Lines minus one 'cos of DBF
subi.w #1,d0 ;Same for words across
nxt_line move.w d0,d1
move.l a1,a2
nxt_word move.w (a2)+(a0)+ ;Store screen info in free area
dbf d1,nxt_word
adda.l #128,a1
dbf d2,nxt_line

lea.l wind_def,a5 ;Define screen window
move.l 16(a5),a0
lea.l wind_def,a1
move.w 12(a5),d1
move.w 14(a5),d2
moveq #SD_WDEF,d0
moveq #-1,d3
trap #3
cmpi.w #-4,d0
beq OUT
moveq #SD_SETIN,d0 ;Set ink colour
move.w 8(a5),d1
trap #3
moveq #SD_SETPA,d0 ;Set paper colour
move.w 10(a5),d1
trap #3
moveq #SD_SETST,d0 ;Set strip colour
trap #3
moveq #SD_CLEAR,d0 ;Clear window
moveq #-1,d3
trap #3
OUT
NOT_OPEN moveq #-6,d0
rts
NO_CHAN moveq #-7,d0
rts
BAD_PARAM moveq #-15,d0
rts

CLOSE_WINDOW ;Closes top window (restores screen)
move.l pointer,a5
suba.l #12,a5
lea.l store,a4
cmpa.l a4,a5
bit NO_CHAN ;No window open
move.l (a5),a0
move.l 4(a5),a1
move.w 8(a5),d0 ;Words across
move.w 10(a5),d2 ;Lines down
subi.w #1,d2 ;Lines minus one 'cos of DBF
subi.w #1,d0 ;Same for words across
nxt_line move.w d0,d1
move.l a1,a2
nxt_word move.w (a0)+(a2)+ ;Put stored info on screen
dbf d1,nxt_word
adda.l #128,a1
dbf d2,nxt_line

move.l (a5),a0 ;Release storage space
moveq #MT_RECHP,d0
moveq #-1,d2
trap #1
lea.l pointer,a1 ;Move pointer to previous window
subi.l #12,(a1)
rts

wind_def ds.l 5 ;Param block for window definition
pointer ds.l 1 ;Base of info for top window
store ds.l 30 ;Info for 10 windows (10*12 bytes)
    
```

10 REMark Example menu

```

20 :
30 Pull_Down #6,100,100,1000
40 STOP
1000 DATA 132,52,0,5,2,1,1,0,5,16
1010 DATA "Load file","Save file","Delete file","Copy file","Format cartridge"
1020 :
30000 DEFINE PROCEDURE Pull_Down(channel,x,y,data_line)
30010 LOCAL inkcol,papcol,borcol,borwid,cwd,cht,entries,length
30020 OPEN #channel,con_
30030 :
30040 REMark Find data, read it in and set up window
30050 :
30060 RESTORE data_line
30070 READ wid,dep,inkcol,papcol,borcol,borwid,cwd,cht,entries,length
30080 CSIZE #channel,cwd,cht
30090 OPEN_WIND #channel,x,y,wid,dep,inkcol,papcol,borcol,borwid
30100 DIM entry$(entries,length)
30110 FOR c=1 TO entries
30120 READ entry$(c) : PRINT #channel,entry$(c)
30130 END FOR c
30140 pointer=1
30150 REPEAT Choose_entry
30160 REMark Pad out entry to fill line
30170 choice$=entry$(pointer)&FILL$(" ",length-LEN(entry$(pointer)))
30180 STRIP #channel,inkcol : INK #channel,papcol
30190 AT #channel,pointer-1,0 : PRINT #channel,choice$
30200 key$=INKEY$(#channel,-1) : key=CODE(key$)
30210 STRIP #channel,papcol : INK #channel,inkcol
30220 AT #channel,pointer-1,0 : PRINT #channel,choice$
30230 IF key=208 THEN pointer=pointer-1 : IF pointer=0 THEN pointer=entries
30240 IF key=216 THEN pointer=pointer+1 : IF pointer=entries+1 THEN pointer=1
30250 IF key=27 THEN pointer=0 : CLDSE #channel : CLOSE_WIND : RETURN
30260 IF key=10 THEN EXIT Choose_entry
30270 END REPEAT Choose_entry
30280 :
    
```


PROGRAM FILE

```

30290 REMark Make chosen entry flash
30300 :
30310 FOR c=1 TO 2
30320 STRIP #channel,inkcol : INK #channel,papcol
30330 AT #channel,pointer-1,0 : PRINT #channel,choice$
30340 STRIP #channel,papcol : INK #channel,inkcol
30350 AT #channel,pointer-1,0 : PRINT #channel,choice$
30360 END FOR c
30370 choice$=entry$(pointer)
30380 CLOSE_WIND : CLOSE #channel
30390 END DEFINE
    
```



QL Single-Key Keywords

by Link Tomlin

This program provides a QL facility for single-key entry of keywords, as found on the ZX Spectrum. It can also be adapted for other purposes such as key macros, and so on.

The program uses the fact that SV.KEYQ (at 163916) points to the start of the current keyboard queue. By linking itself into the QDOS list of scheduled tasks, it inspects the queue 50 times a second and acts upon certain key sequences.

When the task is activated, it checks whether it has been switched on or off. If off, it ends and the scheduler passes on to other tasks. When on, it checks for certain key sequences and if a corresponding key definition exists, it puts this into the queue. Tests must be made to check that the queue length is not exceeded, so that no errors occur. CTRL-X is used to switch the program

on and off, as other software may use the key sequences that are defined. For example, there are no definitions for C, I and J as these are already used by the operating system.

The code can be entered into an assembler from the assembly listing, or by using the Basic program with hex data. The code is saved to microdrive as a file called `mdv1_onekey_bin`. It can be re-loaded by:

```

a=RESPR(400)
LBYTES mdv1_onekey_bin,a
CALL a
    
```

When this has been done, the key macros can be used immediately. When the program is working, copy it to a master cartridge as part of a boot file so that it can be loaded automatically.

```

10 RESTORE 100
20 start=RESPR(400)
30 FOR mem=start TO start+374
40 READ byte
50 POKE mem,byte
60 END FOR mem
70 SBYTES mdv1_onekey_bin,374
80 STOP
100 DATA 67,250,1,4,65,250,0,12,33,73,0,4,112,30,78,65
110 DATA 78,117,0,0,0,0,0,0,0,0,0,0,1,0,0,0
120 DATA 2,0,0,8,4,0,0,16,5,0,0,22,6,0,0,30
130 DATA 7,0,0,36,9,0,0,44,11,0,0,50,12,0,0,60
140 DATA 13,0,0,68,14,0,0,76,15,0,0,82,16,0,0,90
150 DATA 18,0,0,98,19,0,0,104,20,0,0,112,21,0,0,120
160 DATA 23,0,0,128,145,0,0,138,146,0,0,146,0,5,65,85
170 DATA 84,79,32,0,0,5,66,69,69,80,32,0,0,4,68,73
180 DATA 82,32,0,5,69,68,73,84,32,0,0,4,70,79,82,32
190 DATA 0,5,71,79,84,79,32,0,0,3,73,70,32,0,0,7
200 DATA 75,69,89,82,79,87,40,0,0,5,76,73,83,84,32,0
210 DATA 0,5,77,79,68,69,32,0,0,3,78,69,87,0,0,6
220 DATA 79,80,69,78,32,35,0,6,80,82,73,78,84,32,0,4
230 DATA 82,85,78,10,0,5,83,65,86,69,32,0,0,5,84,72
240 DATA 69,78,32,0,0,6,85,78,68,69,82,32,0,7,87,73
250 DATA 78,68,79,87,32,0,0,6,194,77,68,86,49,95,0,6
260 DATA 194,77,68,86,50,95,36,121,0,2,128,76,34,106,0,8
270 DATA 38,74,215,252,0,0,0,16,179,203,102,4,34,106,0,4
280 DATA 73,250,254,248,71,250,254,246,65,250,255,66,83,137,18,17
290 DATA 178,60,0,24,103,16,74,84,102,10,178,19,103,16,88,139
300 DATA 177,203,102,246,78,117,70,84,18,188,0,0,78,117,66,130
310 DATA 65,250,255,26,52,43,0,2,209,194,66,130,52,24,83,66
320 DATA 18,24,50,121,0,0,0,224,78,145,74,128,102,4,81,202
330 DATA 255,240,78,117,0,1,132,0
    
```

```

LISTING TWO
*   QL SINGLE-KEY KEYWORDS   *
*   by                         *
*   L.W.Tomlin. 26/7/86.     *
    
```

* This routine is called from BASIC. It links a new task into the scheduler list by using QDOS trap MT.LSCHED.

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PROGRAM FILE

```
START LEA MACTASK(PC),A1 ;A1 = address of task.
      LEA MACLINK(PC),A0 ;A0 = address of link.
      MOVE.L A1,4(A0) ;Set up link for QDOS.
      MOVEQ #1E,D0 ;D0 = MT.LSCHED.
      TRAP £1 ;Add task to list.
      RTS ;Return to SUPERBASIC.
```

* Data area used by both the new task and the scheduler.

```
MACLINK DC.L 0,0 ;Link used by scheduler.
KSTATE DC.W 0 ;Macros on/off switch.
```

* List of keys used by MACTASK. First there is an ASCII key code followed by an alignment byte. Then comes the relative address of that keys macro defenition.

```
MACLIST DC.B 1,0
        DC.W MACA-MACA
        DC.B 2,0
        DC.W MACB-MACA
        DC.B 4,0
        DC.W MACD-MACA
        DC.B 5,0
        DC.W MACE-MACA
        DC.B 6,0
        DC.W MACF-MACA
        DC.B 7,0
        DC.W MACG-MACA
        DC.B 9,0
        DC.W MACI-MACA
        DC.B 11,0
        DC.W MACK-MACA
        DC.B 12,0
        DC.W MACL-MACA
        DC.B 13,0
        DC.W MACM-MACA
        DC.B 14,0
        DC.W MACN-MACA
        DC.B 15,0
        DC.W MACO-MACA
        DC.B 16,0
        DC.W MACP-MACA
        DC.B 18,0
        DC.W MACR-MACA
        DC.B 19,0
        DC.W MACS-MACA
        DC.B 20,0
        DC.W MACT-MACA
        DC.B 21,0
        DC.W MACU-MACA
        DC.B 23,0
        DC.W MACW-MACA
        DC.B 145,0
        DC.W MAC1-MACA
        DC.B 146,0
        DC.W MAC2-MACA
```

* The macro defenitions. These are in the usual QDOS form ie. One length word then the actual string.

```
MACA DC.W 5
      DC.B 'AUTO'
MACB DC.W 5
      DC.B 'BEEP'
MACD DC.W 4
      DC.B 'DIR'
MACE DC.W 5
      DC.B 'EDIT'
MACF DC.W 4
      DC.B 'FOR'
MACG DC.W 5
      DC.B 'GOTO'
MACI DC.W 3
      DC.B 'IF'
MACK DC.W 7
      DC.B 'KEYROW('
MACL DC.W 5
      DC.B 'LIST'
MACM DC.W 5
      DC.B 'MODE'
MACN DC.W 3
      DC.B 'NEW'
MACO DC.W 6
      DC.B 'OPEN £'
MACP DC.W 6
      DC.B 'PRINT'
MACR DC.W 4
      DC.B 'RUN',10
MACS DC.W 5
      DC.B 'SAVE'
MACT DC.W 5
      DC.B 'THEN'
MACU DC.W 6
      DC.B 'UNDER'
MACW DC.W 7
      DC.B 'WINDOW'
```

CHART OF SINGLE-KEY MACROS

KEY	MACRO
CTRL-A	'AUTO'
CTRL-B	'BEEP'
CTRL-D	'DIR'
CTRL-E	'EDIT'
CTRL-F	'FOR'
CTRL-G	'GOTO'
CTRL-I	'IF'
CTRL-K	'KEYROW('
CTRL-L	'LIST'
CTRL-M	'MODE'
CTRL-N	'NEW'
CTRL-O	'OPEN #'
CTRL-P	'PRINT'
CTRL-R	'RUN'
CTRL-S	'SAVE'
CTRL-T	'THEN'
CTRL-U	'UNDER'
CTRL-W	'WINDOW'
CTRL-1	'MDV1_'
CTRL-2	'MDV2_'

PROGRAM FILE

```

MAC1 DC.W 6
      DC.B 194,'MDV1_'
MAC2 DC.W 6
      DC.B 194,'MDV2_'

* This is the actual task that will be performed by
* QDOS each time the schedule handler is entered.

MACTASK MOVE.L $2B04C,A2 ;A2 = current keyboard queue.
        MOVE.L 8(A2),A1 ;A1 points to back of queue.
        MOVE.L A2,A3 ;Copy queue start address.
        ADD.L £16,A3 ;A3 points to physical start.
        CMP.L A3,A1 ;Check if queue is full.
        BNE.S SKIP ;Skip next instruction if no.
        MOVE.L 4(A2),A1 ;A1 = physical end of queue.
SKIP LEA KSTATE(PC),A4 ;A4 points to on/off switch.
     LEA MACLIST(PC),A3 ;A3 points to macro keylist.
     LEA MACA(PC),A0 ;A0 points to macro list.
     SUBQ.L £1,A1 ;A1 points to last queue entry.
     MOVE.B (A1),D1 ;Fetch latest entry in queue.
     CMP.B £#18,D1 ;Is it CTRL-X?
     BEQ.S TOGGLE ;Toggle on/off switch if yes.
     TST.W (A4) ;Check if switch has been set to
     BNE.S TASKEND ;off and exit task if it has.
MACLOOP CMP.B (A3),D1 ;Is the key in MACLIST?
        BEQ.S MOVE ;forward if is.
        ADDQ.L £4,A3 ;A3 points to next key in list.
        CMP.L A3,A0 ;Has end of list been reached?
        BNE.S MACLOOP ;Try again if not.
TASKEND RTS ;Finished as key not found.

* Routine used by MTASK to toggle on/off status of KSTATE.

TOGGLE NOT.W (A4) ;Invert bits of KSTATE.
       MOVE.B £0,(A1) ;Put NULL byte into queue.
       RTS

* Routine to transfer required macro into keyboard queue.

MOVE CLR.L D2 ;D3 = 0
     LEA MACA(PC),A0 ;A0 points to start of macros.
     MOVE.W 2(A3),D2 ;Fetch required offset.
     ADD.L D2,A0 ;A0 = start of required macro.
     CLR.L D2 ;D2 = 0
     MOVE.W (A0)+,D2 ;D2.W = length of string.
     SUBQ.W £1,D2 ;Decrement D2 for DBRA loop
SWAPMAC MOVE.B (A0)+,D1 ;Fetch a byte from the string.
        MOVE.W #E0,A1 ;A1 = QDOS IO.QIN vector.
        JSR (A1) ;Put D1.B into the queue.
        TST.L D0 ;Check if queue is full.
        BNE.S MOVEEND ;Exit if it is.
        DBRA D2,SWAPMAC ;Loop back until end of string.
MOVEEND RTS ;Transfer completed.
    
```

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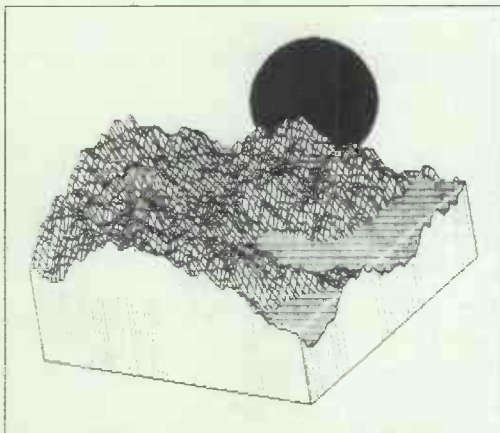
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QL Landscapes by Jose Gonzalez Rodriguez



This program produces 'landscapes' derived from mathematical functions. These are of the form $z=f(x,y)$ and can be modified in the listing, in lines 6800 to 7100. The program is fairly easy to understand and guides the user carefully, although Jose's English isn't very good.

If you have a printer, you can load the appropriate screendump program from microdrive (the Easel cartridge holds about seven programs). To use the program, copy the appropriate screendumper onto the microdrive cartridge holding it and call the screendump program `gprint_prt`.

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PROGRAM FILE

```
1240 DEFine PROCedure aleat
1250 FOR x=paso/2 TO n-paso/2 STEP paso
1260 FOR y=0 TO n STEP paso
1270 h(x,y)=(h(x-paso/2,y)+h(x+paso/2,y))/2+RND(-pa TO pa)
1280 END FOR y:END FOR x
1290 FOR y=paso/2 TO n-paso/2 STEP paso
1300 FOR x=0 TO n STEP paso
1310 h(x,y)=(h(x,y-paso/2)+h(x,y+paso/2))/2+RND(-pa TO pa)
1320 END FOR x:END FOR y
1330 FOR x=paso/2 TO n-paso/2 STEP paso
1340 FOR y=paso/2 TO n-paso/2 STEP paso
1350 h(x,y)=(h(x,y-paso/2)+h(x,y+paso/2)+h(x-paso/2,y)+h(x+paso/2,y))/4+R
ND(-pa TO pa)
1360 END FOR y:END FOR x
1370 END DEFine aleat
1380 :
1390 REMark DRAWS SURFACE ON THE SCREEN
1400 DEFine PROCedure dibujo (nu)
1410 FILL#3,1: IF val$(14)=s$:GO TO 1430
1420 INK#3,colmon:LINE#3,arm(1,1),arm(1,3)*imp TO arm(2,1),arm(2,3)*imp T
O arm(5,1),arm(5,3)*imp TO arm(3,1),arm(3,3)*imp TO arm(1,1),arm(1,3)*imp
:FILL#3,0
1430 FILL#3,0:INK#3,collin
1440 estrc
1450 r=arm(3,1):s=arm(3,3)
1460 tf=arm(5,1)-arm(3,1):u=arm(3,1)-arm(1,1)
1470 v=arm(3,3)-arm(1,3):z=arm(5,3)-arm(3,3)
1480 psx=2*it/2*nu:psy=psx:ps=psx
1490 FOR y=0 TO n STEP psy
1500 FOR x=0 TO n STEP psx
1510 IF x=n:psx=0
1520 IF y=n:psy=0
1530 lx=r+(tf*x-u*y)/n:ly=s+(z*x-v*y)/n
1540 fx=r+(tf*x-u*(y+psy))/n:fy=s+(z*x-v*(y+psy))/n
1550 lxd=lx+ps*tf/n:lxb=lx-ps*u/n:lyd=ly+ps*z/n:lyb=ly-ps*v/n
1560 px=lx+h(x,y)*redx:py=ly+h(x,y)*redy
1570 pxd=lxd+h(x+psx,y)*redx:pxb=lxb+h(x,y+psy)*redx
1580 pyd=lyd+h(x+psx,y)*redy:pyb=lyb+h(x,y+psy)*redy
1590 IF x=0:q1=px:q2=py*imp:q3=pxb:q4=pyb*imp:q5=lxb:q6=lyb*imp:q7=lx:q8=
ly*imp
1600 IF x=0:x1=lx:y1=ly*imp:x2=lx+almar*redx:y2=(ly+almar*redy)*imp
1610 IF x=0:x1b=fx:y1b=fy*imp:x2b=fx+almar*redx:y2b=(fy+almar*redy)*imp
1620 IF x=n AND y<n AND val$(18)=s$:mar
1630 IF x=n:GO TO 1690
1640 INK#3,colmon
1650 IF val$(14)=s$:GO TO 1670
1660 FILL#3,1:LINE#3,px,py*imp TO pxd,pyd*imp TO lxd,lyd*imp TO lx,ly*imp
TO px,py*imp:FILL#3,0
1670 INK#3,collin
1680 LINE#3,px,py*imp TO pxd,pyd*imp:IF y=n:GO TO 1790
1690 IF y=n:GO TO 1790
1700 IF x<n:GO TO 1780
1710 INK#3,colmon
1720 IF val$(14)=s$:GO TO 1740
1730 FILL#3,1:LINE#3,px,py*imp TO pxb,pyb*imp TO lxb,lyb*imp TO lx,ly*imp
TO px,py*imp:FILL#3,0
1740 INK#3,colmon
1750 IF val$(14)=s$:GO TO 1770
1760 FILL#3,1:LINE#3,q1,q2 TO q3,q4 TO q5,q6 TO q7,q8 TO q1,q2:FILL#3,0
1770 INK#3,collin:LINE#3,q1,q2 TO q3,q4
1780 LINE#3,px,py*imp TO pxb,pyb*imp
1790 END FOR x:psx=psy
1800 END FOR y
1810 BEEP 4000,0
1820 INK#3,collin
1830 estrc
1840 END DEFine dibujo
1850 :
1860 REMark DRAWS SEA
1870 DEFine PROCedure mar
1880 FILL#3,1
1890 llx=lx+almar*redx:lly=(ly+almar*redy)*imp
1900 ffx=fx+almar*redx:ffy=(fy+almar*redy)*imp
1910 INK#3,colmar:LINE#3,llx,lly TO llx,ly*imp TO x1,y1 TO x2,y2 TO llx,11
y
1920 LINE#3,fx,fy*imp TO ffx,ffy TO llx,11y TO lx,ly*imp TO fx,fy*imp
1930 LINE#3,x2,y2 TO x2b,y2b TO ffx,ffy TO llx,11y TO x2,y2
1940 LINE#3,x1,y1 TO x2,y2 TO x2b,y2b TO x1b,y1b TO x1,y1
1950 LINE#3,ffx,ffy TO fx,fy*imp TO x1b,y1b TO x2b,y2b TO ffx,ffy
1960 FILL#3,0
1970 INK#3,colfon
1980 LINE#3,ffx,ffy TO llx,11y
1990 LINE#3,x2,y2 TO x2b,y2b
2000 IF y=n-psy:LINE#3,x1b,y1b TO x2b,y2b TO ffx,ffy TO fx,fy*imp
2010 END DEFine mar
2020 :
2030 REMark CHOOSE SUN AND MOON HEIGHT AND SIZE
2040 DEFine PROCedure situasol
2050 IF presol=1:RETurn
2060 con=12*(t/tt)^2.5-12
2070 tamsol=tam*RND(15 TO 26)/100:alsol=con+RND(35*ABS(imp) TO 50*ABS(imp)
):xsol=tam*RND(-70 TO 70)/100
2080 anlu=RND(-30 TO 30)
2090 dis=RND(20 TO 70)/100
2100 IF RND(1)=0:dis=-dis
2110 despx=COS(RAD(anlu))*tamsol*dis
2120 despy=SIN(RAD(anlu))*tamsol*dis*imp
2130 lxsol=xsol+despx:lalsol=alsol+despy:passol=1
2140 END DEFine situasol
2150 :
2160 REMark DISPLAYS SUN
2170 DEFine PROCedure sol
2180 IF passol=0:situasol
2190 IF val$(19)=n$:situasol
2200 INK#3,colcol:FILL#3,1
2210 ELLIPSE#3,xsol,alsol,tamsol,1/imp,0:FILL#3,0
2220 END DEFine sol
2230 :
2240 REMark DISPLAYS MOON
2250 DEFine PROCedure luna
2260 INK#3,colcol:sol:INK#3,colfon
2270 FILL#3,1:ELLIPSE#3,lxsol,lalsol,tamsol,1/imp,0:FILL#3,0
2280 END DEFine luna
2290 :
```

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```

2300 REMark ROTATES STRUCTURE TO DESIRED PERSPECTIVE
2310 DEFine PROCEDURE gira
2320 DIM ar(8,4):DIM gir(4,4):DIM arm(8,4)
2330 RESTORE 2420
2340 FOR x=1 TO 8
2350 FOR y=1 TO 4
2360 READ s:ar(x,y)=s
2370 END FOR y:END FOR x
2380 FOR x=1 TO 4
2390 FOR y=1 TO 4
2400 READ s:gir(x,y)=s
2410 END FOR y:END FOR x
2420 DATA -t/2,-t/2,0,1,t/2,-t/2,0,1,-t/2,t/2,0,1
2430 DATA -t/2,-t/2,h(0,n),1,t/2,t/2,0,1,t/2,-t/2,h(n,n),1
2440 DATA -t/2,t/2,h(0,0),1,t/2,t/2,h(n,0),1
2450 DATA COS(w)*COS(e),COS(w)*SIN(e),-SIN(w),0,SIN(q)*SIN(w)*COS(e)-COS(q)*SIN(e),SIN(q)*SIN(w)*SIN(e)+COS(q)*COS(e),SIN(q)*COS(w),0,COS(q)*SIN(w)*COS(e)+SIN(q)*SIN(e),COS(q)*SIN(w)*SIN(e)-SIN(q)*COS(e),COS(q)*COS(w),0,0,0,0,1
2460 mulmat
2470 redx=(arm(4,1)-arm(1,1))/h(0,n):redy=(arm(4,3)-arm(1,3))/h(0,n)
2480 END DEFine gira
2490 :
2500 REMark MATHEMATICAL ROTATION OF MATRIX
2510 DEFine PROCEDURE mulmat
2520 FOR x=1 TO 8
2530 FOR y=1 TO 4
2540 dato=0
2550 FOR cas=1 TO 4
2560 dato=dato+ar(x,cas)*gir(cas,y)
2570 END FOR cas
2580 arm(x,y)=dato
2590 END FOR y
2600 END FOR x
2610 END DEFine mulmat
2620 :
2630 REMark DRAWS STRUCTURE LINES
2640 DEFine PROCEDURE estrc
2650 maxy=arm(1,2):pmax=1
2660 FOR x=1 TO 8:IF arm(x,2)>maxy:maxy=arm(x,2):pmax=x
2670 IF pmax=1 OR pmax=2:GO TO 2710
2680 LINE#3,arm(1,1),arm(1,3)*imp TO arm(2,1),arm(2,3)*imp
2690 IF pmax=5:GO TO 2730
2700 LINE#3,arm(2,1),arm(2,3)*imp TO arm(5,1),arm(5,3)*imp
2710 IF pmax=3:GO TO 2760
2720 LINE#3,arm(5,1),arm(5,3)*imp TO arm(3,1),arm(3,3)*imp
2730 IF pmax=1:GO TO 2780
2740 LINE#3,arm(3,1),arm(3,3)*imp TO arm(1,1),arm(1,3)*imp
2750 REMark
2760 IF pmax=4:GO TO 2780
2770 LINE#3,arm(1,1),arm(1,3)*imp TO arm(4,1),arm(4,3)*imp
2780 IF pmax=2 OR pmax=6:GO TO 2800
2790 LINE#3,arm(2,1),arm(2,3)*imp TO arm(6,1),arm(6,3)*imp
2800 IF pmax=5 OR pmax=8:GO TO 2830
2810 LINE#3,arm(5,1),arm(5,3)*imp TO arm(8,1),arm(8,3)*imp
2820 IF pmax=3 OR pmax=7:GO TO 2840
2830 LINE#3,arm(3,1),arm(3,3)*imp TO arm(7,1),arm(7,3)*imp
2840 END DEFine estrc
2850 :
2860 REMark DISPLAYS NBCESSARILY TIME TO CALCULATE HEIGHTS (ON ALBAT. SUR FACES)
2870 DEFine PROCEDURE avisa
2880 OPEN#8,com
2890 WINDOW#8,180,25,166,15
2900 BORDER#8,2,collin:CLS#8:INK#8,7
2910 PRINT#8,w5s
2920 PRINT#8,w7s
2930 cod1=CODE(INKYs(-))
2940 IF cod1<10 AND val$(24)=s$:presol=0:supmat
2950 IF cod1<10:presol=0:pres
2960 time$=INT(2^(2*it-7)+.5)-4
2970 IF val$(24)=s$:time$=w5s$
2980 CLS#8:AT#8,1,1:PRINT#8,w49s$:time$:w5$:BEEP 200,0
2990 END DEFine avisa
3000 :
3010 REMark LOCATES AND DISPLAYS STARS
3020 DEFine PROCEDURE estars
3030 FOR x=1 TO RND(200 TO 350)
3040 j=RND(18 TO 491):k=RND(1 TO 251)
3050 BLOCK#10,1,1,j,k,colsol
3060 END FOR x
3070 FOR x=1 TO RND(100 TO 150)
3080 j=RND(18 TO 490):k=RND(2 TO 249)
3090 BLOCK#10,2,2,j,k,colsol
3100 END FOR x
3110 END DEFine estars
3120 :
3130 REMark DISPLAYS FIRST PAGE MESSAGES
3140 DEFine PROCEDURE pres
3150 OVER#20,-1
3160 CLS#20:INK#20,7:BEEP 400,2
3170 RESTORE 3160
3180 lin=25:pag1=12
3190 ultima=pr1+pag1
3200 FOR y=pr1 TO pag1+pr1
3210 READ men$
3220 AT#20,y,10:PRINT#20,men$
3230 END FOR y
3240 INK#0,5:AT#0,0,10:
3250 PRINT#0,w8s$:INK#0,7:PRINT#0,w9s$:INK#0,5:PRINT#0,w10s
3260 AT#0,2,0:PRINT#0,angus$
3270 INK#0,7
3280 DATA w13$,w15$,w16$,w17$,w18$,w19$,w20$,w21$,w22$,w23$,w24$,w25$,w26$
3290 IF senal=1:GO TO 3350
3300 DIM val$(11+1,9)
3310 RESTORE 3400
3320 FOR x=1 TO lin
3330 READ val$(x):END FOR x
3340 senal=1
3350 FOR y=pr1 TO pag1+pr1
3360 AT#20,y,67:PRINT#20,val$(y-pr1+1)
3370 END FOR y
3380 y=pr1:bloque=tomar

```


PROGRAM FILE

```

3390 END DEFine pres
3400 DATA "4","1","28","8","-35","3","7","7","5","1","100",tt,ns
3410 DATA ns,ns,ns,ns,ns,ns,ns,ns,ns,ns,ns,ns
3420 :
3430 REMark INPUTS DATA TO MODIFY VARIABLES
3440 DEFine PROCedure tomar
3450 cod=CODE(INKEYs(-1))
3460 IF cod<208 AND cod<216:cogdat
3470 IF cod=208:sube:GO TO 3490
3480 IF cod=216:baja
3490 ms=y-pri+1
3500 tomar
3510 END DEFine tomar
3520 :
3530 REMark ENHANCES ACTUAL LINE TO CAN MODIFY DATA
3540 DEFine PROCedure bloque
3550 BLOCK#20,372,10,55,10*y,7:BEEP 100,5
3560 END DEFine bloque
3570 :
3580 REMark CHANGES DATA VARIABLES ON SCREEN
3590 DEFine PROCedure cogdat
3600 ms=y-pri+1
3610 y$=val$(ms)
3620 IF cod=10:asigna
3630 AT#20,y,67:PRINT#20,y$
3640 IF y$=ns:pdos
3650 AT#20,y,67:PRINT#20,CHR$(cod)
3660 AT#20,y,68:INPUT#20,val$(ms):val$(ms)=CHR$(cod)&val$(ms)
3670 selecciona:baja
3680 END DEFine cogdat
3690 :
3700 REMark SELECTS REJECT DATA PROCEDURES
3710 DEFine PROCedure selecciona
3720 IF ms=1:cit
3730 IF ms=2:redu
3740 IF ms=3 OR ms=4 OR ms=5:angu
3750 IF ms=6 OR ms=7 OR ms=8 OR ms=9 OR ms=10:colo
3760 IF ms=11 OR ms=12:lim
3770 END SElect
3780 END DEFine selecciona
3790 :
3800 REMark REJECTS INCORRECT INPUT DENSITY DATA
3810 DEFine PROCedure cit
3820 IF LEN(val$(1))>1 OR LEN(val$(1))<1:borr
3830 cod1=CODE(val$(1))
3840 IF cod1<49 OR cod1>55:borr
3850 END DEFine cit
3860 :
3870 REMark ERASES AND INPUTS DATA
3880 DEFine PROCedure borr
3890 AT#20,y,67:PRINT#20,val$(ms)
3900 AT#20,y,67:INPUT#20,val$(ms)
3910 selecciona
3920 END DEFine borr
3930 :
3940 REMark REJECT INCORRECT INPUT PRINTER REDUCTION DATA
3950 DEFine PROCedure redu
3960 prinum
3970 IF val$(ms)>10 OR val$(ms)<-10:borr
3980 END DEFine redu
3990 :
4000 REMark REJECTS DATA IF NO-NUMBER
4010 DEFine PROCedure prinum
4020 IF LEN (val$(ms))=0:borr
4030 FOR x=1 TO LEN(val$(ms))
4040 k9=CODE(val$(ms,x))
4050 IF k9>57 OR k9<45:borr
4060 IF k9=47:borr
4070 END FOR x
4080 END DEFine prinum
4090 :
4100 REMark REJECTS INCORRECT ANGLE DATA
4110 DEFine PROCedure angu
4120 prinum
4130 IF val$(ms)>90 OR val$(ms)<-90:borr
4140 END DEFine angu
4150 :
4160 REMark REJECTS INCORRECT COLOUR DATA
4170 DEFine PROCedure colo
4180 IF LEN(val$(ms))>1 OR LEN(val$(ms))<1:borr
4190 IF CODE(val$(ms))>55 OR CODE(val$(ms))<48:borr
4200 END DEFine colo
4210 :
4220 REMark REJECT INCORRECT SIZE OR ROUGHNESS DATA
4230 DEFine PROCedure lim
4240 IF LEN(val$(ms))>4:borr
4250 prinum
4260 IF val$(ms)>600 OR val$(ms)<0:borr
4270 END DEFine lim
4280 :
4290 REMark SAVES IMAGE INTO MICRODRIVE
4300 DEFine PROCedure imagen
4310 DELETE mdv2_imagench:SBYTES mdv2_imagench,131072,2*15
4320 END DEFine imagen
4330 :
4340 REMark ASSIGN VARIABLES AND RUNS MAIN PROGRAM
4350 DEFine PROCedure asigna
4360 IF mmlena=0:mmlin=8:llena
4370 it=val$(1):imp=val$(2):q=RAD(val$(3)):w=RAD(val$(4)):e=RAD(val$(5))
4380 colmar=val$(9):colmon=val$(6):colsol=val$(7):collin=val$(8):colfon=
al$(10):colun=colsol
4390 picudez=val$(11):t=val$(12)
4400 BEEP 400,0:lanza
4410 END DEFine asigna
4420 DATA w27$,w28$,w29$,w30$,w31$,w32$,w33$,w34$,w35$,w36$,w37$,w38$
4430 :
4440 REMark DISPLAYS SECOND MESSAGES PAGE
4450 DEFine PROCedure pdos
4460 CLS#20:BEEP 400,3
4470 ultima=lin-pag1+2
4480 RESTORE 4420:fy=pri-pag1-2
4490 FOR y=pri TO lin+fy
4500 READ mens
4510 AT#20,y,10:PRINT#20,mens

```

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```

4520 END FOR y
4530 FOR y=pr1 TO linfy
4540 AT#20,y,67:PRINT#20,vals(y-fy)
4550 END FOR y
4560 AT#0,0,14:INK#0,5:PRINT#0,w8s::INK#0,7:PRINT#0,w9s::INK#0,5:PRINT#0,
w56s:INK#0,7
4570 y=pr1
4580 bloque
4590 REPEAT poi
4600 ys=INKEYS(-1)
4610 IF CODE(ys)=10:assigna
4620 IF CODE(ys)=208:sube:END REPEAT poi
4630 IF CODE(ys)=216:baja:END REPEAT poi
4640 IF y=linfy:pres
4650 camb
4660 END REPEAT poi
4670 END DEFine pdos
4680 :
4690 REMark SELECTS SOME SECOND PAGE FUNCTIONS
4700 DEFine PROCEDURE camb
4710 BEEP 100,0
4720 jkl=y-fy
4730 IF jkl=19 AND mon=0:BEEP 31000,15:sube:RETURN
4740 IF jkl=20 AND PEEK(RESPR(0))<>96:BEEP 31000,15:sube:RETURN
4750 IF jkl=22:cargaim
4760 IF jkl=23:copia
4770 IF jkl=24 AND val$(24)=n3:cambia:supmat
4780 cambia:baja
4790 END DEFine camb
4800 :
4810 REMark CHANGES YES BY NOT OR VICEVERSA IF CHOSEN
4820 DEFine PROCEDURE cambia
4830 AT#20,y,67:PRINT#20,vals(jkl)
4840 IF jkl=19 AND passol=0:situasol
4850 IF vals(jkl)=s3:vals(jkl)=n3:GO TO 4870
4860 IF vals(jkl)=n3:vals(jkl)=s3
4870 AT#20,y,67:PRINT#20,vals(jkl)
4880 END DEFine cambia
4890 :
4900 REMark CHANGES YES BY NOT IN THIRD PAGE
4910 DEFine PROCEDURE mcam
4920 jk=y-pri+1:IF jk>ultima-pri-1:RETURN
4930 FOR xx=1 TO ultima-pri-1:AT#20,xx+pri-1,67:PRINT#20,tvals(xx):tvals(
xx)=n3
4940 tvals(jk)=s3:ux=jk
4950 FOR xx=1 TO ultima-pri-1:AT#20,xx+pri-1,67:PRINT#20,tvals(xx)
4960 END DEFine mcam
4970 REMark GOES UP ENHANCED LINE
4980 DEFine PROCEDURE sube
4990 bloque:y=y-1:IF y<pri:y=ultima
5000 bloque
5010 END DEFine sube
5020 :
5030 REMark GOES DOWN ENHANCED LINE
5040 DEFine PROCEDURE baja
5050 bloque:y=y+1:IF y>ultima:y=pri
5060 bloque
5070 END DEFine baja
5080 :
5090 REMark LOADS AND PRINTS A PREVIOUSLY SAVED IMAGE
5100 DEFine PROCEDURE cargaim
5110 CLS#20
5120 AT#20,5,8:PRINT#20,w39s
5130 AT#20,9,8:PRINT#20,w95s
5140 IF CODE(INKEYS(-1))=10:pdos
5150 LBYTES mdv2:imagench,131072
5160 IF PEEK(RESPR(0))=96:CALL PEEK_L (RESPR(0)+4)
5170 PAUSE:pdos
5180 END DEFine cargaim
5190 :
5200 REMark COPY SCREENDUMPER AND THIS PROGRAM IN MDV2_
5210 DEFine PROCEDURE copia
5220 dnom
5230 CLS#20:INK#20,7
5240 AT#20,5,8:PRINT#20,w50s
5250 AT#20,8,8:PRINT#20,w95s
5260 AT#20,12,8:PRINT#20,w90s
5270 IF CODE(INKEYS(-1))=10:pdos
5280 CLS#20:AT#20,5,10:PRINT#20,w51s;nmp;s:w55s
5290 COPY "mdv1"&nmp$ TO "mdv2"&nmp$
5300 AT#20,5,10:PRINT#20,w51s;nmp;s:w55s
5310 AT#20,5,10:PRINT#20,w51s;scdmp;s:w55s
5320 COPY "mdv1"&scdmp$ TO "mdv2"&scdmp$
5330 BEEP 100,0:DIR mdv2_:PAUSE:GO TO 100
5340 END DEFine copia
5350 :
5360 REMark SELECTS AND ADJUSTS MATHEMATICAL SURFACE HEIGHTS
5370 DEFine PROCEDURE altura
5380 xt=mmvals(6)*(mmvals(1)+x*mulx):yt=mmvals(7)*(mmvals(3)+y*muly)
5390 SElect ON ux
5400 ON ux=1:fx1
5410 ON ux=2:fx2
5420 ON ux=3:fx3
5430 ON ux=4:fx4
5440 ON ux=5:fx5
5450 END SElect
5460 h(x,y)=(z*mmvals(5)+mmvals(8))*t/tt
5470 END DEFine altura
5480 :
5490 REMark TRANSFORM COORDINATE LIMITS
5500 DEFine PROCEDURE limites
5510 IF mmlena=0:llena
5520 mulx=(mmvals(2)-mmvals(1))/n
5530 muly=(mmvals(4)-mmvals(3))/n
5540 END DEFine limites
5550 :
5560 REMark CALCULATES CORNER HEIGHTS OF MATHEMATICAL SURFACES
5570 DEFine PROCEDURE limi
5580 limites
5590 x=0:y=0:altura:x=n:altura:y=n:altura:x=0:altura
5600 END DEFine limi
5610 :
5620 REMark DISPLAYS THIRD PAGE MESSAGES
5630 DEFine PROCEDURE supmat

```


PROGRAM FILE

```

5640 BEEP 400,22:CLS#20
5650 mlin=6:mmlin=8
5660 ultima=pri+mlin
5670 RESTORE 7050
5680 FOR y=pri TO ultima
5690 READ mens
5700 AT#20,y,10:PRINT#20,mens
5710 END FOR y
5720 RESTORE 5820
5730 IF tvall=1:GO TO 5790
5740 DIM tvals(ultima-pri+1,3)
5750 FOR y=1 TO ultima-pri+1
5760 READ tvals(y)
5770 END FOR y
5780 tvall=1
5790 FOR y=pri TO ultima
5800 AT#20,y,67:PRINT#20,tvals(y-pri+1)
5810 END FOR y
5820 DATA ss,ns,ns,ns,ns,ns,ns
5830 AT#0,0,10:INK#0,5:PRINT#0,w8$;:INK#0,7:PRINT#0,w9$;:INK#0,5:PRINT#0,
w57$:INK#0,7
5840 y=ux+pri-1:bloque
5850 REPEAT p
5860 ys=CODE(INKY$(-1))
5870 FOR xx=1 TO ultima-pri-1:IF tval$(xx)=s$:sumy=sumy+1:ux=xx
5880 IF ys=10:mcam:asigna
5890 IF ys=208:sube:END REPEAT p
5900 IF ys=216:baja:END REPEAT p
5910 IF y(ultima-1):mcam
5920 sumy=0:FOR xx=1 TO ultima-pri-1:IF tval$(xx)=s$:sumy=sumy+1
5930 IF sumy=0:ux=pri:tvals(1)=s$
5940 IF y=ultima:pdos
5950 IF y=ultima-1:ayuda
5960 BEEP 400,10:mdatos
5970 END REPEAT p
5980 END DEFine supmat
5990 :
6000 REMark DISPLAYS FOURTH PAGE MESSAGES
6010 DEFine PROCEDURE mdatos
6020 IF mllen=0:llena
6030 CLS#20:RESTORE 6460
6040 ultima=pri+mmlin
6050 FOR y=pri TO ultima
6060 READ mens
6070 AT#20,y,10:PRINT#20,mens
6080 END FOR y
6090 FOR y=pri TO ultima
6100 AT#20,y,67:PRINT#20,mvals(y-pri+1)
6110 END FOR y
6120 y=pri:bloque
6130 AT#0,0,10:INK#0,5:PRINT#0,w8$;:INK#0,7:PRINT#0,w9$;:INK#0,5:PRINT#0,
w10$
6140 REPEAT p
6150 ys=INKY$(-1)
6160 ys=CODE(ys)
6170 IF ys=10:asigna
6180 IF ys=208:sube:END REPEAT p
6190 IF ys=216:baja:END REPEAT p
6200 IF y=ultima:supmat
6210 mcogdat
6220 END REPEAT p
6230 END DEFine mdatos
6240 :
6250 REMark ASSIGN DEFAULT DATA FOR FOURTH PAGE MESSAGES
6260 DEFine PROCEDURE llena
6270 DIM mvals(mmlin+1,20)
6280 RESTORE 6470
6290 FOR y=pri TO pri+mmlin
6300 READ mvals(y-pri+1)
6310 END FOR y
6320 mllen=1
6330 END DEFine llena
6340 :
6350 REMark DISPLAYS INFORMATION PAGE
6360 DEFine PROCEDURE ayuda
6370 RESTORE 6450
6380 CLS#20
6390 FOR gg=5 TO 12
6400 READ mens:AT#20,gg,10:PRINT#20,mens
6410 END FOR gg
6420 IF CODE(INKY$(-1))=10:asigna
6430 supmat
6440 END DEFine ayuda
6450 DATA w70$,w71$,w72$,w73$,w74$,w75$,w76$,w77$
6460 DATA w40$,w41$,w42$,w43$,w44$,w45$,w46$,w47$,w38$
6470 DATA -tt/2,tt/2,-tt/2,tt/2,1,1,1,0,ns
6480 :
6490 REMark INPUTS DATA TO FOURTH PAGE
6500 DEFine PROCEDURE mcogdat
6510 kk=y-pri+1
6520 AT#20,y,67:PRINT#20,mvals(kk)
6530 IF CODE(ys)=10:asigna
6540 AT#20,y,67:PRINT#20,ys
6550 AT#20,y,68:INPUT#20,mvals(kk)
6560 kk=y-pri+1
6570 mvals(kk)=y$mvals(kk)
6580 maparta
6590 baja
6600 END DEFine mcogdat
6610 :
6620 REMark ERASES AND INPUTS DATA TO FOURTH PAGE
6630 DEFine PROCEDURE mborr
6640 AT#20,y,67:PRINT#20,mvals(kk)
6650 AT#20,y,67:INPUT#20,mvals(kk)
6660 maparta
6670 END DEFine mborr
6680 :
6690 REMark REJECTS LETTER DATA
6700 DEFine PROCEDURE maparta
6710 IF LEN(mvals(kk))<1 OR LEN(mvals(kk))>5:mborr
6720 FOR x=1 TO LEN(mvals(kk))
6730 k9=CODE(mvals(kk,x))
6740 IF k9>57 OR k9<45:mborr
6750 IF k9=47:mborr

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PROGRAM FILE

```

6760 END FOR x
6770 END DEFine maparta
6780 :
6790 REMark FIVE NEXT PROCEDURES SETS FIVE DIFFERENT MATHEMATICAL SURFACE
S
6800 DEFine PROCEDURE fx1
6810 LOCAL x,y:x=xt:y=yt
6820 z=66-SQRT(x^2+y^2)+8*SIN(SQRT((.2*x)^2+(.2*y)^2))
6830 END DEFine fx1
6840 :
6850 DEFine PROCEDURE fx2
6860 LOCAL x,y:x=xt:y=yt
6870 z=10*SIN(x)+10*SIN(y)+20
6880 END DEFine fx2
6890 :
6900 DEFine PROCEDURE fx3
6910 LOCAL x,y:x=xt:y=yt
6920 z=1/(SQRT((.3*x)^2+(.3*y)^2)/200+1.5E-2)
6930 END DEFine fx3
6940 :
6950 DEFine PROCEDURE fx4
6960 LOCAL x,y:x=xt:y=yt
6970 z=SQRT((.3*x)^2+(.3*y)^2)
6980 END DEFine fx4
6990 :
7000 DEFine PROCEDURE fx5
7010 LOCAL x,y:x=xt:y=yt
7020 z=10*(COS(.2*x)+COS(.2*y))/(x+y+.5)+10
7030 END DEFine fx5
7040 :
7050 DATA "z = 66-SQRT(x^2+y^2)+8*SIN(SQRT((.2*x)^2+(.2*y)^2))....."
7060 DATA "z = 10*SIN(x)+10*SIN(y)+20....."
7070 DATA "z = 1/(SQRT((.3*x)^2+(.3*y)^2)/200+1.5E-2)....."
7080 DATA "z = SQRT((.3*x)^2+(.3*y)^2)....."
7090 DATA "z = 10*(COS(.2*x)+COS(.2*y))/(x+y+.5)+10....."
7100 DATA w53$,w38$
7110 :
7120 REMark SETS ENGLISH MESSAGES
7130 DEFine PROCEDURE mensaj
7140 s$="yes":n$="not"
7150 w1$="Hallo!":w2$="With cartridge in Mdv1, press other key to load it
"
7160 w80$="If you don't want load screendumper, press ENTER."
7170 w3$="...loading "
7180 w4$="...wait ":w5$=" seconds"
7190 w6$=" ENTER: follows":w7$=" Other key: returns to menu"
7200 w8$="Press ":w9$="ENTER":w10$=" after change one data and when finis
h"
7210 w13$="Steps in a side 2^(-D-1), Density D=(1 TO 7)....."
7220 w15$="Printer height reduction (SEIKOSHA SP 1000: 0.82)....."
7230 w16$="X-axis rotation, horizontal axis (-45 to 45 degree)....."
7240 w17$="Y-axis rotation, perpendicular to screen axis (Id.)....."
7250 w18$="Z-axis rotation, vertical axis (-45 to 45 degree)....."
7260 w19$="Mountains colour (1,3,5 or 7)....."
7270 w20$="Sun, moon and stars colour (1,3,5 or 7)....."
7280 w21$="Quadricle line colour (1,3,5 or 7)....."
7290 w22$="Sea colour (1,3,5 or 7)....."
7300 w23$="Background colour (1,3,5 or 7)....."
7310 w24$="Roughness (0 to 600)....."
7320 w25$="Size (0 to 600)....."
7330 w26$="Other....."
7340 w27$="Transparent....."
7350 w28$="Sun apparition....."
7360 w29$="Moon apparition....."
7370 w30$="Stars apparition....."
7380 w31$="Sea apparition....."
7390 w32$="Figure repetition (it's before possible change outlook):
"
7400 w33$="Print after draw....."
7410 w34$="Save figure in Mdv2_ after draw....."
7420 w35$="Load figure from Mdv2_ and print it....."
7430 w36$="Copy the program to Mdv2....."
7440 w37$="Mathematical surface....."
7450 w38$="Anterior page....."
7460 w39$="Sure that image cartridge is in Mdv2_ and press one key:
"
7470 w40$="X-axis left coordinate....."
7480 w41$="X-axis right coordinate....."
7490 w42$="Y-axis posterior coordinate....."
7500 w43$="Y-axis anterior coordinate....."
7510 w44$="Height multiplier....."
7520 w45$="X-axis multiplier....."
7530 w46$="Y-axis multiplier....."
7540 w47$="On high surface translate....."
7550 w49$=" wait "
7560 w56$=" when finish, other key to change"
7570 w57$=" when finish, other key to adjust surface"
7580 w58$="some"
7590 w53$="Information....."
7600 angus$="X-axis rotation = 28 // Y-axis rot. = 0 // Z-axis rot. = 9 an
d size = 175
are good value to draw landscapes"
7610 w70$=" Calculus surfaces time is bigger than calc mountains time"
7620 w71$=" but it are drawn in same time"
7630 w72$=" :":w73$=" - To print your own functions you can easily modify
the fx"
7640 w74$=" procedures, they are at the end of program, before messages"
7650 w75$=" - Height of function (z) must be positive in the corners"
7660 w76$=" :":w77$=" - Press ENTER to run, other key to return"
7670 dnom
7680 END DEFine mensaj
7690 :
7700 REMark SETS COPY MESSAGES
7710 DEFine PROCEDURE dnom
7720 w50$="Push program cartridge in Mdv1_ and blank cartridge in Mdv2_
and press one key"
7730 w90$="ENTER: returns to menu"
7740 w55$=" to Mdv2_":w51$="...Copying "
7750 w95$="If you cannot save it (if time saving is bigger than 20 second
s), you need 'clear' all variables to leave free memory, if so,
you can after press this procedure named 'copia'"
7760 REMark next line sets screendumper and main program names
7770 scdmp$="gprint prt":naps$="QLANDS"
7780 END DEFine dnom

```


PROGRAM FILE



Spectrum Triplets by CM Price

Triplets is a game for two players, played on an eight by eight board. The two players take turns to place an 'x' or an 'o' on the board. A point is scored for each run of three adjacent os or xs, so a run of five would score three points. The winner is the player with the most points when the board has been filled.

You can have two human players or play against the computer. The computer has 33 skill levels from 0 (hardest) to 32 (easiest). To make a move, enter the row, then the column number, and finally confirm the position. To abandon the game, enter 'a' for another turn.

When the computer is playing, it examines each unoccupied position on the board. For each of these it calculates how many points it would score if it played there (a); how many points its opponent would get if they played there (b); how many lines of two with a free end it would form if it played there (c); and how many lines with a free end the opponent would get (d). From these four numbers, a scoring function is calculated as follows:

$s = 100a + 99b + 10c + 9d + 7 - (\text{the sum of horizontal and vertical distances from the centre of the board})$
The square with the highest scor-

ing value calculated in this way is the one the computer plays on.

The variables used are:

k — indicates whose turn it is to move (holds 1 or 2 alternately)
ks — indicates whose turn it is to start a game

a(k) — has value 1 if player k is the computer, -1 if human

1(k) — holds the value of the handicap if player k is the computer

M\$,n\$ — hold the scores of the first and second players, respectively, in a string

ip,jp — position on the screen where the current move will be displayed

p — current move number

m(i,j) — memory map of the board held in a 12x12 array, with the actual playing area held in (3,3) to (10,10)

The printed version of the program contains a section of machine code which emulates a section of Basic (given at the end of the listing) which optimises the counting up and scoring functions.

Theoretically, the player who goes first should always win this game, but in practice it's too complex for this to be at all certain. There is, however, a simple way for the second player to always draw. It shouldn't be too hard to work out, so I won't reveal what it is!

```

18 REM This statement providesspace for the machine code. It MUST be included
19 REM it MUST be thefirst statement, and it MUST haveat least 198 characters in it.
20 REM But it may contain any characterstring.
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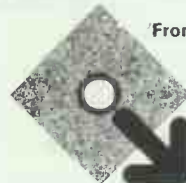
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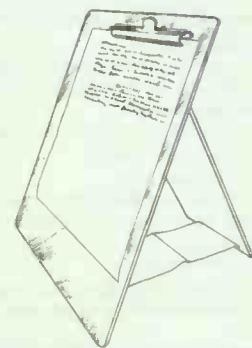


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PROGRAM FILE

```

500 CLS : FOR i=3 TO 10: FOR j=3 TO 10
510 PRINT PAPER 1+j-2*INT ((i+j)/2)+6; INK 0; AT 2*i,2*j+2; " "; AT 2*i+1,2*j+2;
520 LET m(i,j)=0: POKE 40000+12*i+j,0
530 NEXT j: NEXT i
540 LET k=k+1
550 LET m$="00": LET n$="00"
560 PRINT AT 4,0;a$;TAB 12;m$;TAB 15; "-- ";n$;TAB 32-LEN b$;b$
570 REM
580 REM *****
590 REM *
600 REM *   Play the game   *
610 REM *
620 REM *****
630 FOR p=1 TO 64
640 LET c$=a$: IF k=2 THEN LET c$=b$
650 PRINT AT 0,0;
660 PRINT AT 0,12-INT (LEN c$/2);c$;" to play"
670 LET x$=" " : LET y$=" " : IF k=2 THEN LET x$=" " : LET y$=" "
680 LET ip=6+INT ((p-1)/2)-16*INT ((p-1)/32)
690 LET jp=25*k-24+3*INT ((p-1)/32)
700 IF a(k)=1 AND p>2*(k) THEN GO SUB 1570: REM Computer to move
710 IF a(k)=1 AND p<=2*(k) THEN GO SUB 1690: REM Computer random move
720 IF a(k)=-1 THEN GO SUB 1060: REM Human move
730 GO SUB 1320: REM Score and enter move
740 PRINT AT 4,0;a$;TAB 12;m$;TAB 15; "-- ";n$;TAB 32-LEN b$;b$
750 LET k=3-k: NEXT p
760 REM
770 REM *****
780 REM *
790 REM *   End of game   *
800 REM *   Declare winner,play *
810 REM *   tune,exchange start *
820 REM *   ready for next game *
830 REM *
840 REM *****
850 REM
860 PRINT AT 0,0;
870 IF m$>n$ THEN LET c$=a$+" wins !"
880 IF m$<n$ THEN LET c$=b$+" wins !"
890 IF m$=n$ THEN LET c$="It's a tie !!!"
900 FOR i=0 TO 10
910 PRINT AT 0,16-LEN c$/2; INVERSE 1-2*INT (i/2);c$
920 BEEP .14,2*INT (i/10),7+2*i+3*(1-2*INT (i/2)); NEXT i
930 PAUSE 6: BEEP .1,7: PAUSE 4: BEEP .1,7: PAUSE 4: BEEP .1,7
940 PRINT AT 2,2;"Press any key to play again "
950 IF INKEY$<>" " THEN GO TO 950
960 IF INKEY$=" " THEN GO TO 960
970 LET ks=3-ks: GO TO 500
980 REM
990 REM *****
1000 REM *
1010 REM *Read human's move and*
1020 REM *check that it's valid*
1030 REM *
1040 REM *****
1050 REM
1060 BEEP .1,24: PRINT AT 2,2;"Please enter row and column "
1070 PRINT AT ip,jp;
1080 FOR q=1 TO 2: LET i=j
1090 IF INKEY$<>" " THEN GO TO 1090
1100 IF INKEY$=" " THEN GO TO 1100
1110 LET z$=INKEY$: IF z$="a" THEN LET c$="Game abandoned": GO TO 900
1120 IF z$="1" OR z$="8" THEN GO TO 1090
1130 LET j=VAL z$+2: BEEP .1,10
1140 PRINT j-2;
1150 NEXT q
1160 IF m(i,j)<>0 THEN PRINT AT 2,2;"Sorry - that square is taken": BEEP .3,12:
BEEP .3,7: BEEP .3,12: BEEP .3,7: GO TO 1060
1170 PRINT AT 2,2;" Is this correct ? (y/n) "
1180 PRINT AT 2*i,2*j+2;x$;AT 2*i+1,2*j+2;y$: PAUSE 17
1190 IF INKEY$="y" THEN BEEP .1,10: RETURN
1200 PRINT AT 2*i,2*j+2; " "; AT 2*i+1,2*j+2; " " : PAUSE 17
1210 IF INKEY$="y" THEN BEEP .1,10: RETURN
1220 IF INKEY$="n" THEN GO TO 1060
1230 GO TO 1180
1240 REM *****
1250 REM *
1260 REM *
1270 REM *Enter move, calculate*
1280 REM *   and enter score   *
1290 REM *
1300 REM *****
1310 REM
1320 PRINT AT 2,2;
1330 LET m(i,j)=k: POKE 40000+12*i+j,k
1340 PRINT AT ip,jp;1-2;j-2
1350 PRINT AT 2*i,2*j+2;x$;AT 2*i+1,2*j+2;y$
1360 LET s=-1.5
1370 FOR x=-1 TO 1: FOR y=-1 TO 1
1380 LET b=m(i+x,j+y)
1390 IF b<k THEN GO TO 1430
1400 LET a=m(i+x,x,j+y)
1410 LET c=m(i-x,j-y)
1420 LET s=s+(NOT (b-a))+0.5*(NOT (b-c))
1430 NEXT y: NEXT x
1440 IF k=1 THEN LET m$=STR$ (VAL m$+s)
1450 IF k=2 THEN LET n$=STR$ (VAL n$+s)
1460 IF LEN m$=1 THEN LET m$="0"+m$
1470 IF LEN n$=1 THEN LET n$="0"+n$
1480 RETURN
1490 REM *****
1500 REM *
1510 REM *
1520 REM *   Calculation of best *
1530 REM *   move for computer *
1540 REM *
1550 REM *****
1560 REM
1570 RANDOMIZE USR 23760
1580 LET i=PEEK 40003
1590 LET j=PEEK 40002
1600 PAUSE 75: RETURN
1610 REM *****
1620 REM *
1630 REM *
1640 REM *Computer makes a move*
1650 REM *   at random   *
1660 REM *
1670 REM *****
1680 REM

```


PROGRAM FILE

```

1690 LET st=0: LET stop=INT ((65-p)*RND)+1
1700 FOR i=3 TO 10: FOR j=3 TO 10
1710 IF m(i,j)>0 THEN GO TO 1730
1720 LET st=st+1: IF st=stop THEN RETURN
1730 NEXT j: NEXT i: RETURN
1740 REM
1750 REM *****
1760 REM *
1770 REM * Data for graphics *
1780 REM * symbols ( 0 and X ) *
1790 REM *
1800 REM *****
1810 REM
1820 DATA 0,0,3,15,20,24,48,48
1830 DATA 0,0,192,240,56,24,12,12
1840 DATA 48,48,24,20,15,3,0,0
1850 DATA 12,12,24,56,240,192,0,0
1860 DATA 0,0,0,24,20,14,7,3
1870 DATA 0,0,0,24,56,112,224,192
1880 DATA 3,7,14,20,24,0,0,0
1890 DATA 192,224,112,56,24,0,0,0
1900 REM
1910 REM *****
1920 REM *
1930 REM * Machine code loader *
1940 REM *
1950 REM *****
1960 REM
1970 RESTORE 2060: LET k=23760: FOR i=1 TO 19: LET s=0
1980 READ a$: FOR j=1 TO 19 STEP 2
1990 LET x=CODE a$(j)-48: IF x>15 THEN LET x=x-39
2000 LET y=CODE a$(j+1)-48: IF y>15 THEN LET y=y-39
2010 LET x=16*x+y: POKE k,x
2020 LET s=s+x
2030 LET k=k+1: NEXT j
2040 READ y: IF s<y THEN PRINT "Error in DATA line ";2050+10*i: STOP
2050 NEXT i: STOP
2060 DATA "21669ce52e4c36802b36",793
2070 DATA "802b36032b36032b3600",297
2080 DATA "2b3600d113d51a3df274",983
2090 DATA "5d2b36dc2b36fd7e2386",1855
2100 DATA "c61a5fe1e57d936f4e83",1365
2110 DATA "836f56036f462e447a16",898
2120 DATA "80fe01fa365db1e6320",1883
2130 DATA "011c2a479cb820021919",566
2140 DATA "b92001197bd65a5fafb8",1124
2150 DATA "20021919b92002191922",387
2160 DATA "479c21459c3420b9237e",915
2170 DATA "c60c7720af2e4a7ed607",1003
2180 DATA "30012f472b7ed6073001",622
2190 DATA "2f80c609fed720011587",832
2200 DATA "2a479c5f19ed5b4b9ceb",1183
2210 DATA "ed5230aed534b9c2a49",1043
2220 DATA "9c22429c21499c347efe",1186
2230 DATA "0bc2e15c23347efe0bd1",1209
2240 DATA "13131313d5c2de5ce1c9",1223

```

```

10 LET dmax=-1
20 FOR i=3 TO 10
30 FOR j=3 TO 10
40 IF m(i,j)>0 THEN GO TO 190
50 IF p<4 THEN GO TO 160
60 LET w(1)=0: LET w(2)=0: LET t(1)=0: LET t(2)=0
70 FOR x=-1 TO 1
80 FOR y=-1 TO 1
90 LET b=(1+x,j+y)
100 IF b<0 THEN GO TO 150
110 LET a=(1+x,x,j+y+y)
120 LET c=(1-x,j-y)
130 LET w(b)=w(b)+(NOT a)+NOT c
140 LET t(b)=t(b)+(NOT (b-a))+0.5*NOT (b-c)
150 NEXT y: NEXT x
160 LET d=100*t(k)+99*t(3-k)+10*w(k)+9*w(3-k)+7-ABS (1-6.5)-ABS (j-6.5)
170 IF dmax>d THEN GO TO 190
180 LET dmax=d: LET id=1: LET jd=j
190 NEXT j: NEXT i
200 LET i=id: LET j=jd
210 RETURN

```

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Number Conversion Functions by Mads Dam-Larsen

Number-base conversion can be defined as a standard Basic function as follows:

To convert a decimal number from base 10 to another base B, use the following formula:

$N_B =$ the sum as x changes from 0 to 8 of $10^x ((N \text{ DIV } B^x) \text{ MOD } B)$

N is the decimal number to be converted; B is the new base; N_B is the converted number; and x is the accuracy (eight digits in this case). To convert from base B to base 10, swap '10' and 'B' in the algorithm.

The actual function is of the form:

```
DEF FNA=FNB(0)+FNB(1)+  
FNB(2)+...
```

```
DEF FNB(x)=((N DIV B^X) MOD  
B)*10^X
```

FNA will then hold the converted number.

To convert from base B to decimal:

```
DEF FNC=FND(0)+FND(1)+FND(2)...
```

```
DEF FND(x)=((N DIV 10^X) MOD  
10)*B^X
```

These functions cannot convert numbers between bases which are greater than 10.



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PROGRAM FILE



BBC Wordwise Text Recovery

by Terry Blunt

This short utility program allows the user to recover text after a crash while editing in Wordwise or Wordwise Plus. The program, when run, generates and saves a short machine code routine that resides at &C00, which is a safe location for both tape and disk users.

To recover text when in Wordwise or after transferring to another language, *RUN the file. If working from

cassette, change to a new blank tape when the 'RECORD then RETURN' prompt appears.

The routine scans the working RAM area and builds up a file consisting of all ASCII characters, embedded command start and end codes, and TAB codes. This is saved as 'W.TEXT'.

The location memory to compile to can be changed in line 210.

```

10 REM Wordwise text recoverer
20 REM By Terry Blunt
30 REM 3 / 1 / 86
40 REM updated
50 REM 17 / 8 / 86
60
70 MODE 7
80 PRINT "" "To use this program RUN it and slow"" it to save the assembled co
de 50 dir. "
90 PRINT "" "When you wish to recover a piece of "" corrupted text from WORDWISE
re-insert "" the disc and type *RECOVER. "
100 PRINT "" "A new file called 'TEXT' will be "" produced which can be loaded in
the "" normal way and final correcting and "" deleting of unwanted text performed.
"
110 PRINT "" SPC10 "Press any key";
120 IF GET
130 PRINT "" SPC3 "Assemble for Wordwise Plus 7 ";
140 IF (GET AND 95)=89 PRINT "Y":starthi=61C ELSE PRINT "N":starthi=61A
150 PRINT "" SPC13 "WORKING"
160
170 DIM oastext &80
180
190 addlo=670
200 addhi=671
210 base=&C00
220 osnewl=&FFF7
230 oswrch=&FFEE
240 osfind=&FFCE
250 osbput=&FFD4
260 oscli=&FFF7
270
280 FOR I%=0 TO 2 STEP 2
290 Pt=base
300
310 (OPT I%
320
330 LDA #680
340 LDX #text MOD 256
350 LDY #text DIV 256
360 JSR osfind \ Openout file "TEXT"
370 TAY
380 EOR #255 \ Set up start address
390 STA addlo \ cancelling Y offset
400 LDA #starthi
410 STA addhi
420 LDX #65F \ Set number of 256 byte pages
430
440 .loop
450 LDA (addlo),Y \ Get character
460 CMP #602 \ Embedded start (green)
470 BEQ put
480 CMP #607 \ Embedded end (green)
490 BEQ put
500 CMP #600 \ CR
510 BEQ put
520 CMP #620 \ too low
530 BCC skip
540 CMP #600 \ 'TAB' character
550 BEQ put
560 CMP #67F \ too high
570 BCS skip
580 .put
590 JSR osbput \ send to file
600
610 .skip
620 INC addlo \ increment address
630 BNE loop
640 INC addhi \ increment page
650 DEX \ decrement page counter
660 BNE loop
670 TXA
680 JSR osfind \ close file
690
700 .print
710 LDA text,X
720 BEQ end
730 JSR oswrch
740 INX
750 BNE print
760
770 .end
780 JMP osnewl \ newline and exit
790
800 .text
810
820 |
830 NEXT
840 Stext="W.TEXT saved"+CHR50
850
860 Soastext=""$, RECOVER "+STR5"base+" "+STR5"(text+LENstext)
870 X%=oastext MOD 256
880 Y%=oastext DIV 256
890 CALL oscli
900 PRINT "" SPC9, ""RECOVER' saved"

```


PROGRAM FILE



Commodore 64 Enhancer by Shane Broadberry

It is important that the M/C loader for the Enhancer is typed in *before* the demonstration program. Type the M/C loader in first, run it and when it has saved, type: SYS 49152 [return].

This will turn the Enhancer on. When the start message appears, you can now proceed to type in the demonstration program which accompanies it. This program must be typed in or loaded when the Enhancer is in memory and operative, otherwise it will not work. The Enhancer saves to disk or tape the machine code needed to run the Enhancer, so that you won't have to compile it each time you wish to use it. To load it, type: LOAD "enhancer

64", device, 1 [return]. After it has loaded, type: SYS 49152 [return].

The Enhancer was written to allow access from Basic to commands which allow windows on the screen to be scrolled in all directions, which in its turn allows information to come on or go off quickly. The program will allow boxes and borders to be drawn anywhere on the screen and in any size, colour or character. It will reverse the whole screen, or part of the screen. It will store eight screens of text (or colour graphics) for later rapid retrieval in memory that is unused by Basic and most machine code programs.

```

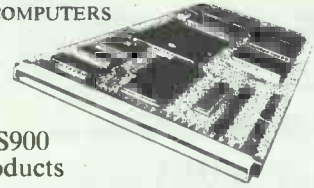
100 REM ENHANCER 64 SHANE BROADBERRY
110
120 #F=CHR$(34)
130 #T="TYPING COMPILING ENHANCER"
140 #P=(80/256)
150 #I="INT" #M="CURRENT LINE:" #PEEK(63)+PEEK(64)*256
160 #EADA T=T+A
170 #A="E49152",A #A=NEXT
180 #T<>221177 THEN PRINT "CHECKSUM ERROR":END
190 PRINT "SAVE TO (D)ISK OR (T)APE?"
200 GET #F:IF #C>"D" AND #C<"T" THEN #M=200
210 #E1=IF #C="D" THEN #E
220 PRINT "PRESS SPACE TO CONTINUE..."
230 GET #F:IF #C<" " THEN #M=230
240 PRINT "OK, SAVING ENHANCER"
250 PRINT "SAVE AS ENHANCER 64" #E", "D", "1"
260 PRINT "NAME:POKE44,8:POKE43,1:POKE45,47:POKE46,37"
270 POKE198,3:POKE631,19:POKE632,13:POKE44,192:POKE43,0:POKE45,0:POKE46,199
280 POKE633,13
290 END
300
310
320 DATA 76,93,192,67,79,77,77,65,78,68,83,58,13,147,144,17
330 DATA 32,32,69,78,72,65,78,67,69,82,32,39,54,52,32
340 DATA 49,57,56,54,32,83,72,65,78,69,32,66,82,79,65,68
350 DATA 66,69,82,82,89,13,17,32,32,32,84,89,80,69,32
360 DATA 34,72,69,76,80,34,32,70,79,82,32,76,73,83,84,32
370 DATA 79,70,32,67,79,77,77,65,78,68,83,13,80,162,80,189
380 DATA 13,192,240,86,32,210,255,232,208,245,169,87,141,33,208,169
390 DATA 82,141,32,208,120,169,52,141,86,83,169,193,141,89,83,169
400 DATA 49,141,84,83,169,192,141,85,83,169,12,141,86,83,169,193
410 DATA 141,87,83,88,96,32,124,165,168,85,185,251,81,240,91,281
420 DATA 34,240,75,201,131,240,89,201,65,144,64,201,91,176,60,132
430 DATA 77,162,80,134,11,56,253,112,193,240,19,201,128,240,22,189
440 DATA 12,193,240,39,48,83,232,208,246,300,11,164,177,36,208,185
450 DATA 251,81,232,208,224,166,177,165,11,24,105,204,157,251,81,200
460 DATA 232,185,251,81,157,251,81,208,246,164,177,200,208,172,200,185
470 DATA 251,81,240,86,281,34,208,246,240,241,163,80,153,253,81,96
480 DATA 200,185,251,81,240,244,201,58,238,246,240,232,201,255,240,31
490 DATA 66,15,48,12,301,204,144,23,56,233,203,178,132,73,32,97
500 DATA 133,185,112,193,48,86,32,210,255,208,208,245,76,239,166,41
510 DATA 255,76,26,167,32,115,80,201,204,144,25,201,218,176,21,32
520 DATA 69,193,76,174,167,233,203,10,168,185,181,193,72,185,190,193
530 DATA 72,76,115,80,201,139,76,99,193,96,32,121,80,76,231,167
540 DATA 66,160,255,202,240,88,200,185,112,193,16,250,49,245,200,96
550 DATA 76,83,67,82,79,76,204,82,83,67,82,79,76,204,85,83
560 DATA 67,82,79,76,204,68,83,67,82,79,76,204,78,76,73,208
570 DATA 66,79,216,67,79,76,79,85,210,78,66,79,216,67,66,79
580 DATA 216,83,84,65,83,200,70,69,84,67,200,72,69,76,208,75
590 DATA 73,76,204,80,125,198,135,198,145,198,162,198,191,195,40,194
600 DATA 200,195,172,195,152,195,190,194,197,194,205,193,82,228,162,80
610 DATA 169,13,32,210,255,162,80,189,83,192,32,210,255,232,224,10
620 DATA 208,245,202,169,45,32,210,255,202,208,250,169,13,32,210,255
630 DATA 169,13,32,210,255,169,32,32,210,255,189,112,193,240,18,201
640 DATA 128,176,87,32,210,255,232,208,241,96,73,126,32,210,255,169
650 DATA 13,32,210,255,169,32,32,210,255,76,86,194,80,80,80,80
660 DATA 80,80,80,80,80,80,80,80,32,233,197,32,76,183,142
670 DATA 13,194,32,76,198,142,39,194,169,80,141,38,194,32,79,194
680 DATA 169,212,141,38,194,173,39,194,141,33,194,32,79,194,96,32
690 DATA 23,195,206,36,194,174,37,194,168,80,173,33,194,145,80,208
700 DATA 202,208,250,174,36,194,240,19,168,80,32,177,197,173,33,194
710 DATA 45,80,172,37,194,136,145,80,202,208,237,160,80,174,37,194
720 DATA 45,80,200,202,208,250,96,120,173,33,194,141,28,194,169,16
730 DATA 33,81,169,80,133,80,169,84,133,81,174,28,194,240,18,165
740 DATA 81,24,185,84,133,81,202,208,246,165,81,133,83,24,185,208
750 DATA 33,83,169,80,133,80,169,84,24,189,38,194,133,81,96,32
760 DATA 33,198,32,205,169,96,32,83,198,32,242,194,96,32,135,194
770 DATA 62,84,168,80,194,23,133,81,177,80,169,16,133,81,104
780 DATA 45,82,200,208,239,230,31,230,83,202,208,232,169,39,133,81
790 DATA 66,32,135,194,162,84,168,80,169,16,133,81,177,82,72
800 DATA 169,23,133,81,104,145,80,200,208,239,230,81,230,83,202,208
810 DATA 32,169,39,133,81,86,96,32,63,195,169,80,133,80,169,84
820 DATA 24,189,38,194,133,81,165,80,24,189,28,194,133,80,173,29
830 DATA 34,240,11,162,80,32,177,197,232,236,29,194,208,247,96,173
840 DATA 30,194,56,237,28,194,141,37,194,173,31,194,56,237,29,194
850 DATA 41,36,194,96,142,33,194,140,35,194,141,34,194,169,80,141
860 DATA 32,194,141,38,194,32,23,195,165,81,24,189,34,194,133,81
870 DATA 60,80,174,37,194,173,35,194,240,87,177,80,73,128,76,132
880 DATA 195,173,33,194,145,80,200,202,208,235,32,177,197,238,32,194
890 DATA 73,32,194,205,36,194,144,216,96,32,233,197,32,76,198,142
900 DATA 33,194,169,212,168,80,174,33,194,32,84,195,96,32,233,197

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910 DATA32,76,198,142,33,194,169,00,168,174,33,194,32,84,195,96
920 DATA32,233,197,160,01,169,00,32,84,195,96,173,18,208,201,234
930 DATA208,249,32,158,183,142,33,194,32,76,198,142,33,208,32,76
940 DATA138,142,32,208,162,00,173,33,194,157,00,216,157,00,217,157
950 DATA00,218,157,00,219,232,208,241,96,169,00,141,32,194,174,37
960 DATA194,160,00,177,80,145,82,200,202,208,248,32,177,197,32,191
970 DATA197,238,32,194,173,32,194,205,36,194,208,226,96,32,23,195
980 DATA165,81,133,83,165,80,133,82,165,80,24,105,01,133,80,165
990 DATA1,105,00,133,81,173,37,194,201,01,240,03,206,37,194,32
1000 DATA249,195,173,40,194,240,03,32,131,197,96,32,23,195,165,81
1010 DATA133,83,165,80,133,82,32,177,197,32,249,195,173,40,194,240
1020 DATA03,32,40,197,96,174,36,194,142,32,194,174,37,194,172,37
1030 DATA194,136,177,82,145,80,136,202,208,248,32,205,197,32,219,197
1040 DATA206,32,194,173,32,194,208,227,96,32,169,196,165,81,133,83
1050 DATA165,80,133,82,32,177,197,32,177,197,32,191,197,32,101,196
1060 DATA173,40,194,240,03,32,09,197,96,32,63,195,32,23,195,173
1070 DATA18,208,201,220,208,249,172,96,194,32,177,197,136,208,250,165
1080 DATA56,233,80,133,80,165,81,233,00,133,81,165,80,133,250
1090 DATA165,81,133,251,96,32,169,196,165,81,133,83,165,80,133,32
1100 DATA165,80,24,105,01,133,80,165,81,105,00,133,81,32,177,197
1110 DATA32,191,197,173,37,194,201,01,240,03,206,37,194,32,101,196
1120 DATA173,40,194,240,03,32,75,197,96,172,96,194,165,80,133,82
1130 DATA165,81,133,83,32,191,197,136,208,250,174,37,194,160,00,177
1140 DATA82,145,80,200,202,208,248,96,172,36,194,200,165,80,133,82
1150 DATA165,81,133,83,32,219,197,136,208,250,32,205,197,174,37,194
1160 DATA160,00,177,82,145,80,200,202,208,248,96,165,250,56,233,01
1170 DATA133,82,165,251,233,00,133,83,165,82,24,109,37,194,133,82
1180 DATA165,83,105,00,133,83,160,00,174,36,194,177,82,145,250,165
1190 DATA250,56,233,40,133,250,165,251,233,00,133,251,32,219,197,202
1200 DATA208,233,96,165,80,56,233,41,133,80,165,81,233,00,133,81
1210 DATA165,80,24,109,37,194,133,82,165,81,105,00,133,83,160,00
1220 DATA174,36,194,177,80,145,82,32,205,197,32,219,197,202,208,243
1230 DATA96,165,80,24,105,40,133,80,165,81,105,00,133,81,96,165
1240 DATA82,24,105,40,133,82,165,83,105,00,133,83,96,165,80,56
1250 DATA233,40,133,80,165,81,233,00,133,81,96,165,82,56,233,40
1260 DATA133,82,165,83,233,00,133,83,96,32,158,183,202,142,28,194
1270 DATA32,76,198,202,142,29,194,32,76,198,142,30,194,32,76,198
1280 DATA142,31,194,173,28,194,205,30,194,176,61,173,29,194,205,31
1290 DATA194,176,53,173,28,194,201,41,176,46,173,30,194,201,41,176
1300 DATA39,173,31,194,201,26,176,32,173,29,194,201,26,176,25,173
1310 DATA28,194,201,255,240,18,173,30,194,240,13,173,29,194,201,255
1320 DATA240,06,173,31,194,240,01,96,76,72,170,96,32,253,174,32
1330 DATA158,183,96,160,00,177,122,201,33,240,21,169,00,141,38,194
1340 DATA32,158,183,224,00,240,225,202,224,11,176,220,142,33,194,96
1350 DATA32,115,00,169,212,141,38,194,32,158,183,76,99,198,32,100
1360 DATA198,32,233,197,32,29,196,96,32,180,198,32,233,197,32,213
1370 DATA196,96,32,180,198,32,233,197,173,31,194,201,25,176,169,32
1380 DATA75,196,96,32,180,198,32,233,197,173,31,194,201,25,176,169,32
1390 DATA32,137,196,96,32,202,198,32,230,198,177,122,201,33,240,01
1400 DATA96,32,115,00,169,01,141,40,194,96,160,00,177,122,201,35
1410 DATA240,06,169,00,141,38,194,96,169,212,141,38,194,32,115,00
1420 DATA169,00,141,40,194,96,177,122,201,37,240,06,169,00,141,40
1430 DATA194,96,169,01,141,40,194,169,212,141,38,194,32,115,00,96
1440 DATA00,00,00
READY.
    
```

```

100 REM ENHANCER DEMO, SHANE BROADBERRY
101 REM THIS PROGRAM MUST TYPED IN
102 REM WHEN THE ENHANCER IS IN MEMORY
103 REM AND ACTIVE OR IT WILL NOT WORK.
110
111 REM MESSAGE FOR SCROLLING..
120 A$="THIS SCROLLING EXAMPLE COULD BE COMING ONTO THE LEFT HAND SIDE OF "
130 A$=A$+"THE SCREEN, SHOWING THAT IT WAS BEING SCROLLED, THEN AGAIN IT COULD "
140 A$=A$+"BE COMING IN FROM THE RIGHT LIKE IT IS BELOW!!!"
150 C=2:POKE3272,23:POKE3281,7:POKE3280,C:POKE646,0
151 IPEEK(773)<>192THENPRINT"MINI LESE LIT" AND _/ THE "NHANCER FIRST":END
160 FBOX 1,1,40,25,160:CBOX1,1,40,25,C
170 FOR2=0T060:NEXT
180 FORX=13T01STEP-1:BOX X,X,41-X,26-X,32,2:NEXT
190 PRINT"#"
200 PRINTTAB(8)"# "NHANCER 64 DEMO":PRINTTAB(6)"# 1986 #HANE IROADBERRY"
210 BOX 1,1,40,7,43,0
220 FBOX 1,8,40,25,160:CBOX 1,8,40,25,2
230 FORX=0T05:FLIP 2,2,39,6:FORZ=0T010:NEXTZ,X:BOX 1,1,40,7,42,0:POKE646,C
240 PRINT"#####"
250 PRINT"#####"
260 PRINT"#####"
270 PRINT"#####"
280 PRINT"#####"
290 PRINT"#####"
300 GOSUB1030
301 REM PRINT UP "PRESS SPACE PLEASE"
310 GOSUB1040:FORZ=0T0300:NEXT:GET6$:IFG$=""THEN310
320 BOX 1,12,40,12,32,C
330 FORX=0T012:USCROLL1,1,40,11:DISROLL 1,12,40,24:NEXT
340 FBOX 1,1,40,10,160:FORX=1T038STEP2:CBOX X,1,X+10,10,X:NEXT
350 PRINT"#####"
360 PRINTTAB(27)"#####"
370 PRINTTAB(27)"#####"
371 REM COLOUR BOX SAME AS BOARDER
380 CBOX 1,11,40,25,C
390 FBOX 1,11,40,25,160
400 CBOX 27,1,40,10,C
401 REM SCROLL LINE LEFT + OTHER RIGHT
410 FORX=0T0125:LSCROLLX1,1,40,5:RSCROLLX1,6,40,11:NEXT
420 PRINT"#####"
430 PRINT"#####"
440 FORX=0T055:USCROLLX1,1,40,9:NEXT
450 PRINT"#####"
460 PRINT"#####"
470 FORX=1T0LEN(A$)
471 REM PUT UP MESSAGE ONTO SCREEN.
480 POKE1703,ASC(MID$(A$,X,1))+128:POKE1744,ASC(MID$(A$,X,1))+128
490 LSCROLL 1,17,40,17:RSCROLL 1,19,40,19
500 Q=Q+1:IFQ=5THENQ=0:GOSUB1040
510 GET6$:IFG$=""THENNEXT
520 FORX=1T06:BOX X,X,20-X,13-X,160,2:BOX X+19,X,41-X,13-X,160,2
530 BOX X,X+12,20-X,25-X,160,2:BOX X+19,12+X,41-X,25-X,160,2:NEXT
531 REM ROUTINE TO DRAW UP RANDOM BOXES
540 CLR:PRINT"#####"
550 FORF=0T0170
560 X=INT(RND(5)*25)+1:Y=INT(RND(1)*11)+1
570 X2=X+10+V:Y2=Y+10+V:V=INT(RND(25)*5)
580 CBOX X,V,X2,Y2,Z=INT(RND(5)*15):NEXT:CBOX 4,5,36,21,0
590 CBOX 5,6,35,20,2:POKE646,2
600 PRINT"#####"
610 PRINT"#####"
620 PRINT"#####"
630 PRINT"#####"
640 GOSUB1030
    
```


PROGRAM FILE

```

650 FORZ=0T0300:NEXTZ:GOSUB1040
660 GETG$:IFG$=""THEN650
670 FORX=1T013:BOX X,X,41-X,26-X,160,6:NEXT
680 FORX=13T01STEP-1:BOX X,X,41-X,26-X,160,2:NEXT
690 BOX 1,1,40,25,160,0:BOX 2,2,39,24,160,0
700 PRINT"#####TAB(5)"THIS IS INSIDE AN 'OPEN' BOX"
710 PRINT"#####TAB(5)"TO CLOSE A BOX WITH A SPECIFIED"
720 PRINT"#####TAB(5)"CHARACTER THE -IF* COMMANDS IS "
730 PRINT"#####TAB(5)"USED.
740 PRINT"#####TAB(5)"HERE ARE TWO BOXES."
750 GOSUB1030
760 BOX 9,15,19,22,160,0:CBOX21,15,31,22,0
770 FORX=0T0300:NEXT
780 GOSUB 1040
790 GETG$:IFG$=""THEN770
800 BOX 20,1,20,25,32,2
810 FORX=0T020:LSCROLL 1,1,20,25:RSCROLL 20,1,40,25:NEXT
820 CBOX 1,1,40,25,2:FLIP 1,1,40,25
830 PRINT"#####TAB(5)"BOXES CAN BE MADE ANY SIZE"
840 PRINT"#####TAB(5)"SO LONG AS THEY FIT INSIDE THE
850 PRINT"#####TAB(5)"SCREEN.
860 PRINT"#####TAB(5)"THE REMAINDER OF THIS PROGRAM"
870 PRINT"#####TAB(5)"IS DEVOTED ENTIRELY TO DEMOS."
871 REM PUT IN BLACK BOARDER
880 BOX 1,1,40,25,160,0:GOSUB1030
890 FORZ=0T0300:NEXT:GOSUB1040:GETG$:IFG$=""THEN890
891 REM DRAW LOTS OF BOXES
900 FORF=0T06:FORX=1T013:BOX X,X,41-X,26-X,160,X+ZAND15:NEXT:Z=Z+1:NEXT
901 REM DRAW COLOURED VERTICAL LINES
910 FORQ=0T02:FORX=1T020:BOX X,1,41-X,25,160,X+ZAND15:NEXT
911 REM DRAW COLOURED HORIZONTAL LINES
920 FORX=1T013:BOX 1,X,40,26-X,160,X+ZAND15:NEXTX,Q
921 REM DRAW SMALL DIAGONAL BOXES.
930 FORF=0T05:FORX=1T024:BOX X+T,X,X+1+T,X+1,160,X+ZAND15:NEXTX:T=T+3:NEXTF
940 FORD=0T060:DCROLLX1,1,24,15:USCROLLX20,10,40,24:NEXT
950 FORD=0T060:USCROLLX1,1,24,15:RSCROLLX20,10,40,24:NEXT
960 PRINT"J"
961 REM DRAW RANDOM 'OPEN' BOXES
970 FORX=0T0250:X1=INT(RND(5)*20):X2=INT(RND(5)*35)
980 BOX X2+1,X1+1,X2+5,X1+6,160,X2
990 USCROLL 11,1,40,14
1000 RSCROLL 11,12,40,24:NEXT
1009 REM DRAW 'DIAMOND' SHAPE
1010 POKE53201,0:POKE53200,0:PRINT"J":FORX=1T010:BOX 20-X,X+2,21+X,X+2,160,X
1011 BOX 9+X,X+12,32-X,X+12,160,X:NEXT
1020 FORX=0T0200:DCROLLX1,1,40,15:LSCROLLX1,13,40,24:NEXT:GOTO120
1021 REM PRINT UP " PRESS SPACE" ECT.
1030 PRINT"#####POKE214,23:PRINT:PRINT"#####PLEASE PRESS ANY KEY TO CONTINUE":
1040 FLIP 5,25,36,25
1050 RETURN
READY.
    
```

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Amstrad CPC File Recovery

by Mark Cummins



This program sets up an RSX command called !RECOVER which allows the user to selectively recover deleted files from the disk. The program works by reading into memory the four sectors that make up the directory. The first byte of each file's directory entry is the active/erased byte; the program checks this byte for each file in the directory. If a file has been erased, the program displays its name and asks if you want to restore it.

If the file is to be restored, the active/erased byte is set to active and the program keeps checking through the directory. Some files are

too large to fit in one directory entry, so another directory entry is used. This is called an 'extent' and is displayed with '(ext)' after the filename. All extents must be restored to properly restore a deleted file.

Another point to note is that files may have already been physically overwritten although the directory is still intact. Restoring these will have no effect.

When all the files have been displayed for recovery, the changed directory is written back to the disk.

The program can be run by typing !RECOVER when the code has been loaded.

```

10 REM Amstrad CPC File Recovery Program
20 REM by Mark Cummins
30 REM
40 MEMORY &7FFF:CLS
50 'Poke in machine code
60 address=&8000
70 FOR i=1 TO 23
80 sum=0
90 FOR j=1 TO 20
100 READ code$:byte=VAL("&"+code$)
110 POKE address,byte:address=address+1:sum=sum+byte
120 NEXT j
130 READ check:IF check<>sum THEN PRINT "Error in data line":990+i*10:wrong=1
140 NEXT i:IF wrong=1 THEN END
150 PRINT "Data loaded correctly.":PRINT "RSX command 'RECOVER' initialized.":C
ALL &8000:END
1000 DATA 01,7C,81,21,89,81,CD,D1,BC,C9,3E,81,CD,55,81,3E,FF,DF,8E,81, 2777
1010 DATA 3E,89,CD,55,81,3E,03,DF,8E,81,3E,84,CD,55,81,DD,21,91,81,21, 2351
1020 DATA C1,81,1E,00,16,00,DD,7E,00,FE,00,CA,40,81,4F,DF,8E,81,39,04, 2003
1030 DATA DD,23,18,E7,DD,7E,00,32,96,81,FE,41,28,0B,FE,C1,28,0B,FE,01, 2307
1040 DATA 2B,0E,3E,02,32,95,81,18,0C,3E,00,32,95,81,18,05,3E,01,32,95, 1163
1050 DATA 81,21,C1,81,1E,00,3A,95,81,57,3A,96,81,4F,06,01,DF,8E,81,D2, 2064
1060 DATA 40,81,0C,C5,01,FF,01,ED,4A,C1,04,3E,05,BB,20,02,19,EA,21,C1, 1944
1070 DATA 81,23,7E,FE,ES,CA,17,81,2B,7E,FE,ES,CC,A2,00,01,1F,00,ED,4A, 2616
1080 DATA 18,EB,23,ES,CD,B5,80,E1,FE,59,CC,11,81,DD,21,BC,81,CD,6F,81, 2971
    
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PROGRAM FILE

```

1090 DATA C9,0E,01,7E,CD,5A,BB,0C,23,79,FE,09,20,F5,3E,2E,CD,5A,BB,7E, 2248
1100 DATA CD,5A,BB,0C,23,79,FE,0C,20,F5,DD,21,97,81,CD,6F,81,7E,FE,00, 2552
1110 DATA 28,07,DD,21,AB,81,CD,6F,81,CD,09,BB,38,FB,CD,81,BB,CD,06,BB, 2673
1120 DATA CD,84,BB,FE,59,28,0E,FE,79,28,0A,FE,4E,28,0C,FE,6E,28,08,18, 2166
1130 DATA E3,3E,59,CD,5A,BB,C9,3E,4E,CD,5A,BB,C9,2B,3E,00,77,23,C9,3E, 2408
1140 DATA 85,CD,55,81,21,C1,81,1E,00,3A,95,81,57,3A,96,81,4F,06,81,DF, 2006
1150 DATA BE,81,30,10,0C,C5,01,FF,01,ED,4A,C1,04,3E,05,80,28,02,18,EB, 1861
1160 DATA 3E,81,CD,55,81,3E,00,DF,0E,81,3E,09,CD,3E,00,00,00,00,00,00, 2356
1170 DATA C9,32,0D,81,E1,22,BF,81,21,8D,81,CD,3E,00,04,3E,00,22,8E,81, 2692
1180 DATA 98,81,2A,BF,81,E5,C9,DD,7E,00,FE,00,C8,CD,5A,BB,DD,23,18,F3, 2871
1190 DATA 81,81,C3,0A,80,52,45,43,4F,56,45,02,00,00,00,00,00,00,00, 1253
1200 DATA 00,41,C1,01,00,00,00,20,20,20,20,20,20,20,20,20,20,20,20, 1216
1210 DATA 59,2F,4E,29,2B,3A,00,20,20,20,20,20,20,20,20,20,20,20,20, 899
1220 DATA 00,00,00,00,00,0A,00,00,00,00,00,00,00,00,00,00,00,00,00, 47
    
```

```

;RECOVER (c) 1986 by Mark Cummins
;
;RECOVER
;This routine allows the user to selectively unerase any disk files that have
;been erased. If a file is longer than 16K then it will be displayed twice, the
;second time with the word (ext) after the filename. To recover the whole file,
;press "Y" each time the filename is displayed. Some files may have been
;overwritten and still have their filename in the directory. In this case the
;file probably won't load.
    
```

```

ld bc,table
ld hl,rsxwork
call %bcd1
ret
;set up the RSX table
    
```

```

;set disc messages off
RECOVER ld a,129
call bios
;A holds BIOS 'set message' command name.
;Find and store the address of the command.
    
```

```

ld a,%ff
rst 3
defw cmd_far_addr
;%ff = disk messages disabled.
;Do a FAR CALL to BIOS 'set message' routine
;at this address.
    
```

```

;set retry count to a smaller value
ld a,137
call bios
;A holds BIOS 'set retry count' command name.
;Find and store the address of the command.
    
```

```

ld a,3
rst 3
defw cmd_far_addr
;set retry count to 3 (default = 16).
;FAR CALL to BIOS 'set retry count' routine
;at this address.
    
```

```

;read sector 0 with different sector values until right format is found
ld a,132
call bios
ld ix,sect_value
;A holds BIOS 'read sector' command name.
;Find and store the address of the command.
;IX holds address of System, Data, and IBM
;first sector numbers.
    
```

```

loop ld hl,buffer
ld e,%00
ld d,0
ld a,(ix)
cp 0
jp 2,seton
;HL holds address of first sector buffer.
;Drive = A.
;Track = 0.
;A holds first sector no. of format to test.
;If A = 0 then the format can't be determined
;so set messages and retry count to default
;and return to Basic.
;C contains first sector number of the format.
;Do a FAR CALL to BIOS 'read sector' routine
;at this address.
jr c,direct
inc ix
jr loop
;If the format tested is correct then Jump,
;else IX holds address of next format to test
;and we go round again.
    
```

```

;set up the directory track & sector values according to the disk's format.
direct ld a,(ix)
ld (sector),a
cp %41
jr z,system
cp %c1
jr z,data
cp %01
jr z,ibm
system ld a,2
ld (track),a
jr start
;Load A with the first sector number
;and store it.
;Jump to System if first sector number = %41.
;Jump to Data if first sector number = %c1.
;Jump to IBM if first sector number = %01.
;Directory on track 2 if System format.
;Directory on track 0 if Data format.
;Directory on track 1 if IBM format.
    
```

```

;read in all four sectors that make up the directory
start ld hl,buffer
ld e,%00
ld a,(track)
ld d,a
ld a,(sector)
ld c,a
ld b,1
rst 3
defw cmd_far_addr
jp nc,seton
;HL holds address of directory buffer
;Drive = A.
;D holds the directory track number.
;C holds first sector number of directory.
;Set 'no. of sectors loaded' counter to 1.
;Do a FAR CALL to BIOS 'read sector' routine
;at this address.
;If unsuccessful then set messages and retry
;count to default and return to Basic.
;Inc. C to point at next directory sector.
    
```

```

inc c
push bc
ld bc,511
adc hl,bc
pop bc
inc b
ld a,5
cp b
jr z,query
jr s1
;HL holds address of directory buffer for the
;next sector.
;Add 1 to 'no. of sectors loaded' counter.
;If all four directory sectors have been
;loaded then jump,
;else go round and read in next sector.
    
```

```

query ld hl,buffer
q1 inc hl
ld a,(hl)
cp %e5
jp z,repair
dec hl
ld a,(hl)
cp %e5
call z,erased
ld bc,31
;HL points to address of the directory buffer.
;A holds first byte of the filename.
;If %E5 then it is the end of the directory so
;rewrite the directory sectors and finish.
;A holds the file active/erased byte.
;If %E5 then the file has been erased so jump.
    
```


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```

adc hl,bc ;HL holds address of next filename entry.
jr q1 ;Go round again.

erased inc hl ;HL is on first byte of filename.
push hl ;Print the filename and ask whether to recover
call fileprint
pop hl
cp "Y" ;If A = "Y" then the user wants to recover the
call z,unerase ;file so jump to the unerase routine.
ld ix,lf
call sprint ;Print a linefeed after the filename.
ret

fileprint
ld c,1 ;Print the first 8 letters of the filename.
f1 ld a,(hl)
call &bb5a
inc c
inc hl
ld a,c
cp 9
jr nz,f1
ld a,"." ;Then print the filename extension divider
call &bb5a
f2 ld a,(hl) ;and the 3 letter filename extension.
call &bb5a
inc c
inc hl
ld a,c
cp 12
jr nz,f2
ld ix,recov ;Display a message asking the user whether or
call sprint ;not to recover the file.
ld a,(hl) ;A holds entry extent number.
cp 0
jr z,flush
ld ix,ext ;If entry extent number > 0 then tell the user
call sprint ;this is second.directory entry for the file.
call &bb09 ;Flush the keyboard buffer.
flush jr c,flush
f3 call &bb81 ;Switch the text cursor on.
call &bb06 ;Wait for a character from the keyboard.
call &bb84 ;Switch off the text cursor.
cp "Y" ;Jump to routine f4 if answer is "Y" or "Y".
jr z,f4
cp "y"
jr z,f4
cp "N" ;Jump to routine f5 if answer is "n" or "N".
jr z,f5
cp "n"
jr z,f5
f4 jr f3 ;The wrong key was pressed so wait for another
ld a,"Y" ;Print "Y" on the screen.
call &bb5a
ret
f5 ld a,"N" ;Print "N" on the screen.
call &bb5a
ret

unerase dec hl ;HL points to the file's active/erased byte.
ld a,0
ld (hl),a ;Set the byte to 0 (active).
inc hl ;HL points to first byte of filename.
ret

;write back all four sectors that make up the directory
repair ld a,133 ;A holds BIOS 'write sector' command name.
call bios ;Find and store the address of the command.

ld hl,buffer ;HL holds address of directory buffer.
ld e,&00 ;Drive = A.
ld a,(track) ;D holds the directory track number.
ld d,a
ld a,(sector) ;C holds first sector number of directory.
ld c,a
ld b,1 ;Set 'no. of sectors written' counter to 1.
rst 3 ;Do a FAR CALL to BIOS 'write sector' routine
defw cmd_far_addr ;at this address.
jr nc,seton ;If write unsuccessful then set messages and
;retry count to default and return to Basic.
;Inc. C to point at next directory sector.

inc c
push bc ;HL holds address of directory buffer for the
ld bc,511 ;next sector.
adc hl,bc
pop bc
inc b ;Add 1 to 'no. of sectors written' counter.
ld a,5
cp b ;If all 4 directory sectors have been written
jr z,seton ;then jump,
;else go round again.
jr r1

;set disk messages on again
seton ld a,129 ;A holds BIOS 'set message' command name.
call bios ;Find and store the address of the command.

ld a,&00 ;&00 = disk messages enabled
rst 3 ;Do a FAR CALL to BIOS 'set message' routine
defw cmd_far_addr ;at this address.

;set retry count to default value
ld a,137 ;A holds BIOS 'set retry count' command name.
call bios ;Find and store the address of the command.

ld a,16 ;A holds retry count (16 is the default).
rst 3 ;Do FAR CALL to BIOS 'set retry count' routine
defw cmd_far_addr ;at this address.
ret ;Return to Basic.

bios ld (cmd_name),a ;A holds the BIOS command name.
pop hl
ld (basic),hl ;Store return pointer.
ld hl,cmd_name ;HL points to the command name address.
call &bcd4 ;Ask the kernel where it is.
ret nc ;Return to Basic if it is not found.

ld (cmd_far_addr+0),hl ;Store the routine's address
ld a,c ;and ROM number.
ld (cmd_far_addr+2),a
ld hl,(basic)
push hl ;Restore the return pointer.
ret
    
```

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PROGRAM FILE

```

;Print a string routine.
sprint ld a,(ix)
      cp 0
      ret z
      call &bb5a
      inc ix
      jr sprint
table defw names ;RSX table.
      jp RECOVER
names defb "RECOVER","R"+12B
      defb 0
rsxwork defb 4

cmd_name defb 0 ;Storage area for BIOS command name.
cmd_far_addr defb 3 ;Area for storing BIOS address and ROM no.
sect_value defb &41,&c1,&01,&00 ;System,Data,IBM sector values

track defb 0
sector defb 0
recov defb " Recover? (Y/N) :",0
ext defb " (ext)",0,0,0,0,0,0,0,0,0
lf defb 13,10,0
basic defw 0000
buffer defb 2048
    
```



Pascal VAL(n\$) Function

by Peter Eriksson

This standard function implements VAL(n\$) in Pascal. It can easily be the equivalent of the Basic command converted to all versions of Pascal.

```

{ Pascal Function: VALUE, version 1.30 }
{ (C) 1986 Peter Eriksson Productions }

Function Value(Numstr:String):Real;

Var I,J,P,Sign,Base : Integer;
    Svar : Real;

Begin
    Svar := 0;
    Sign := 1;
    I := 1;
    Numstr := Concat(Numstr,'!');
    Base := 10;

    If (Numstr[I]='&') { Number is in octal notation? }
    Then
        Begin
            Base := 8;
            I := Succ(I);
        End;
    If (Numstr[I]='%') { Or is it in binary? }
    Then
        Begin
            Base := 2;
            I := Succ(I);
        End;
    If (Numstr[I]='-') { Maybe a negative number? }
    Then
        Begin
            Sign := -1;
            I := Succ(I);
        End;

    { Let's read in the integer part of the number }
    While ((Numstr[I]='0') And (Numstr[I]<Chr(48+Base))) Do
        Begin
            Svar := Svar*Base+((Ord(Numstr[I]) Mod 128)-48);
            I := Succ(I);
        End;

    If Numstr[I]='.' { Is there any decimals in the number? }
    Then
        Begin
            I := Succ(I);
            J := 1;

            { Let's read in the fractal part of the number }
            While ((Numstr[I]='0') And (Numstr[I]<Chr(48+Base))) Do
                Begin
                    Svar := Svar*Base+((Ord(Numstr[I]) Mod 128)-48);
                End;
        End;
    
```


PROGRAM FILE

```

I := Succ(I);
J := J*Base;
End;

Svar := Svar / J;
End;

Svar := Sign*Svar;

< Is the number written in scientific notation? >

If ((Numstr[I]='E') or (Numstr[I]='e'))
Then
Begin
P := 0;
I := Succ(I);
Sign := 1;

If (Numstr[I]='-') { Negative exponent? }
Then
Begin
Sign := -1;
I := Succ(I);
End;

{ Let's read in the exponent }

While ((Numstr[I]='0') And (Numstr[I]<Chr(48+Base))) Do
Begin
P := P*Base+((Ord(Numstr[I]) Mod 128)-48);
I := Succ(I);
End;

If (Sign=1) Then Svar := Svar*Exp(P*Ln(Base))
Else Svar := Svar/Exp(P*Ln(Base));
End;

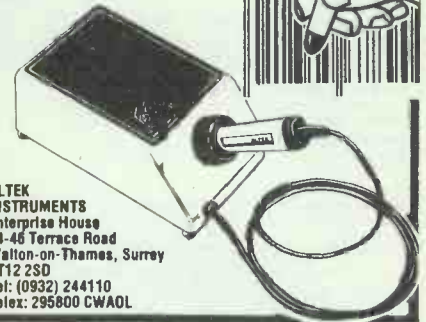
Value := Svar;
End;

```

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Amstrad CPC464/664 Screenswap Tip

by Gavin Moffitt

This short program provides two programs. To store a screen in RAM use !SCREENCOPY, and to retrieve it use !SCREENSHOW. When in use, there is 26k left for

```

10 REM *****
20 REM * RSX LOADER *
30 REM * (C) 1986 Gavin Moffit *
40 REM * !SCREENCOPY - copy screen to RAM *
50 REM * !SCREENSHOW - redisplay screen *
60 REM *****
70 IF PEEK(42750)=1 THEN MODE 2:PRINT"RSX's Already Loaded":END
ELSE MEMORY 25999:check=0:FOR a=42750 TO 42816:READ
a$:b=VAL("&" + a$):POKE a,b:check=check+b:NEXT
80 IF check<>6502 THEN MODE 2:PRINT "Error in DATA":END
90 CALL &A6FE:MODE 2:PRINT"RSX's Initialised":END
100 DATA 01,08,A7,21,25,A7,C3,D1,BC,C9,10,A7,C3,35,A7,C3,29,A7,
53,43,52,45
110 DATA 45,4E,53,48,4F,D7,53,43,52,45,45,4E,43,4F,50,D9,00,00,
00,08,A7,11
120 DATA 90,65,21,00,C0,01,00,40,ED,B0,C9,11,00,C0,21,90,65,01,
00,40,ED,B0
130 DATA C9,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,
00,00,00,00

```

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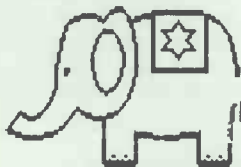
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PROGRAM FILE



Atari BOOTC

by Ronaldo Sergio de Biasi

This short machine language routine automatically changes Atari 8-bit Basic revision B into revision C on booting. When it has been added to boot disks, the bugs in revision B are automatically removed. The program is useful for Atari owners who don't have revision C or have other uses for the cartridge slot.

When BOOTC is used as an **AUTORUN.SYS** file, it changes revision B into revision C and traps the System Reset key so that ROM Basic will not be switched on each time this key is pressed. As a bonus, the default screen colour is changed from faint blue to pink. This can be changed in lines 100 to 110 of the second listing:

just change 64 to the value representing another hue. The original colour is 148.

To use the routine, type in and save the first two programs. Load the first program and then insert the disk holding the second program (**BOOTC**) into the drive. It should also hold **DUP.SYS** if you're using DOS 2.0 or 2.5, or the program **KCP.SYS** if you're using DOS 3.0. Then run the program. This creates an **AUTORUN.SYS** file that automatically loads and runs **BOOTC** each time you boot the disk. Finally, copy the **AUTORUN.SYS**, **BOOTC**, **DUP.SYS** or **KCP.SYS** to all the disks from which you want to use revision C.

```

10 OPEN #1,8,0,"D:AUTORUN.SYS"
20 PUT #1,255:PUT #1,255
30 PUT #1,0:PUT #1,6
40 PUT #1,69:PUT #1,6
50 FOR I=1 TO 70
60 READ A:PUT #1,A
70 NEXT I
80 PUT #1,226:PUT #1,2
90 PUT #1,227:PUT #1,2
100 PUT #1,0:PUT #1,6
110 CLOSE #1
120 DATA 169,148,141,197,2,169,0,141,68,2,169,1,133,9
130 DATA 173,48,2,133,203,173,49,2,133,204,160,4,177,203,133,205
140 DATA 200,177,203,133,206,162,0,160,82,189,58,6,145,205,232
150 DATA 200,224,12,208,245,169,12,141,252,2,108,250,191
160 DATA 50,53,46,2,36,26,34,47,47,52,35,2
    
```

```

10 FOR I=16384 TO 16427:READ A:POKE I,A:NEXT I:A=USR(16384)
20 DATA 104,169,0,133,203,169,160,133,204,162,32,160,0,177,203,72
30 DATA 169,255,141,1,211,104,145,203,169,253,141,1,211,136,208,237
40 DATA 230,204,202,48,6,208,230,160,0,208,226,96
50 FOR J=1 TO 16:READ A,B:POKE A,B:NEXT J
60 DATA 54017,255,43231,234,43232,240,43233,17
70 DATA 43234,234,47913,0,49139,0,49140,0,49141,0
80 DATA 49142,0,49143,0,49144,0,49145,0,5784,32,5785,196,5786,4
90 FOR K=1390 TO 1403:READ D:POKE K,D:NEXT K
100 DATA 169,64,141,198,2,169,255,141,1,211,173,106,22,96
110 POKE 709,202:POKE 710,64
120 ? CHR$(125):NEW
    
```



BBC Sideways ROM Switch-Off

by Allan Kelly

This program switches off sideways ROMs using an area of memory between &2A1 and &2B0, one byte per ROM. This area of memory is used by the operating system to remember which sockets contain ROMs. The value &82 means that a ROM is present and has a service entry; &C2 means that a ROM is present with language and service entries; &60 means that the ROM only has a language entry; and &0 means that no ROM is present.

When the OS has been reset, it scans the ROM banks and looks for a copyright message. If it finds one, it looks for a ROM-type byte which should be located at &8006 in the

ROM. This byte is stored between &2A1 and &2B0. When this has been done, the OS carries on with the rest of the reset process.

The program traps the break using **OSBYTE &F7** and, depending on user instructions, will remove the look-up byte from the table at &2A1, causing the ROM to 'disappear'.

To use the program, the command ***CODE** is used. ***CODE x y** will alter the state of ROM x according to y. If y is 0, then the ROM will be switched off after the next break; if y is 1, it will be switched on. To carry out these changes, a break has to be issued so that the OS can perform a reset. To do this, push Break.

PROGRAM FILE

```

10 REM Switch ROMs off
20 REM Allows BBC sideways ROMs to be switched off
30 REM Effects occur after Break
40 REM Allan Kelly 3/10/86
50
60 REM Once installed user *CODE
70 REM *CODE x y
80 REM x is rom number
90 REM y=0 OFF y<>0 ON
100 old_vec=?&200+(?&201*256)
110 osbyte=?&FFF4
120 FOR pass=0 TO 3 STEP 3
130   PX=?&7000
140   L
150   OPT pass
160   .off LDY#0
170   .back LDA roms,Y
180   CMP#0
190   BNE stay
200   STA&2A1,Y
210   .stay INY
220   CPY#&10
230   BNE back
235   BEQ get_userv
240   .on LDA#&F7
250   LDX#&4C
260   JSR osbyte
270   LDA#&F8
280   LDX#off MOD 256
290   JSR osbyte
300   LDA#&F9
310   LDX#off DIV 256
320   JSR osbyte
330   .get_userv LDA#command MOD 256
340   STA&200
350   LDA#command DIV 256
360   STA&201
370   RTS
380
390   .command CMP#0
400   BNE nocom
410   CPX#&FF
420   BEQ no_more
430   TYA
440   STA roms,X
450   RTS
460   .nocom JMP old_vec
470
480   .no_more LDA#&F7
490   LDX#0
500   JMP osbyte
510   .roms EQU&FFFFFFFF
520   EQU&FFFFFFFF
530   EQU&FFFFFFFF
540   EQU&FFFFFFFF
550   J
560   NEXT
570   END

```

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Amstrad PCW8256 CP/M Tip

by Alan Haken

The CP/M manual for the 8256 has a section on page 133 about selecting a mixed print mode. This selection is made by issuing an escape sequence, **ESC ! n**, where n must be in the range 0 to 63. The manual states that the decimal numbers correspond to 5-bit numbers, which is untrue. In fact, they correspond to 6-bit numbers. The corrected values are:

Bit	Value(dec)	Turns-on
5	32	Enlarged
4	16	Double-strike
3	8	Emphasised (bold)
2	4	Condensed (17cpi)
1	2	
0	1	Elite (12cpi)

Add values together *ad lib* for any desired combination of features.

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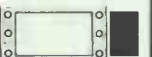
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● **APRICOT F1.** Expanded 640k RAM, 720k disk drive, 12in monitor. Superwriter, Supercalc, Superplanner, MS-DOS, MS-Basic, games disk, manuals, 15 blank disks. Perfect condition, £450. Tel: (0904) 647219 (Yorkshire). Could deliver.

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● **BBC B. 40/80 track 400k D/ D drive, external interface board, joysticks, books, software.** Superb for educational computing, any reasonable offer considered. Tel: 0977 82784.

● **APRICOT PORTABLE.** 256k RAM, 720k disk, Ramdisk, LCD screen, Supercalc, Superwriter, Superplanner, Basic, Pascal, under guarantee. £390. Tel: Bristol (0272) 733291.

● **ATARI ST PUBLIC DOMAIN DISKS.** Games, utilities, desk accessories, languages, music applications and more. Lists and further info: P. Glover, Mangrove House, Balls Park, Hertford, SG13 8AQ (stamp appreciated).

● **APRICOT PORTABLE AS NEW.** Four master disks including: Supercalc, Superwriter, voice, sketch, tutor, GWBasic, async, diary, etc. Full set manuals, LCD screen, case perfect. £400 o.n.o. Tel: 0530 416505 (Ashby).

● **OLIVETTI M24.** Includes 640k, BUS converter, 20MB disk, mouse, 8087 coprocessor, complete system for Autocad. Sell for £1799. Also Wren portable, plus £750 worth of software. Offers! Tel: 0342 27751.

● **BBC MICRO TELETXT ADAPTER WITH FIRMWARE AND PSU,** £80. Hantarex green screen monitor, £55. View 2.1 with view spell, £40. Printmaster £10. Tel: (0283) 37880 Eves or (0928) 714179 W/ves.

● **EPSON HX-20.** Complete with case, micro-drive, charger, cables, manuals and cassettes, £195. Tel: Leighton Buzzard (0525) 220960.

● **NEWBRAIN AD.** Expansion box (64k), disc controller, monitor, Tandon 200k, Micronix 40/80TR 1.6m, foot breaker PSU. Tapes, disks, software, books, original Grundy literature. The lot for £650. Tel: Aylesbury (0296) 84557.

● **WANTED:** Disk drive, new or 2nd hand, Slimline (1/2 height) double sided, 40 tracks. E.g. Canon model 211A internal. Tel: Claude (0734) 661813.

● **BBC MICRO.** Complete system, two disk drives, Microvitec colour monitor, Solidisk 64k sideways RAM, Eprom programmer, over £1000 worth of software (business and games). Tel: Mick on 01-428 0516 Eves. £500.

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● **BBC B DFS.** 2xCS100 disk drives, Philips V7001 12" green monitor, Merlin scribe word processor, Gemini beebcalc. Beebug masterfile on disk. £450 o.n.o. Tel: (0661) 34772.

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● **SINCLAIR QL. 256k,** Delta twin 720k 3 1/2" disk drives, Philips green monitor, Sagesoft integrated accounts. Plus all software, leads, manuals, books, perfect, £450. Tel: (01) 445 6217 Eves w/ves Mr Leigh.

● **BBC B FITTED WITH WATFORD 12 ROM BOARD.** Akhter dual drive 800k 40/80T, Phoenix green monitor, 6502 2nd processor. BitstikCAD system plus Wordwise+, view range and 60 top games. Bargain at £850. Tel: (01) 435 4895.

● **ACT SIRIUS.** 10Mb Winchester, 1.2Mb floppy, 640kb RAM. Complete with much software, technical

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● **OSBORNE-01.** Single density, brown case, CP/M, MBasic, Supercalc, Wordstar, Mail-Merge, £250 o.n.o. Also ZX Spectrum 48k. With software and tape recorder, £60. ZX81 16k, £20 o.n.o. Software. Tel: Reading 471793.

● **HITACHI VIDEO MONITOR MODEL VM-905AK.** Hardly used, black and white. Excellent condition. Tel: Adam (01) 723 7030 Ext 1438. After 6pm (01) 299 1357. Will sell to best offer.

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● **SUPERBRAIN QD.** 2x780k drives, 2x4MHz Z80. CPU, integral monitor, C/PM 2.2, Wordstar 3.0, dBase II, Multiplan, Milestone, MBasic, Quickcode, dUtil, Datastar. Manuals. £390. Ideal small business machine. Tel: (01) 866 5168 Eves. (01) 948 5544 Ext 225 (office).

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● **FOR SALE.** VideoGenie system, green monitor, Basic manual, many reference books, plus Z80 code manuals and assorted games. Tel: Steven after 4pm on 0489 877771. Offers.

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● **IBM PC. 640k, 20Mb** Winchester, RS232, parallel ports, real time clock, £1500. Also Acorn Z80 second processor plus bundled software £200. Harpenden, Herts (05827) 5761 after 6.30pm.

● **BBC B. Solidisk DFS,** 256k switched 2/4Mhz RAM, metal case, 40 track D/S disk, wordwise Plus, all manuals, £460. BBC 2nd Z80 processor, incl DNFS, original CPM packages, Cobol, etc. All manuals, as new. £220. Tel: 0480 53775.

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● **MATMOS PC.** 64k CP/M computer, 340k disk drive. Includes CP/M 2.2, Microsoft Basic, advanced user guide and technical manual. £125 o.n.o. Tel: 0202 895432.

● **WORDPERFECT VERSION 4.1.** Unopened, IBM ver. £300. Apricot 32/10F 512k RAM, 10MByte, new, in box, £690. Data Warden 10Mbyte tape streamer, £400. Apricot RAM card, 256k, £100. Apricot black 9" monitor, £50. Tel: I. Bryce 0603 630326.

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- **SIRIUS-1.** 2x620k, MSDOS, CP/M, various packages, £800 o.n.o. Hardly used, good condition. Tel: 07372 41464 Reigate.
- **APPLE (ITT2020).** Disk drive, screen, paddles,

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- **AMSTRAD TAPES,** Amsoft spreadsheet, Hisoft Pascal, Kuma Logo, Dean music composer, mini office, French, German and other educational, also games and books, £35 o.n.o. or will separate. Tel: Faversham (0795) 532437.
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- **GEMINI Z80IVC GM812.** Gemini GM829 disk

controller. UCSD Pascal for Nascom2 with Gemini. Two Nascom2 boards. Two Nascom RAMB 48K. Unused Dragon 64. ALF want, Eves Maldon (0621) 828752.

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- **SERIU 16-BIT BUSINESS MICRO.** Complete with DBase II database, Supercalc spreadsheet, Select word — processor, Hi-Res graphics, etc. Private use only. Bargain £675 o.n.o. Mr Driver, Dorking (0306) 730552.
- **SANYO 555.** 256k RAM, twin 360k disks, Sanyo mono monitor, MSDOS V.2.11, Wordstar, Spelstar, Calcstar, Datastar, Reportstar, printer cable, manuals, £350. Tel: (092084) 300 Eves, (0992) 554469 daytime.
- **FUTURE COMPUTERS FX30.** 40Mb hard disk, 256k, 800k floppy drive. Internal LAN, IBM expansion cards compatible. MS-DOS, CPM-86 Conc/CPM, Spellbinder, PlannerCalc, etc. £3,000. Tel: 041-633 2312.
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- **SUMMA GRAPHICS MOUSE AND SUPPLIED SOFTWARE.** Unused, £70. Tel: (01) 609 5678.
- **OPEN ACCESS IBM ORIGINAL,** £100. DBasell tutor disks and manual, £25. QED+ desktop, £50. Casio PB700 pocket micro, 4k, basic, £60. Or exchange for Bronica ETR/SQA camera equipment, Mark, (0723) 361528.
- **SPEED IMPROVED ELECTRON.** Plus-1, Plus-3, Seikosha GP100A 14" colour T.V., "View", "Database", disks, magazines, over £200 software. Originally £1000. Asking: £325. Contact: Mr T. Shoaib, 22 Duart Drive, Newton Mearns, Glasgow. G77 5DS.
- **IBM PC/AT SOFTWARE.** New, sealed and unregistered. Volkswriter deluxe, £66. 20/20, £200. Spotlight — desktop manager, £40. GEM desktop, £30. GEM programmers tool kit, £230. Fortran 77, £200. Tel: (0734) 64271.

END

LEISURE LINES

Brain-teasers provided by JJ Clessa.

Only one king has been crowned in England since the Norman Conquest. This is a true statement — why?

PRIZE PUZZLE

A certain club organises an annual charity drive among its members as follows:

Two charities are nominated and each club member must vote for one or the other. When all the votes have been counted, each member is asked to donate to his chosen charity as many pounds sterling as that charity received votes.

This year's charity drive was the 10th year in succession and each year the club membership has increased. There are now getting on for 300 members.

By a remarkable coincidence, on every charity drive to date, the difference in donations made to the two charities has been exactly the same.

How many members are there at the moment?

Answers on postcards please, or backs of envelopes, to reach us not later than 28 February 1987. Send your entries please to Leisure Lines,

February Prize Puzzle, PCW, 32-34 Broadwick Street, London, W1A 2HG.

PRIZE PUZZLE NOVEMBER '86

A very low response — less than 50 entries — to our puzzle about the marbles. Perhaps it was more difficult than usual.

Anyway, the correct answer was 'Blue' and the winning entry this month came from Mr G Langley of Canterbury who receives our congratulations, and who will shortly also receive his prize.

Keep puzzling.

END

LOOK AT IT THIS WAY AND IT'S A 32 USER MACHINE WITH SUPER FAST RESPONSE.

Please send me further information on the new
 Sprite 386
 Sprite 286

NAME _____

ADDRESS _____

POSTCODE _____

Send to: Jarogate Ltd, Unit 2, HQ3, Hook Rise South,
 Surbiton, Surrey KT6 7LD.
 Or telephone us on: 01-391 4433.

Whichever way you look at it, Jarogate's new Sprite 386 is an innovation in computer technology.

Like its sister the Sprite 286, which features a 256k intelligent disk cache, the Sprite 386 Multi-user uses Concurrent DOS XM and Microsoft Xenix, offering big system performance at a micro price.

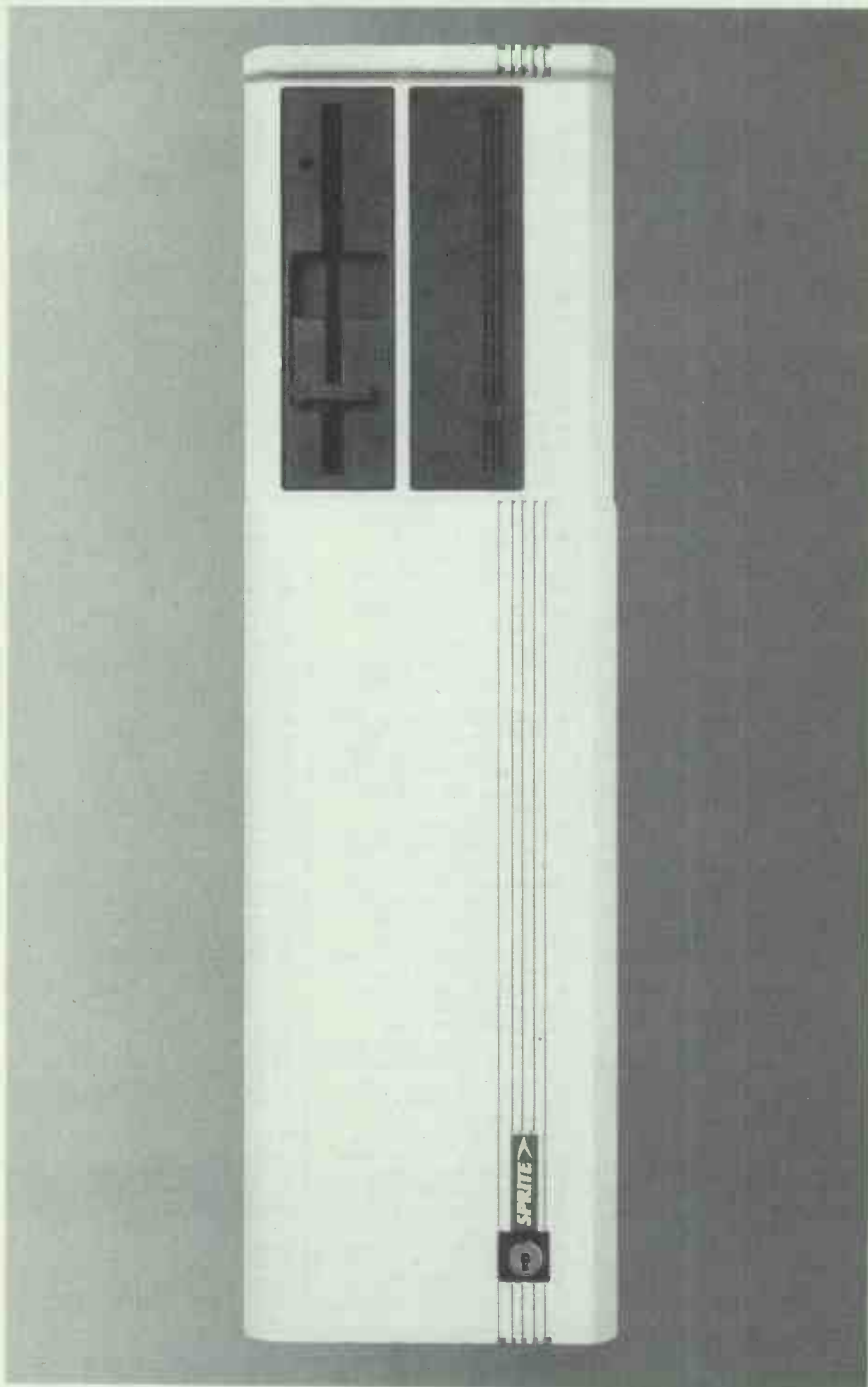
As a floor standing model the system is capable of servicing up to 32 users. This is achieved by combining the new 80386 Intel Chip with Jarogate's own 80186 based intelligent disk cache. The Sprite 386 offers up to 16 megabytes of RAM with zero wait states thus providing superfast response.

At Jarogate we build computers to defy obsolescence. To that we add the reassurance of excellent after-sales service, a wide range of application software and an international dealer network.

So, whichever way you look at it, our Sprite family of microcomputers has something unique to offer you.



COMPUTING AHEAD OF ITS TIME



LOOK AT IT THIS WAY AND IT'S A SINGLE USER MACHINE WITH 32 BIT PROCESSING POWER.

Whichever way you look at it, Jarogate's new Sprite 386 PC is an innovation in computer technology.

As a desk top model the Sprite 386 Super PC services the discerning single user with a wide range of specialist features such as Graphics, CAD/CAM, Financial Modelling and System 36* emulation applications. The machine is compatible with IBM PC/AT*, offering 6 PC/AT expansion slots and packing around four times the power. It provides up to 16 megabytes of RAM with zero wait states and brings 32 bit processing power to PC software.

Jarogate are a company with 8 years success

in microcomputers. We believe in building machines with a future. That's why, in terms of design and performance, the Sprite family are way ahead of their competitors and can consistently be updated. Whichever way you look at it, the Sprite family of computers has something unique to offer you.

*System 36 and IBM PC/AT are IBM registered trademarks of International Business Machines.



COMPUTING AHEAD OF ITS TIME

Please send me further information on the new
 Sprite 386
 Sprite 286

NAME _____

ADDRESS _____

POSTCODE _____

Send to: Jarogate Ltd, Unit 2, HQ3, Hook Rise South,
 Surbiton, Surrey KT6 7LD
 Or telephone us on: 01-391 4433.

If you don't know where to turn for help, then you need look no further. The ACC is here to point you in the right direction, and Rupert Steele is your guide.

If you haven't yet visited your local computer club, you should; it's a good chance to meet people who know something about the home computer business, and about the capabilities of the different machines on the market. You might just find someone there who knows why your program won't work — or how to work round that annoying little bug.

Or perhaps you would like to receive detailed technical information about your particular machine, in which case you might be interested in joining the national user group that supports your machine. With the wider availability of specialist software (some of which can be very complicated), you might also find a user group for your favourite program.

Either way, you'll need to find out where your club or user group is located. Some of the larger user groups place advertisements in *PCW*; alternatively, you may find information about activities at your local library or in the local press. And you can always ask the ACC. The ACC is the national body for computer clubs and user groups, and it runs a service for anyone wishing to get in touch with their local computer club (just send an *sae* to John Dale at the address below).

As well as providing publicity for computer clubs, the ACC runs a number of services. We have an insurance scheme which allows clubs to obtain cover at low prices for both public liability and computers brought to their meetings.

Club news

Mike Dirom has written to me about The Southern Apricot Group. This small, self-help group meets on the last Saturday of every other month for a session running from 11am to 5pm with a break for a 'pub' lunch. The group consists mainly of self-employed consultants or businessmen who use Apricots at work, many of whom joined because of the poor quality of computer manuals combined with poor support from dealers (I know the problems well... 16-bit machines are notorious for lack of machine/operating system documentation, although applications tend to be better described). There is a monthly circular to keep the members in touch, and they meet in the function-room annexe of a pub in the village of Fovant (between Salisbury and Shaftesbury). Although most of

the club's members live within 20 miles, some come from as far afield as Oxford, Gloucester and Halesowen. Contact Mike Dirom at 'High-over', Glasses Lane, Sutton Mandeville, Salisbury, Wiltshire SP3 5NB for further details, or call him on Fovant (072270) 219.

Moving across to Derbyshire, I have had a letter from Andrew Price about an MSX newsletter called 'Memory Alpha'. Andrew doesn't run Memory Alpha, but he considers it such a useful guide for MSX owners that it deserves wider recognition. The newsletter is served up as a cassette tape (which actually runs as a program in order that you can find the right info using the menus provided). It comes as unprotected software, so you can examine the listing to see how some of the tricks are achieved. To find out more, contact Memory Alpha directly, by writing to Memory Alpha, 16 Mayfield, North End, Portsmouth, Hants — and please enclose an *sae*.

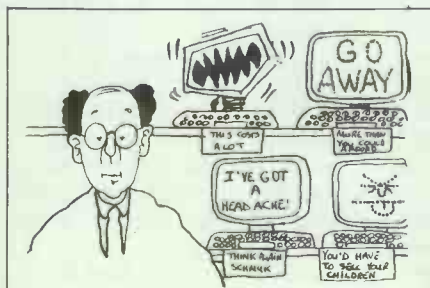
The Amstrad bandwagon runs on. Jeff Walker has written to me about his 'WORLDWIDE' Amstrad CPC users club. The yearly subscription of £3 provides a monthly newsletter on tape/disk, containing members' views and contributions, plus access to the members' software library. Probably the most remarkable thing about this group is, however, the name: WACCI. A good, catchy acronym is well worth having in a club name, and WACCI is no exception. Send an *sae* to Jeff Walker, WACCI, 75 Greatfields Drive, Hillingdon, Uxbridge UB8 3QN for more information.

I have heard from Paul Mullen announcing the formation of the 1512 Independent User Group for the Amstrad. Judging from reports in the press, he'll have to wait a bit before the membership builds up, while Alan Sugar gets the deliveries going

at a rate to match demand. Anyway, the new club is for users of the new Amstrad PC and is an offshoot of the long-established CP/M User Group. There will be a newsletter, access to public domain and a question & answer service (probably via a bulletin board). Local meetings are planned (subject to local organisers volunteering) and membership will be £20pa. Contact Paul at the 1512 Independent User Group, PO Box 55, Sevenoaks, Kent TN13 1AQ, or call (0732) 450908.

Meanwhile, Chris Bryant has sent me a copy of the latest issue of his *Amstrad Computing Newsletter (ACN)*. This is also aimed at the Amstrad CPC machines (and the latest issue contains a letter from Jeff Walker plugging WACCI). The newsletter is distributed on hardcopy and includes listings and reviews. It also gives details of various third-party hardware add-ons and has a page entitled 'Adventure Corner' as well as detailed help solving no less than 23 different adventure programs! There is also a small public-domain software library, available at media cost, and a printing-out service for members. Send an *sae* please to Chris Bryant at 11 Havenview Road, Seaton, Devon EX12 2PF.

Finally, I have had a letter from a 'Very Organised Person'. Mike O'Regan has a Psion Organiser (one of those calculator-sized computers with an alphabetic — not qwerty — keyboard and a bundle of built-in functions such as a diary, database and soon a kind of electronic Filofax). Not content with organising Mike, his Psion Organiser has decreed that Mike should run the 'Independent Psion Organiser User Group'. The machine further asks that anybody interested should write to it, care of Mike O'Regan at 130 Stapleford Lane, Beeston, Nottingham NG9 6GB. The Psion hasn't mastered sticking on stamps, and would, therefore, prefer an *sae*.



'... and of course, sir, all our systems are user-friendly.'

To tell the ACC about your club, to request a mention in this column, or to obtain labels for mailing to the ACC's register of computer clubs, contact Rupert Steele, 12 Philbeach Gardens, London, SW5 9DY. Tel: (01) 370 0601.

For any other enquiry, including the details of your local computer club, send an *sae* and details of the enquiry to John Dale, 12 Poplar Road, Newton, Powys SY16 2QG. **END**

It must be remembered that chess started out as a game for humans, but developed into something that computers were very good at. Fortunately Novag has not forgotten its roots, as Kevin O'Connell reports.

In the most recent Commonwealth Championship, two Novag computers took part and performed very creditably.

The following game was played in the sixth round.

White: Novag Constellation Forte. Black: S Sohel (Bangladesh). Opening: Queen's Gambit Declined.

1 d2-d4 Ng8-f6
2 c2-c4 e7-e6

In the first round, the other Novag Constellation Forte was White against Levi (Eddy Levi of Australia, not my partner David Levy of computer bet fame) and fared well in another ending that emerged from a Benoni Defence after 2 ... c7-c5 3 d4-d5 g7-g6 4 Nb1-c3 d7-d6 5 e2-e4 Bf8-g7 6 Bf1-e2 0-0 7 Bcl-g5 h7-h6 8 Bg5-h4 a7-a6 9 a2-a4 e7-e6 10 Ng1-f3 Rf8-e8 11 Qd1-c2 e6xd5 12 c4xd5 Bc8-g4 13 h2-h3 Bg4xf3 14 Be2xf3 Nb8-d7 15 0-0 c5-c4 16 Ra1-cl Nd7-c5 17 Rc1-d1 Qd8-d7 18 Rd1-d4 b7-b5 19 a4xb5 a6xb5 20 Qc2-e2 Nf6xe4 (initiating a complicated sequence that wins the exchange) 21 Rd4xe4 Nc5xe4 22 Nc3xe4 f7-f5 23 Qe2-c2 f5xe4 24 Bf3xe4 g6-g5 25 Bh4-g3 Ra8-a2 (Black is after more material).

26 Be4-f5 Qd7-c7 27 Bf5-e6+ Kg8-h8 28 Qc2-g6 Re8-f8 29 Be6-f5 Rf8xf5 (the only way to deal with the twin threats of Qg6-h7 and Bg3xd6) 30 Qg6xf5 Qc7-e7 31 Qf5-e6 Qe7xe6 32 d5xe6 Bg7-f8 33 f2-f4 g5xf4 34 Rf1xf4 Kh8-g8 35 Bg3-h4 Ra2-a7 (Black must now admit that he will never be able to take the b-pawn) 36 g2-g3 Ra7-c7 37 Kgl-g2 b5-b4 38 Rf4-g4 Kg8-h7 (or 38 ... Bf8-g7 39 Bh4-f6 and 40 e6-e7) 39 Bh4-d8 Rc7-c8 40 e6-e7 Bf8xe7 41 Bd8xe7 c4-c3 42 Be7xd6 c3-c2 43 Bd6-f4 Rc8-d8 44 Rg4-h4 Rd8-d4 45 Rh4xh6+ Kh7-g8 46 Rh6-c6 b4-b3 47 Rc6-c3 Kg8-f7 48 Rc3xb3 Rd4xf4 49 Rb3-c3 c2-c1R (trying a last desperate attempt at creating some confusion) 50 g3xf4 and Black played on for a while longer before resigning.

3 Nb1-c3 d7-d5
4 Bc1-g5 Bf8-e7
5 e2-e3 0-0
6 Ra1-c1 c7-c6
7 Ng1-f3 Nb8-d7
8 Bf1-d3 Rf8-e8
9 0-0 Be7-d6?

This allows White to make progress in the centre with gain of time.

10 e3-e4 d5xe4
11 Nc3xe4 Bd6-e7
12 Bg5-f4 Nd7-f8
13 Nf3-e5 Nf8-g6

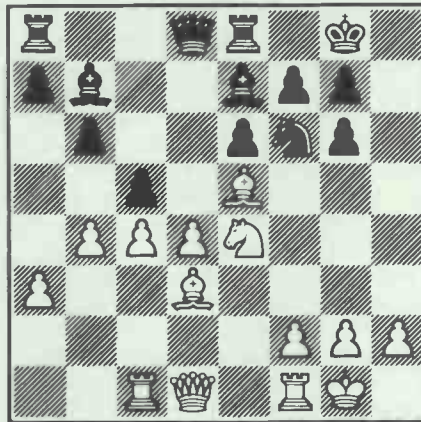
13 ... Nf8-d7 may be slightly bet-

ter, but it is not really the sort of move (admitting that the previous move was a complete waste of time) that a human, surrounded by a group of onlookers, can bring himself to make, especially when playing against a computer.

14 Ne5xg6 h7xg6
15 Bf4-e5 b7-b6

Black must get his pieces developed, and this move creates some room for the bishop and also prepares c6-c5 which will help to free Black's game.

16 a2-a3 Bc8-b7
17 b2-b4 c6-c5



18 Be5xf6 g7xf6

So Black has acquired the bishop pair, but he cannot keep them.

19 d4xc5 f6-f5
20 Ne4-d6

20 Ne4-g3 b6xc5 21 Rcl-bl would leave White with a small advantage, but also with the danger that the bishop pair could become active.

20 ... Be7xd6
21 c5xd6 Qd8xd6
22 c4-c5

The most logical way of trying to capitalise on the queen-side pawn majority.

22 ... b6xc5
23 Bd3-b5 Qd6xd1
24 Rf1xd1 Re8-d8
25 b4xc5 Rd8xd1+
26 Rc1xd1 Bb7-d5
27 c5-c6 Ra8-c8
28 Rd1-c1 Rc8-c7

White has a passed c-pawn, but it is blockaded by the rook on c7 and has both White's pieces tied to its defence.

29 h2-h4 Kg8-f8
30 Bb5-a4 Kf8-e7
31 Rc1-c5 Ke7-d6
32 Rc5-a5 Bd5xc6
33 Ra5-a6

The only way to regain the pawn.

33 ... f7-f6
34 Ba4xc6 Rc7xc6
35 Ra6xa7 Kd6-e5
36 a3-a4 f5-f4
37 a4-a5 Ke5-f5
38 Ra7-a8 Kf5-g4
39 a5-a6 Rc6-c1+

Not 39 ... Kg4xh4?? 40 Ra8-h8+, followed by a6-a7-a8Q.

40 Kg1-h2 Rc1-a1
Rooks belong behind passed pawns (yours or your opponent's).

41 a6-a7 Kg4-f5
42 g2-g3 f4-f3

Better 42 ... f4xg3+ — if White recaptures with the f-pawn, then Black might have some chances with his passed e-pawn.

43 Ra8-d8 Ra1xa7
44 Rd8-d3 Kf5-g4
45 Rd3-d4+ Kg4-h5

Everyone knows that computers are not supposed to be able to play endgames, so no doubt Black was beginning to be confident of victory. One of his problems was that the computer was obviously blissfully unaware of its disability.

46 Rd4-f4 Ra7-a3?

Either 46 ... f6-f5 or 46 ... g6-g5 would have been better.

47 Rf4xf6 e6-e5

Now 47 ... g6-g5 was needed to prevent the following manoeuvre.

48 Kh2-h3

Heading for g4 if it can, otherwise the pawn will advance.

48 ... e5-e4

49 g3-g4+ Kh5-h6
50 h4-h5 Ra3-a2

51 Rf6xg6+ Kh6-h7

52 Kh3-g3 Ra2-a1

53 Rg6-e6 Ra1-g1+

54 Kg3-f4 Rg1-g2

55 Re6-e7+ Kh7-h6

Or 55 ... Kh7-g8 56 Re7xe4 Rg2xf2 57 Re4-e3 and White wins.

56 Re7-d7

Almost all roads lead to Rome, but this is 'prettier' than, for example, 56 Kf4-f5 Rg2-g1 56 ... Rg2xf2 57 g4-g5+ Kh6xh5 58 Re7-h7 mate) 57 Re7xe4.

56 ... Rg2xf2

Is this perhaps an unfortunate case of a human following an inaccurate algorithm? There is an old Russian proverb that 'all rook endings are drawn'. Not if you allow mate, though!

57 g4-g5+ Kh6xh5
58 Rd7-d6! 1-0

Black has resigned since mate is now inevitable.

END

Mike Mudge recognises the importance of reader participation in his column, so this month he sits back and listens while you do the talking.

Problem (i) (suggested by Professor Leo Alex of State University of New York) Solve in integers the equation $1 + x + y = z$

where the primes dividing the product xyz are restricted to 2, 3 and 5. Professor Alex would like to assure readers that the number of solutions is finite!

Problem (ii) (suggested by the author, Mike Mudge) 1729 is the smallest number that can be expressed as the sum of two cubes in two different ways — that is:

$$1^3 + 12^3 = 9^3 + 10^3 = 1729$$

What is the smallest number that can be expressed as the sum of two cubes in three different ways? Notice that in 1912 W Lenhart obtained:

$$46969 = \left(\frac{95}{7}\right)^3 + \left(\frac{248}{7}\right)^3 = \left(\frac{149}{12}\right)^3 + \left(\frac{427}{12}\right)^3 \\ = \left(\frac{341899}{30291}\right)^3 + \left(\frac{1081640}{30291}\right)^3$$

This is readily converted to an identity in integers by multiplying throughout by the common denominator $(7 \times 12 \times 30291)^3 = 2544444^3$.

How readily can the smallest number expressible in $a -$ ways as the sum of b -terms, each the c^{th} power of an integer, be computed for realistically small a , b and c ? Estimates of computing power needed?

Problem (iii) (suggested by Donald Cross of Exeter)

(a) 1729 is the smallest number that can be expressed as $a^2 + ab + b^2$ in four different ways with a & b positive (16-ways if negative a , b & c are allowed).

How many numbers less than a million can be expressed as the sum of two cubes in two different ways and as $a^2 + ab + b^2$ in eight different ways with a & b positive (generalise by removing the restraint less than a million.)

(b) If a number is prime, can it be expressed as $a^2 + ab + b^2$ in more than one way with a & b positive?

Readers are encouraged to send their work, together with complete or partial attempts at the solutions to these problems, to Mike Mudge, 'Square Acre', Stourbridge Road, Penn, Staffordshire WV4 5NF, tel: (0902) 892141.

It would be appreciated if such submissions contained a brief summary of results; together with thoughts relating to these problems, in a form suitable for publication in PCW. These submissions will be judged using suitably vague criteria, and a prize will be awarded by PCW

to the 'best' contribution received by the closing date.

Please note that submissions must arrive by 1 May and can only be returned if a suitable stamped, addressed envelope is provided.

Mike Mudge welcomes correspondence on any subject within the areas of number theory and other computational mathematics. Particularly welcome are suggestions, either general or particular, for future 'Numbers Count' articles; all letters will be answered in due course.

Isolated readers can be put in contact with others sharing the same interests. However, greater efficiency regarding published problems should result from contacting the prize-winner directly.

August review: Farey series

The subject of Farey Series produced an anonymous submission of Farey, and Farey 2. Would the programmer who recognises ScanPointer and PosCount and who quoted Theorem 29 from Hardy & Wright please contact me.

An estimate of 103 years, on a BBC Micro to construct F^{1025} using a crude bubble sort approach, is interesting...

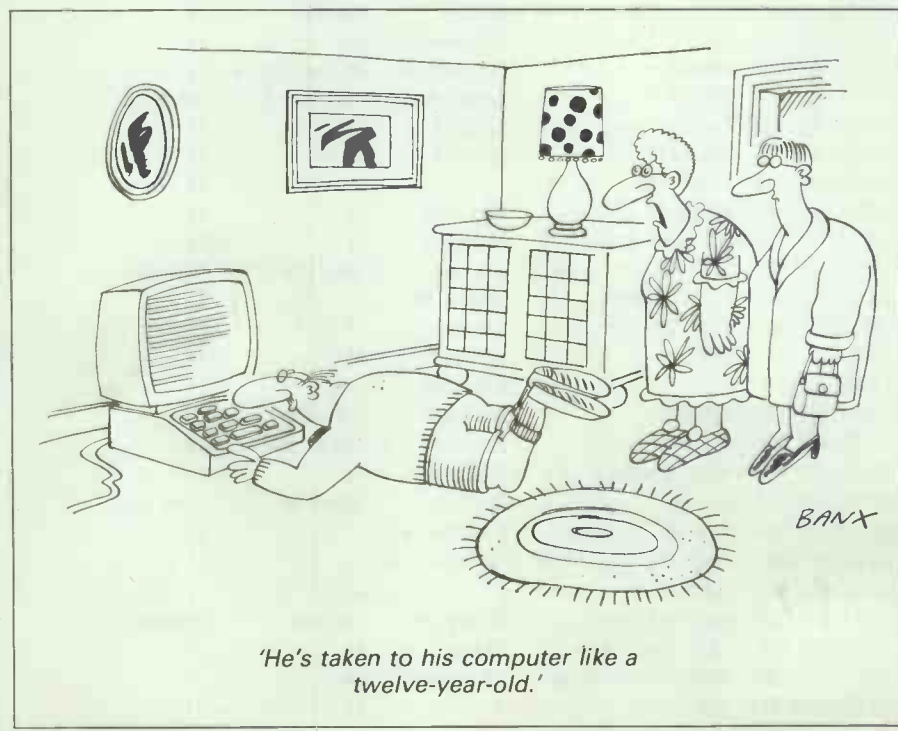
A straightforward summary of Farey Series results together with a

number of references is to be found in *Recreations in the Theory of Numbers* by Albert H Beiler (Dover 1964 £5.35) — a book which all 'Numbers Count' readers should possess.

Most attempts at this problem established simple arithmetical methods of generating terms of Farey Series and identified the major problem as one of satisfactorily displaying the output.

Graphical routines included those for a Tandy TRS-80, and a very efficient print routine for an Epson LX80 displaying F^{256} on, effectively, three sides of A4.

However after application of 'suitably vague criteria' (here it is important to emphasise that the purpose of the 'Numbers Count' competition is not to rank professional or semi-professional mathematicians or computer scientists, but to encourage empirical number theory as an alternative to game-playing on a personal computer; and to reward enthusiasm) this month's prize-winner is Ben Coffison of 9 McMurtrie Street, North Rockhampton, Queensland 4701, Australia. Ben programmed in Pascal, but due to local circumstances ran his programs on a VAX11 minicomputer; minor changes would make his routines available in TurboPascal. Ben would certainly welcome correspondence on this or related matters from PCW readers. **END**



UK BULLETIN BOARDS

An up-to-date list of UK bulletin boards, compiled by Peter Tootill.

Tel No	Name	Location	Weekday hours	Weekend hours	Baud	Notes
(0001)185 4179	Dublin Fido	Dublin	10pm-8am	10pm-8am	3/1275	
(0001)885 634	DUBBS-Dublin	Dublin	8pm-8am	24	3-24	
(0001)903 341	IACCBS	Eire	24	24	3	Irish ACC. Runs on Comodore 64.
(01)200 3439	Airtel - TBBS	London	24	24	3/1275	Pilots area
(01)200 7577	TBBS London NW	London	24	24	3/1275	TBBS, Tandy Users Group
(01)207 2989	Dark Crystal Fido	London	24	24	3-12	
(01)248 5747	Prestel 24 hrs	London	24	24	3	No graphics on this number
(01)346 7150	Marctel	London	24	24	3/1275	FBBS system.
(01)348 9400	TBBS London	London	24	24	3-12	
(01)399 2136	M6-Net	London	-	Sun 5pm-10pm	3	
(01)429 3047	OSI Lives!	London	24 Ring back	24 Ringback	3	
(01)450 9764	Techno Line	London	24	24	1275v	Commercial + 452 1500 eve +w/e
(01)452 1500	Techno-line 2	London	evenings	24	1275v	Commercial
(01)455 6607	NNBBS London	London	24	24	3/1275	
(01)542 3772	WBBS Wimbledon	London	-	sat7pm-mon8am	3/1275	
(01)542 4977	TBBS Rovoreed	London	24	24	3-24	
(01)543 7020	Dataflex Fido	S.London	24	24	3/1275	
(01)573 8022	Tecom	London	7pm-8am	all day Sun	300	Interak micro section
(01)580 1690	Poly Fido	London	24	24	3-12	
(01)638 2034	CyberZone	London	24	24	3	
(01)624 5338	Twilight Phone	London	24	24	3	
(01)648 0018	MBBS Mitcham	London	24	24	3/1275	
(01)658 6942	Typnet	London	24	24	3	
(01)679 1888	Distel	London	24	24	3	Display electronics -Commercial
(01)679 6183	Distel	London	24	24	3/1275	Display Electronics - Commercial
(01)735 6153	Brixton ITeC	London	24	24	1275	
(01)853 3965	Assylum	London	24	24	3	Writers and comms areas
(01)863 0198	London U'ground Fido	London	24	24	3/1275	Fido -Amiga,Atari ST sigs
(01)883 5290	NBBS London	London	24?	24	3/1275	
(01)888 8894	Gnome at home	London	24	24	1275v	
(01)927 5820	Owitel	London	24	24	1275v	
(01)941 4285	Metrotel	London	24	24	1275v	
(01)960 4742	ITCU Exchange & Mart	London	24	24	1275v	ITeCs central system?
(01)968 7402	Communitel	London	24	24	1275v	
(01)985 3322	Hackney BBS	Hackney	24	24	1275v	
(01)986 4360	Health data	London	24	24	1275v	
(0204)43082	Bolton BBS	Bolton	8pm-8am	24	3-24	8am-8pm on ring back
(0206)862 354	Pete's Place	Colchester	24	24	3	
(021)430 3761	CBABBS	Birmingham	24 (not Thurs)	24	300	
(021)444 1484	TUG II	Birmingham	8am-10pm R/B + 10pm-8am		3	
(0222)461 824	Capital Data Line	Cardiff	24	24	3	Computer repair company
(0222)464 725	Cardiff ITeC	Cardiff	24	24	1275v	
(0223)243 642	Acorn BBS		24	24	1275v	
(0224)641 585	ABERDEEN ITEC	Aberdeen	24	24	1275v	
(0224)781 919	Aberdeen Commodore	Aberdeen	24	24	300	Commodore 64 based
(0247)455 162	SBBS II (Irish Man)	Ireland	9pm-11pm r/b + 11pm-9am		3/1275	rates are daily
(0247)467 863	Fido Bangor	Bangor NI	24	24	3-24	PC-DOS,CP/M, BBC,Tech. help sigs
(0258)54 494	TBBS Blandford	Dorset	24	24	300	Blandford Computers
(0268)22 177	BITEC	Basildon	24	24	1275v	
(0268)25 122	BITEC	Basildon	24	24	300	
(0268)710 637	RICBBS	Basildon	5pm-10pm	24	?	
(0272)421 196	Octopus	Bristol	6pm-6.30am	24	3/1275	
(0274)480 452	OBBS Bradford	Bradford	24	24	3/1275	Colour for BBC users
(0295)720 812	Bloxam	Bloxham	10pm-1am	10pm-1am	300	
(0342)315 636	Fido PD Software	E.Grinstead	24	24	3-24	PD software database
(0367)81 507	Comp. for Christ £2	Faringdon Ox	24	24	3/1275	Sponsored by Courier Consultancy
(0376)518 818	REACT	?	24	24	300	
(0384)635 336	West Midlands	Stourport	6pm-8am	6pm-8sm	300	TBBS
(0392)53 116	CBBS South West	Exeter	24	24	3/1275	
(0394)276 306	BABBS-1 Felixstow	Felixstow	24	24	300	
(0395)272 611	CFC	?	24	24	300	John Burden

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(0429)234 346	On-Line Systems	Cleveland	24	24	3/1275	Commercial
(0443)733 343	MBBS Mid Glamorgan	Ferndale	6pm-1am	6pm-1am	300	was on 755298
(0463)231 339	Betelgeuse 5		24	24	3/1275	
(0482)465 150	Hamnet	Hull	6pm-8am	24	3/1275	Radio Hams
(0482)859 169	Forum-80	Hull	7pm-11pm	1pm-11pm	3/1275	Midnt-8am Bell 103
(0483)573 337	Fido Compulink 1	Guildford	24	24	3/1275	Multi-user (see C/link 2)
(0483)573 338	Fido Compulink 2		24	24	3-24Bel	Multiuser system
(04862)25 174	PBBS-'Adult' BBS	Mitcham	24	24	3/1275	
(0492)49 194	Cymrutel	Colwyn Bay	24	24	1275	
(0506)38 526	Livingstone BBS	Livingstone	24	24	300	
(051)220 3761	Fido Compulink North	Liverpool	24	24	3/1275	
(051)428 8924	Liverpool Mailbox	Liverpool	24	24	3-24	Britain's first 24 hr system
(0524)60 399	CNOL	Lancaster	24	24	300	Clinical BBS for medics
(0532)600 749	L.E.H.S Fido	Leeds	10pm-8am	10pm-8am	3/1275	
(0534)39 389	Jersey Fido	Jersey	24	24	3/1275	
(0592)860 313	JMBBS Amstrad BBS	Fife	9.30pm-8am	9.30pm-8am	300	Sponsored by John Menzies
(0602)817 696	MACTEL	Nottingham	24	24	3-12	Macintosh Users
(0604)20 441	Norview	Northants	24	24	1275v	
(061)427 1596	OBBS Manchester	Manchester	24	24	3/1275	
(061)494 6938	Fido TeePee link	Manchester	24	24	3-24	
(061)773 7739	Fido Manchester	Manchester	24	24	3/1275	Mektronic Electronic design cons
(0625)33 703	Telemac 15	?	24	24	3/1275	
(0628)824 852	C.A.T.S. Fido	Maidenhead	24	24	3/1275	V22/bis coming
(0642)481 643	System 2000 Com.Club	Redcar	7pm-7am	?	300	
(0642)784 819	Fido Teeside	Cleveland	24	24	3/1275	
(0698)884 804	SABBS	?	24	24	300	Atari based system
(0702)54 6373	C.View Rochford	Kent	24	24	1275v	
(0702)552 941	Haptel	?	24	24	300	Commercial system
(0705)524 805	Gosport Apricot BBS	Gosport	24	24	300	300
(0705)736 025	BBS09	?	7pm-10pm Wed	10am-10pm Sun		
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(0742)667 983	PIP	Sheffield	24	24	300	
(0752)364 059	Haunting Thunder	?	2am-6am???	???	3/1275	Fido
(0762)333 872	PBBS£1 Portadown	N.Ireland	10pm-1am R/B	10pm-1am	R/B 300	
(0766) 4154	Fido Dragon	Porthmadog	24	24	3-24	
(0767)50 511	Fido Gamlingay	Sandy,Beds	24	24	3-24	
(0782)265 078	Stoke ITeC	Stoke	24	24	1275v	
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(0895)52 685	London West Tech	?	24	24	3/1275	TBBS
(0903)212 552	Lasermail Fido		24	24	3/12	Subscribers (12/24 coming?)
(0905)52 536	Access Fido	Worcester	24	24	3-24	Midi section
(0908)668 398	Key Board	M.Keynes	8pm-8am ex.Tue	and Thurs	12h	Spectrum Micron BBS
(091)477 3339	Log On the Tyne Fido	Tyneside	10pm-7am	10pm-7am	3/1275	
(0923)676 644	SBBS - Watford	Watford	9pm-11pm plus	+11pm-6am	3/1275	Times are daily
(0925)411 265		Warrington	24	24	3-24	
(0934)29 570	Avon Fido	Weston sNare	24	24	3/1275	
(0936)77 025	NBBS Cheshire	?	24	24	3/1275	

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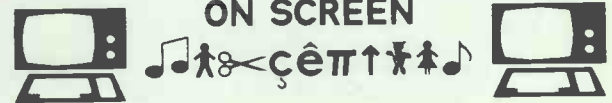
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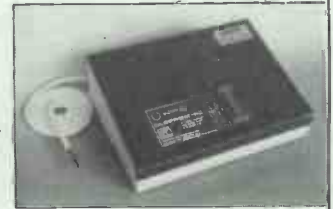
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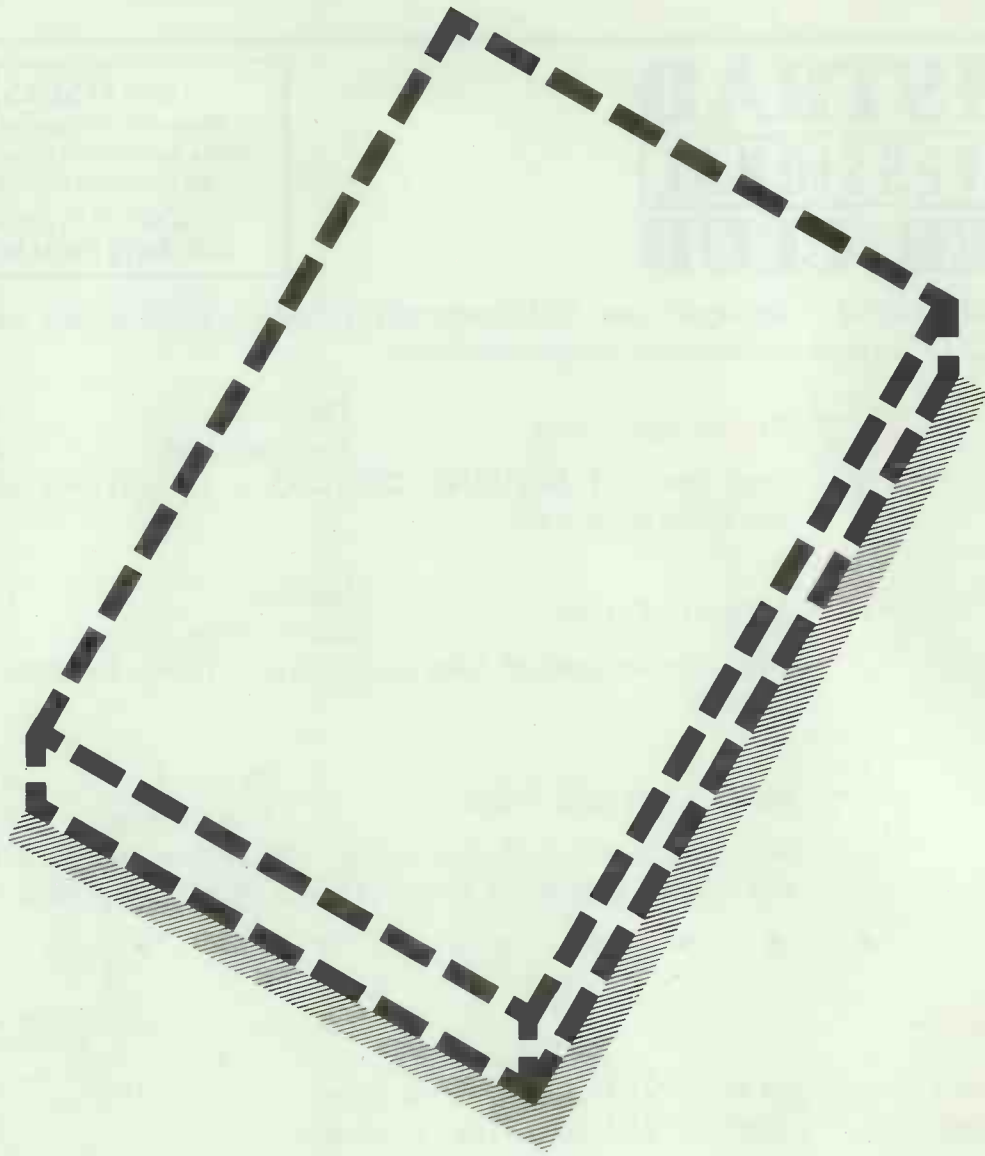
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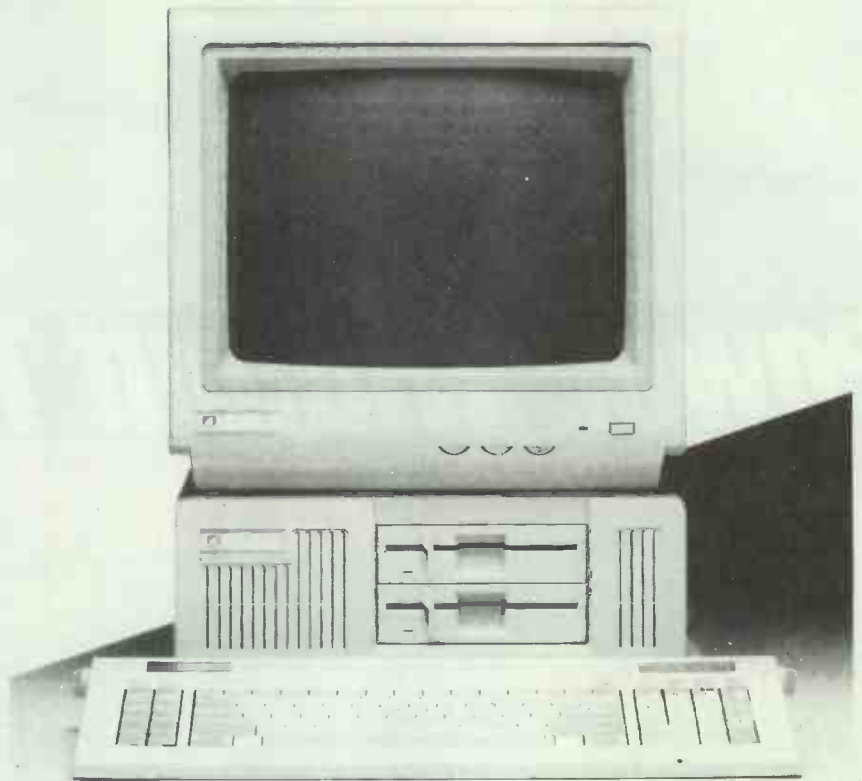
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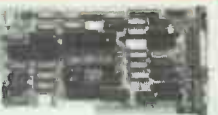


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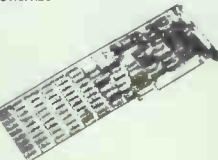
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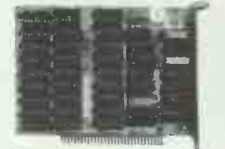
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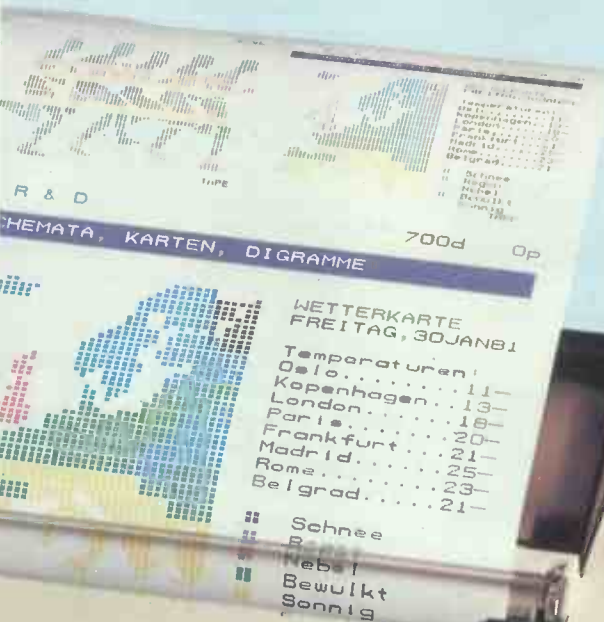
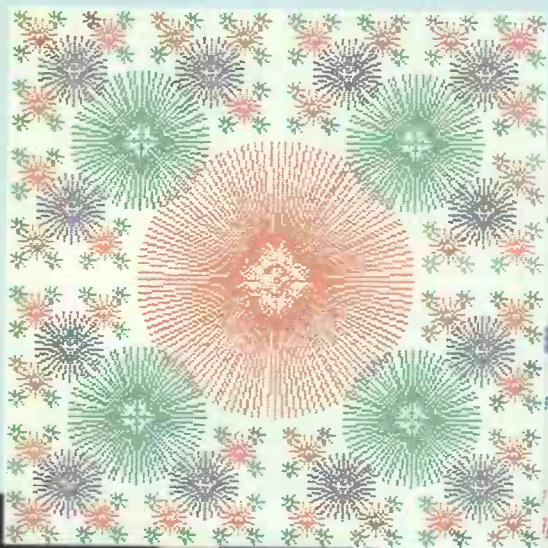
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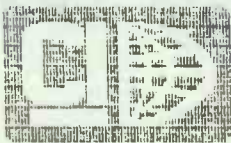
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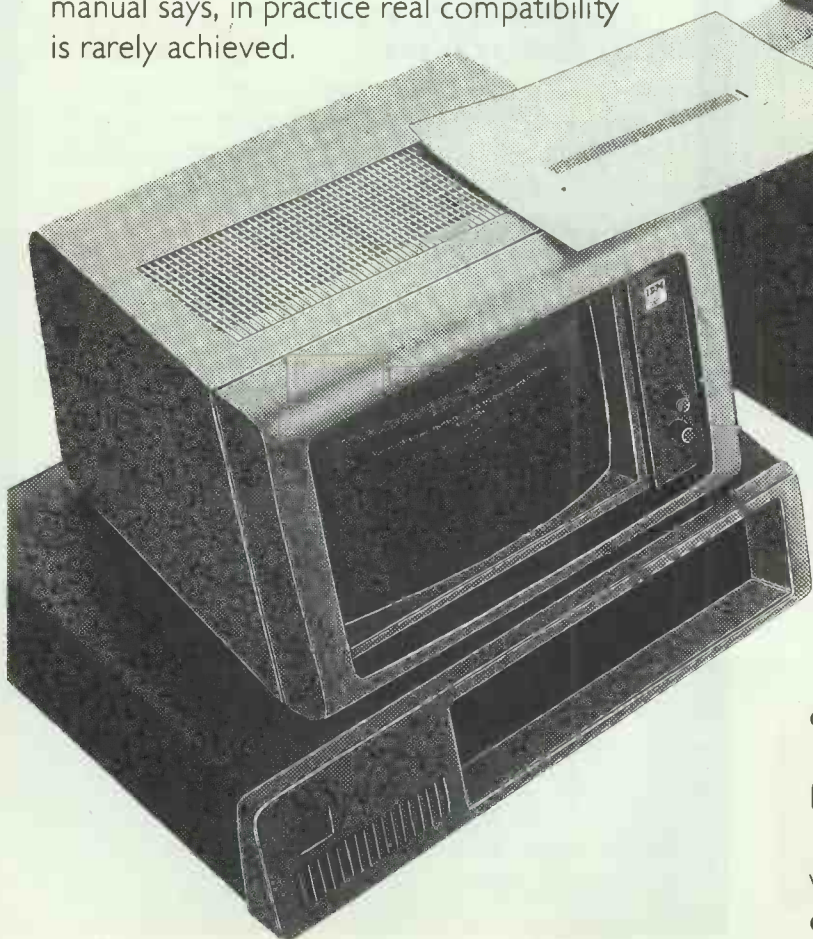
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Hallams Court, Blackheath, Guildford, GU4 8QZ
A TECHNOLOGY GROUP COMPANY

How does Softstrip bridge the gap between computers?

One of the perennial problems facing computer users today is incompatibility.

No matter what you read, or what the manual says, in practice real compatibility is rarely achieved.



And as most solutions need to be tailor-made, they are generally complex and expensive.

However, there is now an easy and affordable way to pass information from one computer to another.

It's called Softstrip. And it's print computers can read.

First, what is Softstrip?

Very briefly, Softstrip is printed computer data. It's a bit like a floppy disk, but on paper.

A single data strip can hold up to 5,500 bytes of software, text, graphics - even music.

To read a strip, you use a Softstrip Reader which scans the data and transmits it to your computer through the serial port.

The incompatible made compatible.

Here's how it works.

Since Softstrip is basically a computer file on paper, any computer equipped with a Softstrip Reader can read it.

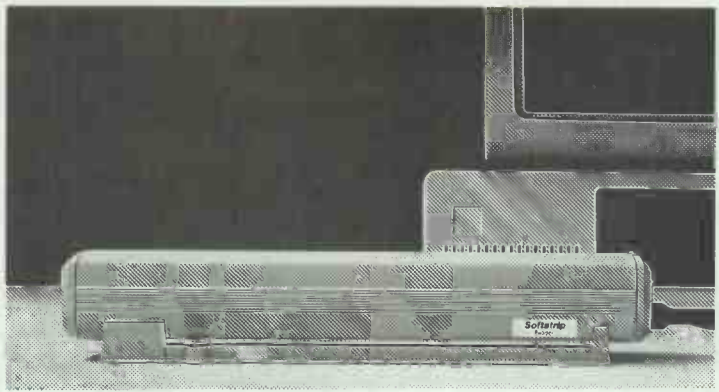
A data strip containing unformatted ASCII text produced on an IBM PC, for example, can be read by a Macintosh and vice versa.

So strips can be distributed throughout an organisation and read into computers of various makes.

There are other possibilities, too.

For instance, you might prefer to use an IBM PC for word-processing, but a Macintosh for desktop publishing.

You can therefore print out a strip containing your IBM word-processed text (most dot matrix or laser printers will do), and read it directly into your Macintosh for printing.

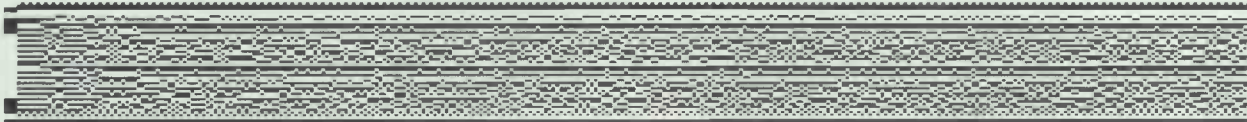


THE SOFTSTRIP READER COSTS £200 + VAT SRP.*

What can Softstrip do for your company?

Since Softstrip is designed to store, retrieve and distribute data, the applications are virtually endless.

A strip could contain price lists, part lists, product details, invoices, sales figures - whatever information needs to be sent to computer users.



THIS SOFTSTRIP CONTAINS OVER 40 POSSIBLE USES FOR SOFTSTRIP. IT CAN BE READ INTO ANY COMPUTER EQUIPPED WITH A SOFTSTRIP READER.

If you're worried about the formats being different, don't.

Softstrip offers a range of software on strip to convert files into the right format.

Here's just a few: Lotus 1-2-3 to Pagemaker. WordStar to Apple Writer. Lotus 1-2-3 to Excel.

Doesn't all this cost a lot?

Surprisingly little. At £200*, the Softstrip Reader is well within most people's reach. For another £20* our StripMaker™ software enables you to print your own strips.

And since Softstrip is on paper, it merely costs the price of paper to run.

Just compare the price of duplicating and distributing floppy disks to sending sheets of paper to see the difference.

There are many other savings to be made - especially when it comes to time and space.

A typical 12 page document, for example, will fit onto just four data strips, which can be filed away on one sheet of A4.

The same four strips can be read into a computer in two to three minutes. Rather faster than you could key in 12 pages, we think.

Strips can even be photocopied making the cost of data distribution lower still.

So far we've only scratched the surface of Softstrip's vast potential. There's plenty more to know.

For more information, cut the coupon or phone for your nearest Softstrip dealer.

Because when it comes to closing the incompatibility gap, we're now open for business.

I would like to know more about Softstrip. Please send me more details.

Name _____

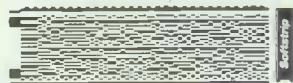
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Print mode switch.
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KX-P1592

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1-inch paper cut mechanism.
Sheet feed option.



KX-P1595

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IBM matrix, graphic printer and Diablo 630 emulation.
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Sheet feeder option.
Centronics parallel and serial interfaces.

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Hercules compatible graphics card.
Supports Mono, CGA, EGA, MULTI
SYNC and 25 KHZ monitors.
32 column display, parallel port,
optional RS232C port,
clock/calendar optional.

EGA MULTI RES
IBM EGA compatible graphics card.
Supports Mono, EGA, Multisync
and 25 KHZ monitors.
256K display memory, parallel port
standard.
Clock/calendar optional.

GRAPHIX PLUS II
IBM Mono/Printer/CGA Adaptor
Compatible.
Supports Mono, CGA and
composite mono monitors.
16 colour capability, parallel print
port,
Clock/calendar optional.

MONO PLUS
IBM Mono/Printer adaptor compatible.
Printer port and clock/calendar option.

COLOUR XVI
IBM CGA compatible.
Supports CGA monitors to 16 colour
capability.
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Clock/calendar optional.

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The range covers nearly every application requirement and where STB cannot meet the required specification, modification or even special hardware development and production can take place.

STB has been producing add-on video, memory and I/O cards for the IBM PC compatible marketplace since the company was founded in 1981. STB's reputation for QUALITY and high PERFORMANCE products has steadily grown throughout the years.

The STB CHAUFFEUR HT provides the extra refinement in today's world of monochrome graphics. Today just being Hercules compatible is not enough. STB's CHAUFFEUR HT offers total Hercules graphics card compatibility and much more. You can now display a full 132 columns making spreadsheets packages like 1-2-3 easy to read, all in a high resolution 8 x 14 character set. In addition to being Hercules compatible the CHAUFFEUR HT will display on any standard monochrome monitor with a resolution of 1056 x 352. What's more, the CHAUFFEUR HT will drive any standard CGA colour monitor with a driver for microsoft windows in four colours to a resolution of 1024 x 200. With 25 KHZ monitors, resolutions of 640 x 400 can be achieved from standard CGA software with no additional drivers. When it comes to I/O the CHAUFFEUR HT has it covered with a parallel printer port as standard and an optional RS232 interface and clock/calendar.

The EGA MULTI RES provides all the IBM EGA capability plus parallel interface and optional clock/calendar. In keeping with STB's tradition of offering more for your

money the EGA MULTI RES will also produce a resolution of 832 x 350 in 16 colours using the Microsoft window drivers provided when using an EGA graphics display, and 752 x 410 resolution in 16 colours on Multisync displays. When using a 400 line, 25 KHZ display the STB EGA MULTI RES will produce 640 x 400 line graphics in 16 colours. The added benefit of using the STB EGA MULTI RES in the OLIVETTI PC range is that with the existing OLIVETTI monitor you can now achieve EGA capability.

If it is standard IBM monochrome graphics you then require the STB MONO PLUS with printer port and clock/calendar option. The standard Hercules graphics compatibility is serviced by the STB H Card again with printer port and optional clock/calendar.

The monitor range from Technitron X-Data provides HIGH QUALITY and PERFORMANCE products built to EXACTING STANDARDS. The 12 MHI-1 or 12 MHI-1A with P31 or Amber CRT, both have anti-glare screens with tilt and swivel stands as standard. The 14 CMI-2 is a CGA monitor with 0.31 dot pitch anti-glare CRT and text mode as standard, the tilt and swivel stand is an option. Whilst the 14 CHI-1 gives you that little extra 25 KHZ 400 line display all from standard software when used with the CHAUFFEUR HT or EGA MULTI RES. ALL BOARDS CARRY A 2 YEAR WARRANTY AND THE POWERFUL PC ACCELERATOR SOFTWARE. In addition to the warranty both boards and monitors are supported through Technitron X-Data's 'hot line'. Monitors carry a 12 month return to depot warranty.

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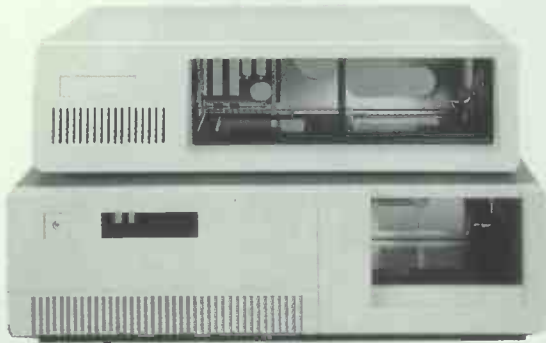


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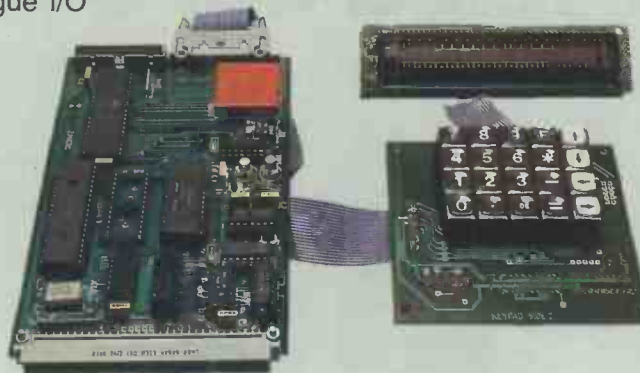


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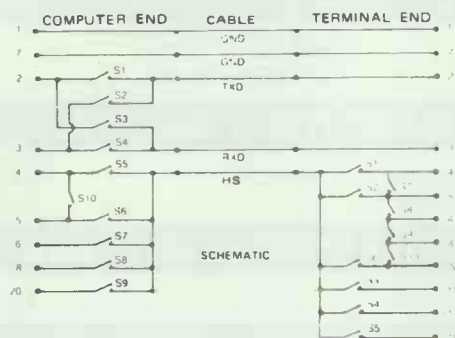
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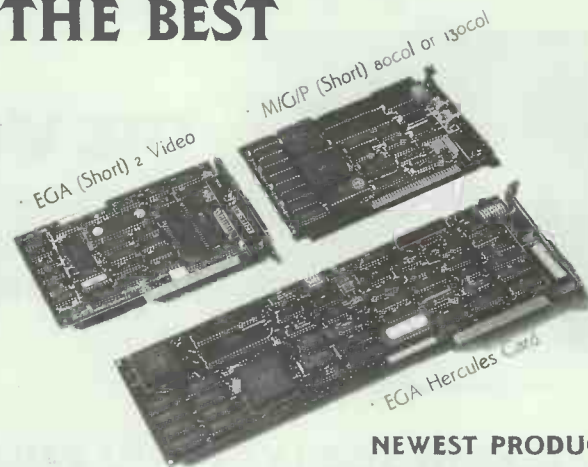
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JANUS/Ada C-Pack	CP/M-80	£ 130
JANUS/Ada D-Pack	CP/M-80	£ 260
Supersoft Ada	CP/M-80	£ 250

PROGRAM EDITORS

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Epsilon V3.01	PC-DOS	£140
Lattice CVUE	PC-DOS	£ 95
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FirstTime for Turbo-P	PC-DOS	£ 50
Pmate PC	PC-DOS	£155
RED v6.6	PC-DOS	£ 65
XTC (with Pascal source)	PC-DOS	£ 65
Vedit-Plus	PC-DOS	£155

CSE (with C source)	MS-DOS	£ 60
MIX Editor	MS-DOS	£ 35
Pmate 86 v4.00	MS-DOS	£150
Vedit-Plus	MS-DOS	£155

Vedit-Plus	CP/M-86	£155
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CSE (With C source)	CP/M-80	£ 60
MIX Editor	Z80 + CP/M-80	£ 35
Nevada Edit	CP/M-80	£ 30
Vedit-Plus	CP/M-80	£155

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CHIP CHAT

There's nothing worse than receiving free demo disks of software from the US and finding that HM Customs wants to slap an import tax on them. To avoid all the hassle, William Poel, head of software distributor New Star, told his new US supplier Sandy Schupper of Brown Bag Software to mark samples appropriately.

Imagine his surprise when \$40,000 worth of Brown Bag software arrived at Heathrow marked 'Samples: no commercial value'...

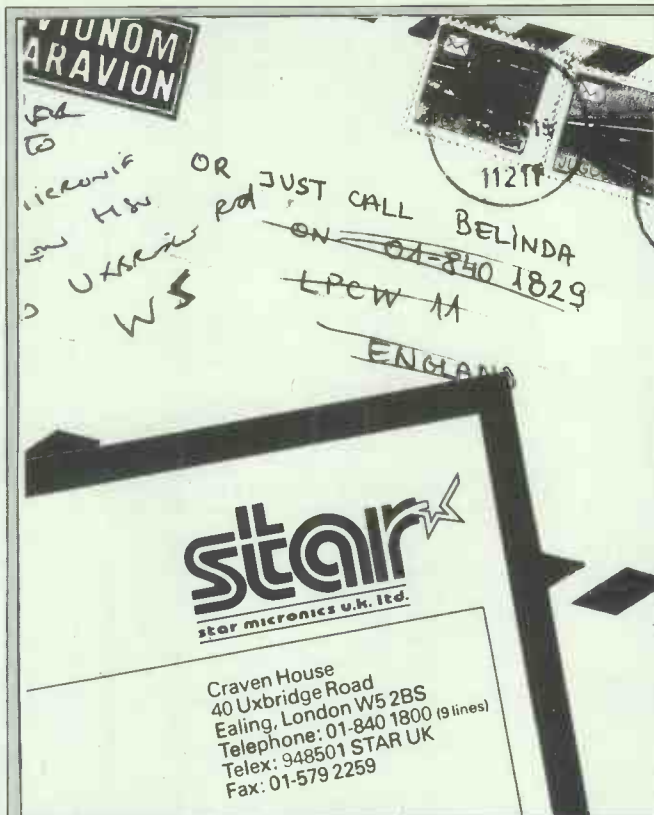
Apple is holding a postal auction of an Apple IIGS in support of Comic Aid. The machine has been personally autographed by Steve Wozniak and comes with £500 of software.

Computers must be serious stuff these days. The latest Comic Aid book — *The Utterly Utterly Merry Comic Relief* contains not a single joke about computers. Personally we like the suggestion of one wit that the Apple IIGS was of course named after everyone's favourite fruit, the Granny Smith.

You have until 28 February to get your bids in to Apple...

Corporate Software has to tread lightly on a number of grounds with its UNLock utility. Three disks are available at between £74 and £95 which will allow you to make unprotected copies of such fortresses of anti-piracy as Framework II and 1-2-3.

Corporate claims that UNLock 'removes tedious copy protection problems built into many popular business packages.' Such delicate wording is doubly advisable for Corporate. Its PR company, Wickes Associates, also promotes Ideal Software which distributes DoubleDOS — a protected product easily



This envelope, containing a small coupon from Star Micronics' advert in the November issue of PCW, successfully made its way to the printer manufacturer all the way from Yugoslavia. So next time you're worried that your first-class letter is going to take five days to get round the corner, try missing the address off completely...

freed by UNLock...

The battle for Prolog is hotting up. Recognising that Borland's Turbo Prolog is opening up a whole new market, Expert Systems International is offering to knock £50 off its £145 Prolog-2 Personal to buyers sending in the cover of their Borland manual.

The company is concerned that, with a few features missing, 'first-time users aren't getting a flavour of what Prolog is really like.'

But then with £595, £995

and £1395 versions of Prolog also in its stable, maybe ESI's Personal version isn't all that complete either...

Programming takes on an Italian flavour with Polyhedron's Prism software. This utility includes a module called SPAG which helps maintain 'ancient Fortran spaghetti code'...

At the recent Times/Hewlett Packard Computer Press Awards ceremony, news writer category winner Charles Brown of *PC Business World* made a very

worthy speech about *The Times* and the Wapping dispute. We noticed his political opinions weren't strong enough to induce him to refuse to accept his prize of an HP Portable Plus...

At that same dinner, guest speaker William Rushton added polish to his speech by referring to a Radio 4 show called *Nerves of Silicone*. Maybe he should have made a clean breast of the matter and admitted that he'd never listened to it...

Proof that the Amstrad PC has finally arrived (gained respectability we mean, not actually been delivered) comes in a Morgan Computer Company ad. An IBC PC is being sold with the explanation that it is 'Amstrad compatible'...

Proof that Amstrad really started arriving version 2 — in mid December *PCW's* editor, Derek Cohen, spotted 30 Amstrad PCs which had just been delivered to central London computer store Gultronic. Bet they thought Christmas had come early...

In the same store an anxious customer was enquiring about software that would enable him to print Russian and Greek characters on his computer. The helpful assistants suggested he ought to go shopping in Russia and Greece...

Talking of helpful staff, a staff member was having trouble getting his Toshiba printer to work properly with his PC. The printer was doing a line feed after every character and the reviewer needed to see exactly what codes the printer was receiving.

A call to Toshiba revealed that there was no hex dump facility on the printer. 'Not to worry,' chirped the tech help chappie. 'Plug in an Epson printerto see what's going on.'

WE'RE LOOKING FOR (MORE) EXPERTS

PCW prides itself on being up at the sharp end of personal computing. We try to bring you the scoops, the new-machine reviews, the technical information on the latest products. But we can't do it all ourselves; there's just too much to cover and not enough of us. So we rely upon outside experts, like Kathy Lang, Guy Kewney, Mike Liardet and Martin Banks, and we need even more of them. In particular, we're looking for people who are professionally involved with personal computers, and who would like to write about them.

You might be a programmer, a hardware designer or a college lecturer; if you have something to say that's relevant to our readers, we'd like to hear from you.

Our readers are people who use personal computers, and they want to read articles that help them get the most from their investment. They want to know how hardware and software works, what new technologies

are coming along, what products and techniques the professionals use, and why.

Let's be quite clear: we are not interested in letting people puff their own products for free. But we might be interested in the design decisions that went into your product, or the problems you encountered in getting it to work.

Don't be fooled that it's easy. Things which have become second nature to you will need explaining to a non-specialist. Remember, PCW readers are smart and highly motivated; they want the benefit of your experience, without being preached at, patronised or blinded with jargon.

If you'd like to share some of your expertise with PCW readers (and get paid for it), why not send us a synopsis or a few sample paragraphs?

We look forward to hearing from you.

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