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BENCHTESTS & REVIEWS

JVC HC-95

Nick Walker runs the rule over a machine that links video to computing under the MSX2 banner.



ARC JET TURBO

A machine that tries to be an AT-clone and an XT-clone in the same box; Peter Jackson investigates.

TANDY 102

The Tandy 100 finally gets a UK-standard internal modem, to Menno Aartsen's relief.

EOGRAPH

Fool your software into thinking that your matrix printer is a graphics plotter, with this board reviewed by Stephen Applebaum.

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HOMEBASE

Another set of pop-up utilities for the PC, with Simon Williams in the driving seat.

PC MICE

Various pointing devices for the IBM PC have emerged; we sort them out.



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INTELLIGENT MODEMS

Our communications man Peter Tootill looks into our four fast communicators.

SDS-XP MODULA-2

This compiler adds a syntax-directed editor and a windowing environment to its language. Nick Walker is convinced.

RBASE 5000

Microrim's highly-rated database is now sold by Microsoft. Kathy Lang investigates its credentials.

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SLOW BOAT TO CHINA

Bob Couttie explains the problems of selling to the billion inhabitants of the People's Republic.

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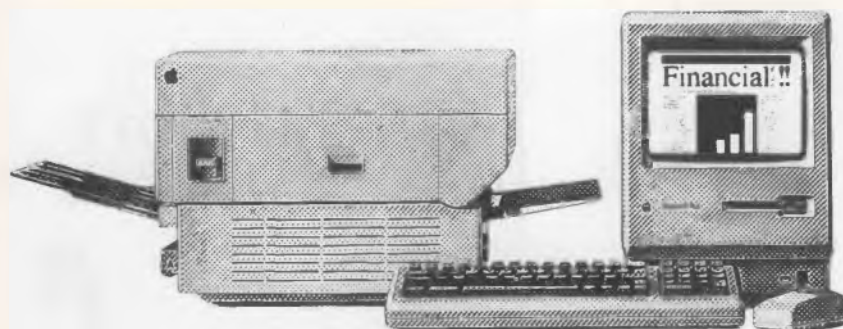
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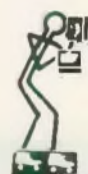
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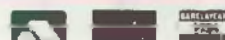
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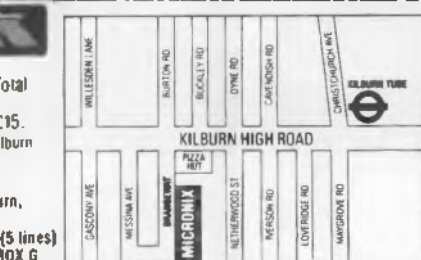
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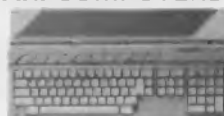
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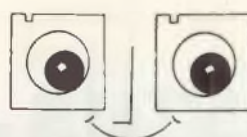
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DATALIFE	M0525-01HR	S/side S or 0 Dens	11.49	11.25	11.00		
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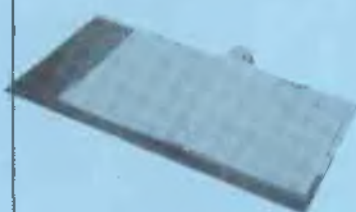
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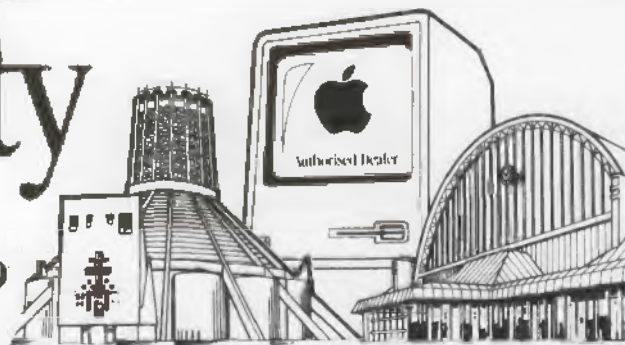
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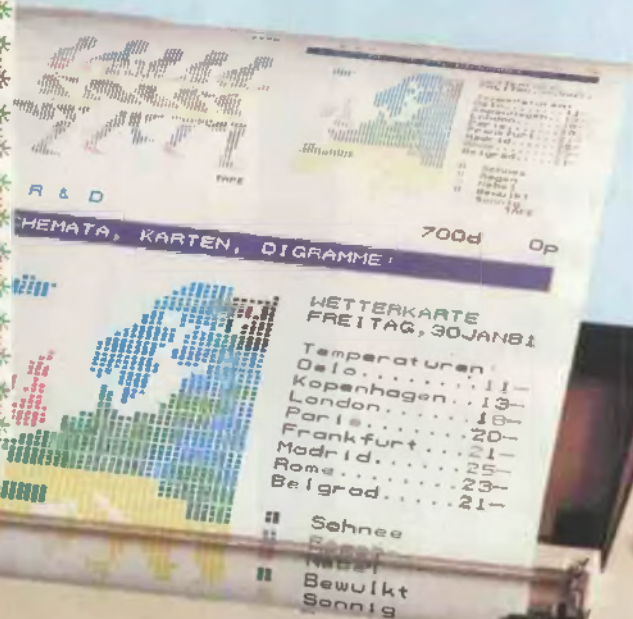
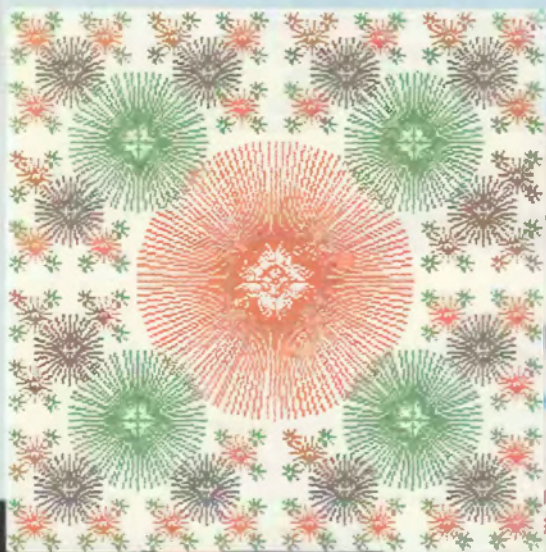
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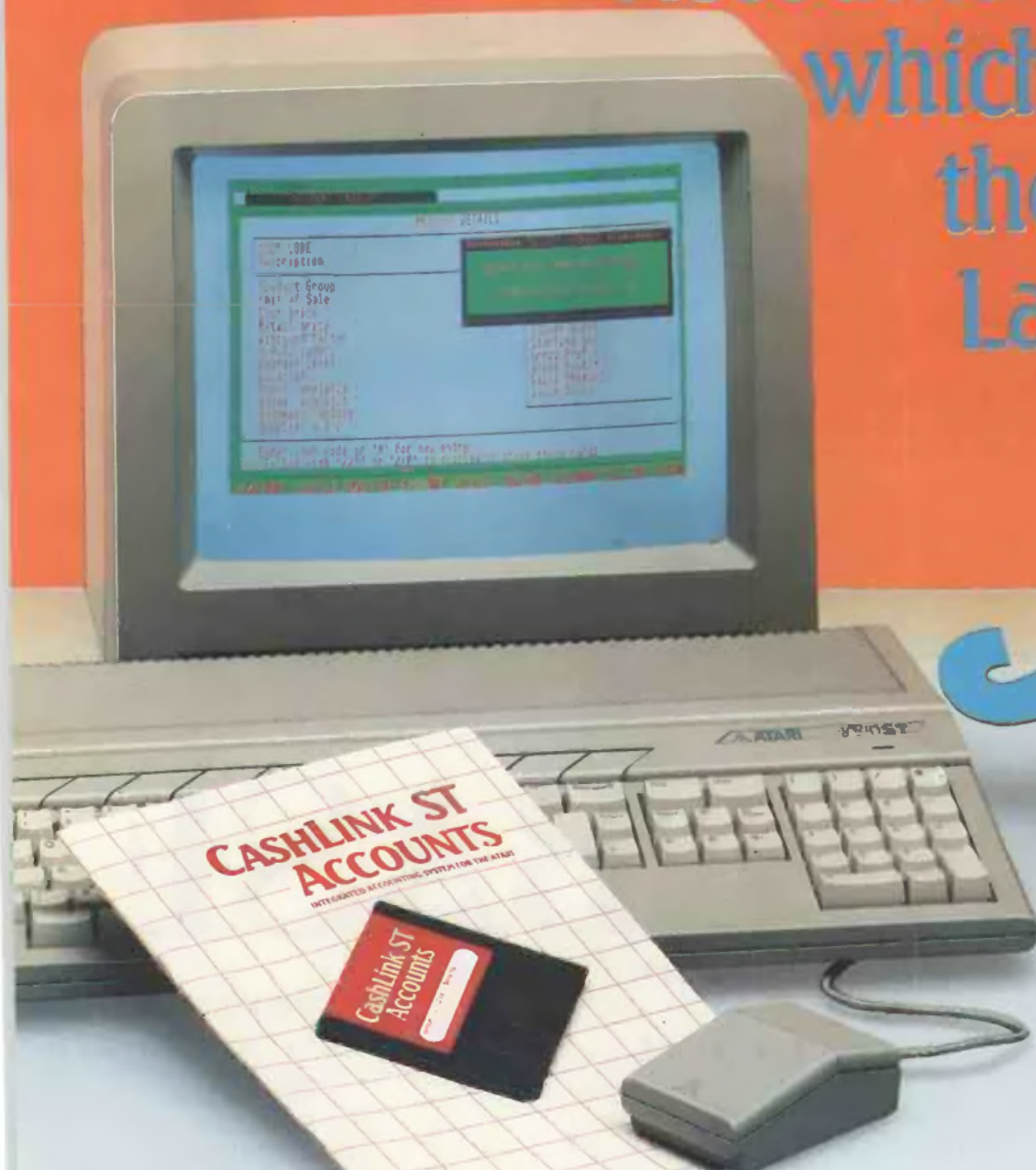
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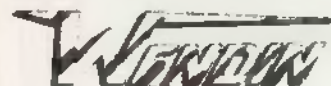
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HOW TO TURN YOUR PCW8256/8512 INTO A BUSINESS WORKSTATION

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Each transaction need only to be entered once,
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Specially written for PCW8256

Utilizes the RAM Disk to eliminate the need for changing disks during the day.

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Sales Ledger

Invoice Posting
Cash Receipts
Debtors List
Statements
View Account

Purchase Ledger

Bill Posting
Cash Payments
Creditors List

Remittances
View Account

Name & Address Labels

Nominal Ledger

Lists of Accounts
Reports
Periodic Transactions
N.L. History

Cashbook

Bank Statement Entry
Full Reconciliation
Periodic Transaction
View
(gives TRUE cash status)

VAT Returns Invoicing/ Credit Notes

Single Drive System:

200 Accounts
(Sale, Purchase)
1000 Transactions
200 Nominal Accounts

Dual Drive System:

1000 Accounts
(Sales, Purchase)
4000 Transactions
200 Nominal Accounts

Management Reports

- 1) Stock Report
Value of Stock
Cost of Sales
- 2) Assets including
Depreciation
- 3) Prepayments &
Postpayments
- 4) Expenses
- 5) Profit & Loss
- 6) Balance Sheets

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A SIMPLIFIED INTEGRATED PAYROLL SYSTEM

designed to be fully compliant with all current tax/National Insurance guidelines.

High capacity

up to 100 employees per data disk.

Department management

up to 100 departments may be held on each payroll data disk.

Tax compatible

handles all H, L, P, V, BR, D, NT, F tax codes both normal and week 1/month 1.

National Insurance compatible

contains N.I. tables A-G.

S.S.P. compatible

handles all S.S.P. rates and caters for full attendance records and automatic calculation of S.S.P. qualifying days and S.S.P. to be paid.

Additions and deductions

the system caters for 13 additions - pre and post tax - each of which may be pre-set (e.g. union) or entered for each period (e.g. expenses). The post tax tax deductions may also be factored on a sliding scale from the pay this period.

Overtime rates

caters for the 7 normal overtime rates.

Pension schemes

the system incorporates most pension schemes on fixed value or sliding scale.

Holiday pay

caters for statutory, unpaid and holidays at two rates with full records for the year.

Documents

the system caters for P35 and P60 prints as well as full employee details prints.

Annual updates for TAX and N.I. changes are available together with full software support if required

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24 Abbot Street, Wrexham, Clwyd LL11 1TA.
Tel: 0978 358832

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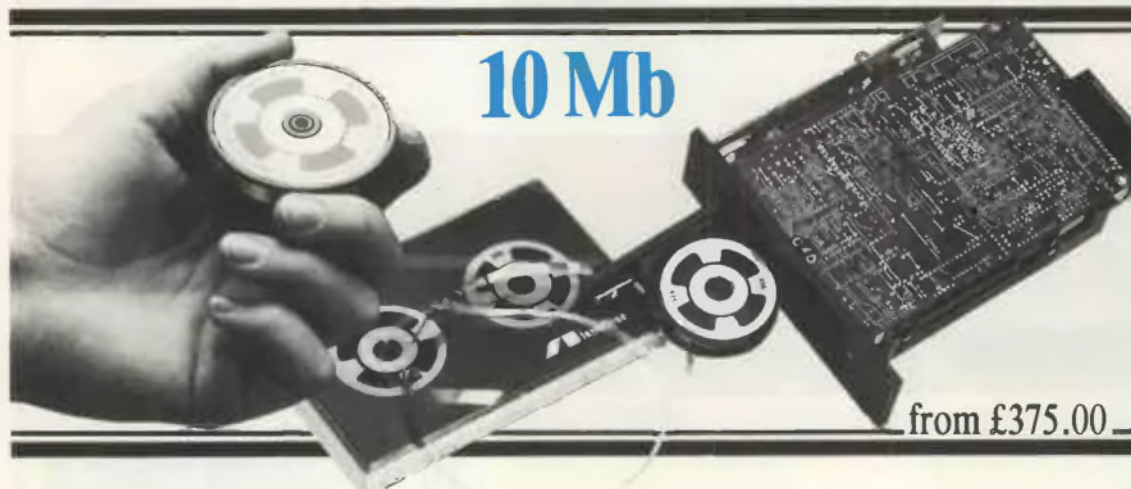
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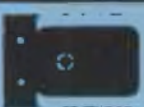
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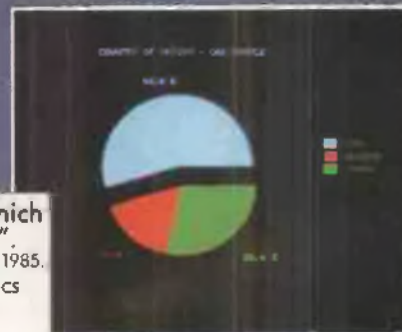
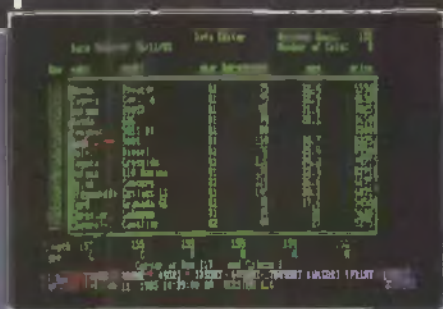
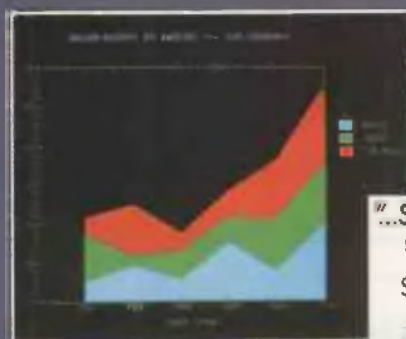
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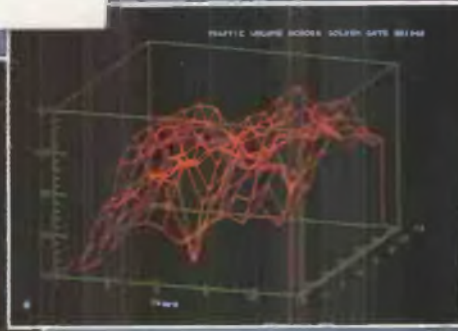
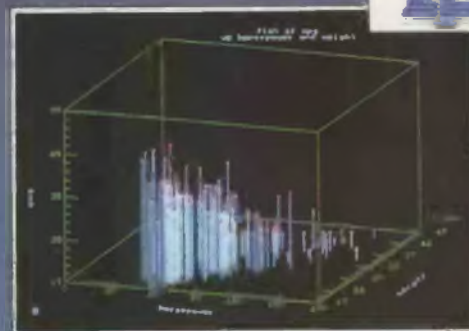
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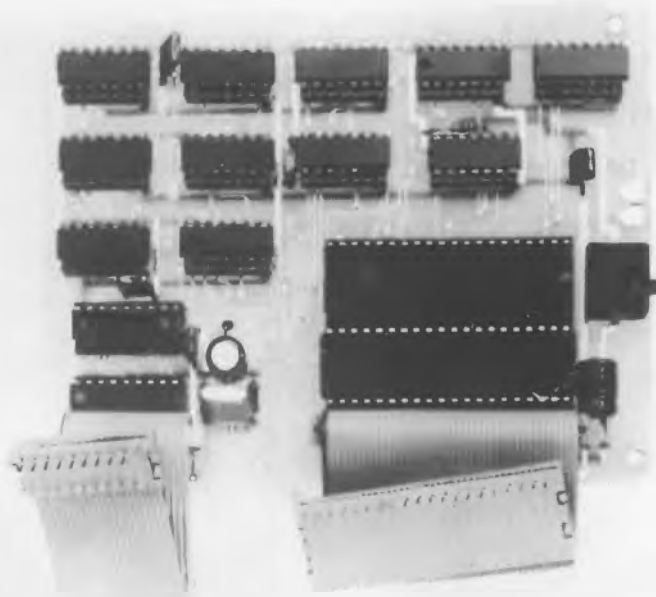
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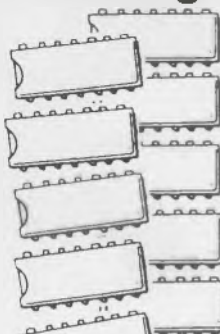
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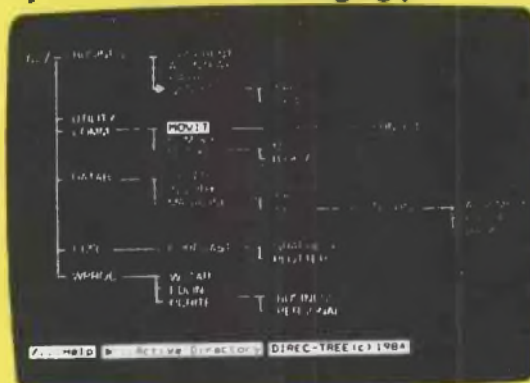
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New Star offers Altogether more

The name of NewStar Software needs no introduction to many Amstrad users; the company first made its name selling a range of software for Amstrad machines, and particularly for the PCW8256.

Recently NewStar has extended its range to include a number of PC products — generally at much lower prices than their counterparts from historic major brand-name sources.

One of the big developments in business software in recent years has been the introduction of integrated packages which combine spreadsheet, wordprocessing and other functions.

At the PCW show, NewStar will launch Altogether, a budget-priced package for the IBM marketplace. This brings together wordprocessing, database, graphics, spreadsheet, communications and planning in a single suite of programs which will sell for £150 — some £300 less than the nearest competitive product for the IBM PC.

A number of alternative WP packages for the Amstrad are now available, and NewStar's offering in this market includes NewWord, reviewed by Nick Walker in last month's edition of PCW.

This is now available, not only for the Amstrad, but in other versions also. The latest is a powerful and versatile multi-user system, based on NewWord 3, which will display its versatility at the show on a network of Amstrad, IBM and HM Systems Minstrel machines. The Amstrad version of the product, NewWord 2, will appeal to users of the 8256 whose needs are not satisfied by the LocoScript program supplied with the machine.

After the IBM hardware clones, it was only a matter of time before the trend was

followed in software. A number of companies have introduced clones of the best-selling Lotus 1-2-3 spreadsheet, and in this market NewStar will be offering VP Planner from the PaperBack Software range.

Also of interest to many business users, the memory-resident multi-user spreadsheet, Cracker2, will be demonstrated on the stand by its author, Ian Searle. Cracker works in background with other products such as NewWord, dBase, WordStar and Word.

Attraction for Apple users

Apple users in search of almost any software or accessories for their systems need look no further than the PCW Show.

Alongside all the latest hardware like the Mac Plus, LaserWriter and Hard Disk 20, the Apple stand will include one of the biggest displays of Apple software and accessories ever seen.

And it will all be on sale thanks to a group of specialist dealers from throughout the London area who are joining forces to provide this service as part of September's main event.

The AppleTalk network system is expected to feature prominently, as are the desktop publishing packages.

There are also hopes that the PCW Show will provide more detailed news of the new Apple II — still a closely guarded secret in the States — if not the opportunity for a glimpse of the product itself.

Keynote session

Professor Chris Edwards of Cranfield will chair this year's keynote conference, sponsored by the trade weekly MicroScope, on the opening day of the show. Others taking



Getting down to business inside PCW Show's business hall last year. This September the choice of personal computing hardware, software and peripherals will be bigger than ever.

PCW SHOW FOCUS

part include David Fraser of Microsoft, William Poel of NewStar and Stafford Taylor, the ex-IBM man now one of the top management at MBS. They will face questions from an invited audience of business and computer Press and from other leading figures in the industry.

Galaxy of games

All the big names in home computer software are lining up their latest games for the PCW Show launch-pad.

Firebird, part of BT's Telecomsoft, will feature The Hive, for Spectrum and Amstrad machines, in which a swarm of bees are determined to take over the world. You have to enter the hive and destroy the giant Queen Bee. Fast wire-frame animation in three dimensions.

US Gold is offering arcade action, with exciting coin-op games converted for home computers, plus Masters of the Universe with He-Man, Battle Cat and Man-at-Arms all featured on the stand.

From Mikro-Gen comes Stainless Steel, in Amstrad, Commodore and Spectrum versions. Teenage hero Ricky Steel sets off on a mission to save the world – in a series of scenes featuring Neil Studwick's high-quality graphics.

Jeff Minter always one of the PCW Show's big attractions, will be back with another of his visually stunning presentations for Llamasoft, while for more excitement, look out for Steve Crow's Firelord from Hewson.

Acorn shows its power

Two powerful new machines will be featured on the Acorn stand in Olympia's National hall – the M19 and the Master 512.

The M19 is essentially a re-badged version of the machine of the same name from the parent Olivetti company. It's an entry-level PC intended particularly for schools and colleges which are Acorn's traditional customers and now

find they need IBM compatibility.

But the main focus of attention is likely to be the 512, latest addition to the Master series of machines. This is a 16-bit machine with 512k of RAM and DR's friendly front-end GEM.

Included in the GEM Collection are GEM Desktop – with calculator and diary – plus the graphics and wordprocessing programs GEMPaint and GEMWrite. This is effectively the key which unlocks a door to another universe of software, since it runs under DOS Plus – providing compatibility with CP/M86 and MS-DOS.

All this is in addition to the high-resolution graphics, versatile communications (including Prestel) and of course BBC Basic, which are the hallmark of the rest of the range.

In addition to the main National hall stand, Acorn will also be taking part in the special education area of the PCW Show, with a range of specialist products for schools.

New look Flyer

After a slow start, the market for IBM compatible portables is at last taking off, and one of the stars at last year's show, the Tava Flyer, is back at Olympia in September with significant new features and facilities.

A new high-contrast back-lit screen gives improved viewing, and the machine now includes IBM 3270 terminal emulation facilities. This will be a boon to big business users working away from base, because it means they will be able to use their Flyer as a terminal for the company's central computer system.

The heart of this powerful laptop is an Intel 80186 processor running at 4.915 MHz, and memory is expandable from 256k to 640k. Both MS-DOS and CP/M86 operating systems are supplied. The hard-disk version of the Tava provides 20 Mb of integral Winchester disk storage – and distributors Computer Frontier say confidently that this will withstand a 6g shock during operation.

Comms options also include either European (CCITT) or North American Bell standards internal modems.

Networks attract

Olivetti is expecting strong interest in its range of network products being demonstrated at PCW Show. Europe's premier computer company has been selling networks for the past four years and reports a big increase in sales over recent months.

The full Olivetti line-up will be on show, from the entry level M19 to the multi-user

M24 – including the portable M22, together with a full range of applications software.

Guide book

Amstrad users who want to make the most of the LocoScript software supplied with the machine may be interested in Babani Publishing's new Reference Guide to Word Processing on the 8256 and 8512 which will be on sale at the show. It includes practical advice and a range of simplified "follow the arrows" charts which simplify more complex procedures. There is also a full reference section which shows all possible type styles, line spacings and character sets.

New IBM adds CAD

KGB Micros of Windsor always makes headlines at the PCW Show, demonstrating business products with a difference – for example the Torus Icon networks system which won a Standard Micro Business Award two years ago.

This year will be no exception; KGB will be showing IBM's powerful new RISC (reduced instruction set computer) machine running a number of multi-user applications including accounts and CAD.

The September event will be the scene for KGB's launch of a new Unix version of the AutoCad design package which was unveiled by AutoDesk in North America at the end of June.

Sandy Saunderson, KGB's managing director, says that AutoCad is already established as the best-selling CAD package, with customers among city institutions as well as engineers: "Anyone who needs to produce detailed drawings – for example interior layouts – will find AutoCad useful, and the new version will increase its appeal, particularly in larger establishments."

In recent months KGB has expanded from its headquarters in Windsor with a new branch at Elephant and Castle in South London, serving both City firms and the increasing number of companies which are moving South of the River.



The New Tava Flyer Winchester disk based portable computer. The Tava Flyer features 20 MBs of integral Winchester storage, back lit screen and facilities for coaxial connection to IBM mainframes.

For further information: Ayon Cinnamon, Graham Hockham & Associates, 09328 68177.

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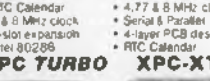
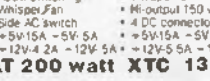
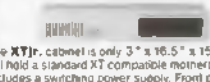
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Not a Nice town

The idea of holding Comdex Europe on the French Mediterranean, combined with an International Business Software conference, in sunny June, sounded so good, I expected that Comdex Europe might, after all, become an exhibition worth travelling to.

The way I looked at it, Nice was a popular (but possibly expensive) resort which businessmen would gladly seek an excuse to visit. And the software conference would attract new exhibitors, new visitors, and therefore the show would have lots of delegates, paying lots of money, and making the exhibitors happier than they

were when Comdex Europe was held in the winter in Amsterdam.

You can tell I'd never been to Nice before.

I didn't like Nice within half an hour of landing, but an 85 Franc (roughly £10) taxi fare for a two-mile journey wasn't all.

There was the fact that it proved virtually impossible to get a taxi from the exhibition centre once you were there.

There was the 'reception' organised by the 'depute-Maire' of Nice, where we were invited for 6.30, and were not permitted to have a drink, even of plain water, until 7.15, when this official finally deigned to show up.

There were the vice girls, or 'filles de luxe', who accosted you in the evening with promises of sexual bliss for 'Mille Francs'.

There was the blatant exploitation of the locals,

who viewed you with all the sympathy and understanding of a vulture for a carcass, and stripped you of money with the same kindness that a mugger shows to the victim. As one American delegate said sadly: 'After paying \$125 per head for a meal in France, the one thing you should expect is good cooking, not just a rip-off.'

I'll spare you the details of my own eating experience, with attendant medical expenses, because the symptoms are still too fresh in my own mind for me to want to write about them. Suffice it to say that I only had one meal during three days in Nice.

Some of the locals seemed to be under the impression that organised crime ran the town. Organised crime is welcome to it, because, judged by the quality of the exhibition, I am under no temptation to return.

The show, as you must have guessed from the amount of space devoted to the travelogue, was not much to write home about.

Before it started, the organisers promised 10,000 visitors. In writing. They also promised that IBM would participate.

IBM did participate — in the software conference, by sending two executives. They weren't the executives specified in the programme — no, they (possibly afraid of Gaddafi) stayed at home, and sent their flunkies. Nice, well-informed, interesting guys, of course. And after the show, the 10,000 turned out to be a 'typographical error' and 4000 people turned up 'as we said.'

Exhibitors weren't impressed. The man from Tallgrass said:

'Typographical errors don't get transmitted down voice calls, and that figure (10,000) was what we were told to expect. We know, because we told them that 4000 would be a total disaster.'

The fact of the matter is that an 'international' computer conference in Europe is a dream. There is no 'pan-European' market, there are no 'supra-national' suppliers, and even the biggest European shows are

really for the benefit of the local market.

Hannover Fair is enormous, but the visitors are German. Scicob is vast, almost as big as Hannover in some places, but the visitors are French. And Compec is pretty big, in London, and the UK computer industry is what buys the tickets there. Even PCW Show visitors, who are as internationally based as any, are mostly British. It's held in London, after all, and in English. What do you expect?

I chaired two sessions at the software conference. One featured an IBM senior executive talking about network strategies, and attracted a huge audience of over 40 people. The other featured five database designers and distributors talking about profitable ways of selling software, and attracted 15 people. I'm told the average session attracted seven people, and one session chairman confessed to having delivered his prepared paper to an audience of two — the translators.

I left Sheldon Adelson, the owner of Interface, cornered by three heavy-looking gentlemen in the exhibition building. They were urging him to pay extra for the office facilities in the building, extra for the restaurant, extra for the lounges, extra for the security, and so on.

Adelson has dealt with people of this stripe before. 'Tell them,' he said, 'that I'm putting Nice on the international map. Tell them that I'm going to make it the international trade show venue of Europe. I'll make Nice the Las Vegas of Europe. I'll bring the big industries — shipping, skiing, golfing — all of them, to Nice. I'll bring the big buyers of Europe.' And he said to the press, later, that next year's show was already booked up.

If Interface Group organises another Comdex Europe in Nice, feel free to go, with the excuse of the show, in order to enjoy what Nice has to offer.

That, I suppose, might be possible. If you are into



Drawing with a mouse is an improvement on the etch-a-sketch techniques that were first offered on micros, but is still pretty crude by comparison with the costly alternative of a graphics tablet.

Summagraphics does sell a mouse (illustrated), with a brand new offer of free support for Microsoft mouse drivers and a new, low, £99 price tag. But it also does a graphics tablet.

To help sell the Summagraphics tablet, the company has decided to offer it with a free copy of Digital Research's GEM Draw, starting at £525 (plus VAT) for the 5in x 6in pad.

Details on (0635) 32257)

gambling, there are casinos, and Monaco is an hour's drive away. There must be some entertainment, but since my hotel distributed a guide to Paris, not Nice, it's hard to be sure. I certainly didn't see any big signs saying 'Frank Sinatra Live!' or 'Tom Jones Sings!' the way you do in Las Vegas, where Comdex has its successful venue each year. But then I did spend two days in bed with hypodermic needles attached...

On second thoughts, let's be honest. If Interface Group does organise another Comdex Europe in Nice, my candid advice is: don't go. There isn't even any sand on the beach.

A cure for A Mess DOS

I think I have a cure for anybody who believes in Father Christmas, fairies, or Star Wars. Just spend a week learning the basic commands for the DOS for the IBM PC. Apart from the

fact that you'll be cured of your credulity, you will be very angry. Mucking about with A Mess DOS like MS-DOS makes you very, very angry.

The simple truth is that MS-DOS is a program, and probably not a lot worse than many a program we have to load into our machines from time to time. It has bugs, it does things which aren't explained, and the manual says it does things which it doesn't do.

But from the operating system, we expect rather better.

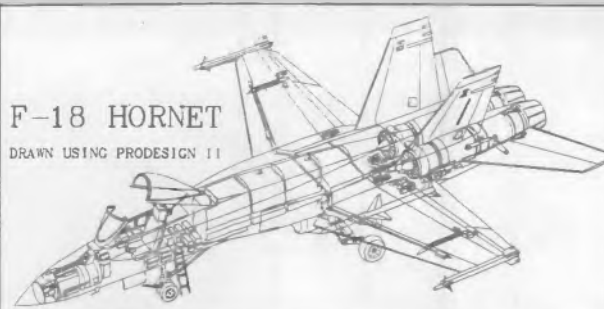
One reason I have no hope for Digital Research's GEM mouse is simple — the essential program we call A Mess DOS, sabotages it.

You can try to protect the user from the operating system by building what programmers call a 'shell' around it. It takes your commands and feeds them through to MS-DOS. GEM is such a shell. Xtree, Pathminder, Dosamatic, and so on, all try to do the same thing.

The trouble is, whenever things go wrong, A Mess

F-18 HORNET

DRAWN USING PRODESIGN 11



This picture of a fighter aircraft was produced on an ordinary Star matrix printer, using a new CAD package called ProDesign 11 which costs £249.

Judging a CAD package from its technical specifications is like judging a flower show over the phone: this is supposed to be 'the most advanced CAD package available for microcomputers,' and that's official, say the importers. Well. At any rate, the picture is worth looking at.

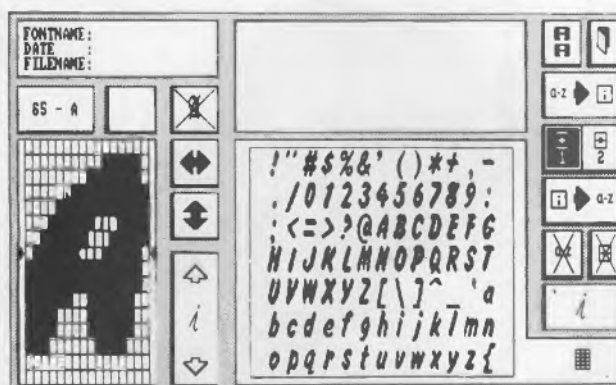
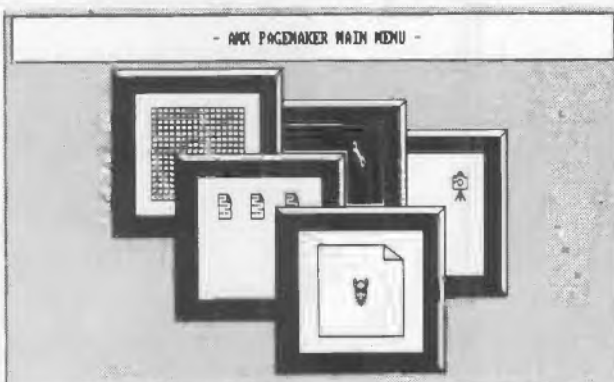
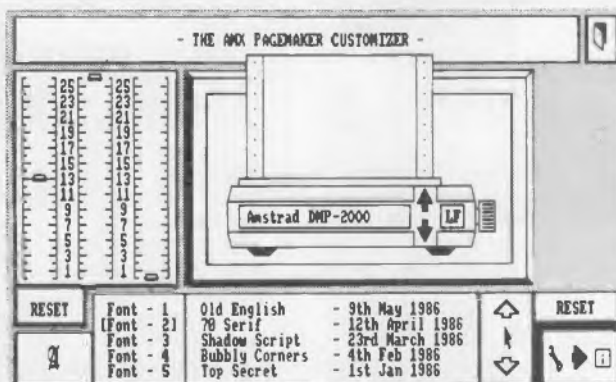
The product is one of many trying to steal some of the huge CAD market created by the much more pricey AutoCad package. For £75 extra, SK Microsystems, the importer, will supply a DXF Translator program which converts Autocad files to ProDesign 11 files, or vice versa. Details from SK on (0405) 079331.

DOS kills the shell! Which is, of course, exactly when you really need the shell.

I've spent a couple of weeks playing with DOS shells. What a mess! Every

time you do something you shouldn't (which is what beginners are doing all the time) the whole thing falls to pieces.

And it is, God help us all,



The AMX Pagemaker program, now available for all Amstrad machines (except PCWs) costs £50, and allows you to create text and graphics as one image, and print them out on a single A4 sheet of paper.

I'm a little unhappy about the name, since it somehow implies that it is similar to Aldus Pagemaker, which is a very much niftier piece of work, driving a laser printer and available on the Macintosh and (soon) the IBM with

Microsoft Windows.

AMX Pagemaker is a very much cheaper and grottier product. You might argue that the ratio of price to performance is very much in Advanced Memory Systems' favour, because Aldus' version is very expensive indeed.

But the sample shown here illustrates its shortcomings as well as it shows its abilities.

Details on (0925) 413501.



The Penman Plotter is remarkable. Not only has it survived the winning of several micro industry awards for Peripheral of the Year, and so on, it is now available in a version that doesn't even need a computer.

This one has a built-in modem. Phone up somebody with a Penman picture in their computer, plug the Penman into the phone, and it will run around on any piece of paper like a Logo Turtle, trailing three coloured pens behind it and drawing nice precision pictures. Details on (0903) 209081.

Microsoft's own programs which cause most of the misery. Microsoft, which wrote A Mess DOS, screws it up more often than anybody else.

Xitan's imported shell, Xtree, lets you look at the disk from a nice, logical viewpoint, and sort it out. It even lets you run programs on the disk: you just type the letter X, and it suddenly shows you that filename as if you'd typed it in yourself. Highlight FORMAT, for example, type X, and there it is, FORMAT, just waiting for you to hit RETURN. I did.

'Strike any key to format c:', said the machine.

I turned the power off. I try not to be a wimp but there are some experiments I'm just not brave enough to try: formatting all 10Mbytes of programs and data on my hard disk — which is what happens when you format c: — is something along those lines. And I admit that pressing Control-Alt-Delete might not be 'any key' and might have worked by restarting the computer; but I still wasn't going to try. Try it and tell me, if you like. If it formats your hard disk, I'll report the fact to other readers and you can feel virtuous. Me, I turned the power off. What can I tell you? That I lost two hours' worth of typing which I hadn't saved? Why should you care?

I found another Microsoft program buried in the Windows directory. It was

called something blatantly self-explanatory, like ST or PQ. I wonder what that does, I thought, and executed it.

It logged onto drive A and spun the disk for a bit, then told me that there was an error.

Abort, Retry, Ignore?

There certainly was an error — there was no disk in drive A. Why should there be? But until I put a disk (any disk) in drive A, the system wouldn't abort. It kept trying to read drive A and asking whether I wanted to abort.

Oh, and as soon as you get the Abort Retry Ignore message, the shell is dead. It's non re-entrant.

Look, I'm not a raw, ignorant beginner. I've been using MS-DOS for a couple of years. I even know how to delete a directory.

The latest DOS (PC-DOS) manual actually tells you how to do this. It has an index, which says Directory, remove. I suspect most beginners are still looking for Directory, delete, or Directory, erase, and feeling stupid.

The command is RD, or RMDIR, and if you know that, you can find it in most A Mess DOS manuals.

For example, in the Olivetti M24 MS-DOS User Guide, if you look under Commands, you will find DEL. There is no index, so I have no idea why you might look under DEL if you were a beginner.

Let us assume you did, because you enjoy reading manuals, and have got to

Chapter Six, page 34. The previous pages, naturally, you have memorised.

There, on page 34, you will be told the DEL pathname. Pathname, it says, is 'the specification of the file(s) to be deleted (excluding the drive to delete files in the default drive, excluding the directory path to delete file(s) in the current directory).'

Even I can tell that there's a simple proofreading error there. Whether the beginner would spot it, I wonder. The language is reminiscent of the worst of the DHSS claim forms, whereby the above-mentioned (hereinafter referred to as omitted) claimant (but not as in section 3.2.2, par 5.1) may (providing agreement is reached as laid down in the Act, section 6, see below) . . .

The thing goes on like this for two pages, recommending helpful tricks like 'alternatively, enter a path ending in a directory'. Of course, you understand this intuitively.

Finally, it adds:

'Remarks — to delete an actual directory (as opposed to all the files that a directory contains) you must use the RMDIR command.'

The manual has no index. That appears to be the only reference in the whole book to RMDIR. And it doesn't mention the fact that if you use RMDIR on a directory, it won't work! Firstly, you have to delete all the files in the directory.

Now, the manual for A Mess DOS is full of helpful

hints. You can, it keeps telling you, create a file by using the COPY command. Just type COPY CON FRED, end with control-Z, and you've created a file.

Well, yes, very useful it is, too. I do it all the time. And with this method, I have also created files and discovered they don't exist. No explanation, they just don't exist.

What has happened is simple: I've tried to COPY CON FRED when there already is a directory called FRED. You can't create a file called FRED when there's a directory called FRED.

Show me, in any A Mess DOS manual, where it says this. And then show me how I find the place. And finally, show me where the computer itself, the operating system, when running, tells me it doesn't work.

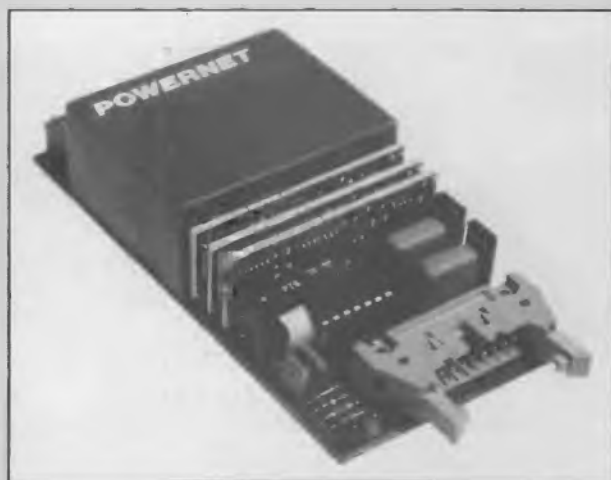
No, it doesn't tell me. On the contrary, it says it has worked. You copy CON FRED, and after your control-z nothing happens. Then you have the wit to type RETURN, and it bursts into life, and says '1 file(s) copied.'

Gosh, you think, I'm clever to type RETURN.

It lies. FRED the directory exists, but FRED the file is a figment of the disk controller's imagination. TYPE FRED and you'll be told 'File not found.'

My various copies of A Mess DOS have told me on occasion:

'Write protect error writing to device PRN'



Normally, the Powernet method of connecting computer to serial printer (through the mains) involves plugging in a separate Powernet unit. This little box is available to people building their own systems, making the interface part of the design.

Details from Radamec Electronics on (0344) 775115.

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"We want you to show how much our new £505 printer can produce in 60 seconds," said Epson. "Oh good," we thought, "a short-copy ad." Then they told us their EX800 could print 300 characters a second - and we were as happy as two ducks in a duvet factory. "Half a minute," I said, tapping out SOS messages on a calculator, "if you think we're writing all that, I'm a monkey's uncle." "Have a banana," they said. Hmph. Such sympathy. We were moved to tears. Anyway, here we are, faced with writing War and Peace Part One and completely on our own into the bargain. Well, not completely alone - after all, you're still reading, aren't you? Of course you are. You're not the sort of namby-pamby who's put off by a bit of eyestrain when there's half a chance of some decent writing, I can tell. You don't need any of those dreadful 'hi-tech' shots with lasers, grids and dry ice wafting all over the shop to grab your attention. The riff-raff might have cleared off already in search of those ads where big, busty women suggestively stroke some product or other under the headline 'Look at the big features on our new model', but have you? No, of course not. Nor are you impressed by any of those corny gimmicks that are just second-rate substitutes for the genuine interest that only the printed word can generate. After all, does 'Animal Farm' need a scratch 'n' sniff card to make it live? Would 'Lady Chatterley's Lover' be any more interesting as a pop-up book? (Well, come to think of it ...) No, you read to improve yourself, to learn about the world around you - and even if you don't manage either here, at least there's a chance that you'll learn a thing or two about computer printers. This is Epson's ad, after all, so I really should tell you about the big features on their new mod ... oops. What I mean is, the EX800 has a far greater list of specifications than any other printer in its price range (which is just as well for us, given the amount that we've got to write). As we said earlier, the EX800 costs only £505 (RRP exc. VAT) - which just so happens to remind me of an extremely amusing and interesting fact about money. Now you really are going to learn something about the world! This could even be your big chance to improve yourself. All you have to do is casually drop this into conversation at parties, and zap pow, instant success! It's far easier than learning how to play the piano, after all. (You must remember the ad I mean - 'They laughed when I sat down at the piano - someone had nicked the stool.' Yes, that one. What a load of old rubbish.) Anyway, where was I? Oh yes, this extremely amusing and interesting fact. Did you know - and not a lot of people do - that the unit of currency in Vietnam is the dong? It's true, it really is! Look it up if you don't believe me. And just think, but for a quirk of geography, it could have been the unit of currency here. Then even our innocent little nursery rhymes would have turned out completely different, e.g.: 'Said Simple Simon to the pieman, "Let me taste your wares!" / Said the pieman unto Simon, "Show me first your ..."' well, you get the idea. We'd better get back to the printer before the Advertising Standards Authority cottons on. The most important feature of the EX800 has to be its speed. It whizzes along at 50 c.p.s. in letter-quality mode, but can manage an astonishing 300 c.p.s. in Elite draft. To give you an idea of how quick that is, we'll count up what we've written and then let you know how long the EX800 would have taken to get this far. Meanwhile, name that tune. Rumpty tumpty tumpty tum, rumpty tumpty tara, rumpty tumpty tumpty tum, piddley piddley pom. No idea? Here's the rest. Rumpty tiddley, tumpty tiddley, rumpty tiddley tum. Rumpty tumpty tumpty tum, rumpty tiddley pom. Yep, it's the Archers. And at the third stroke, the EX800 would have been printing for twenty-seven seconds ... beep ... beep ... beep. Here, hold on a minute. That means we haven't even reached the bottom of the first page. Gordon Bennett, we're going to be here writing all night at this rate. Still, that's all the more reason to get on with it, I suppose. The new Epson EX800 is remarkably easy to use. The new Epson EX800 is remarkably easy to use. (Yes, that was deliberate repetition, as this is an important feature - and OK, it does use up a few more characters.) The thing is, when you want to change typesyles on an ordinary printer, you have to go through the whole rigmarole of making software commands. (Dragsville, Arizona.) The Epson EX800, on the other hand, has a 'Selectype' panel on the front. (Freaky City, Florida.) All you have to do to choose

a style from the wide - or to use a longer word, extensive - range of print options (N.B. there are two NLQ fonts) is push one or two of the eight backlit switches. Now that's what I call simple. It's certainly far simpler than, say, balancing a packet of frozen faggots on your head, hopping up and down on one leg, flapping your arms and shouting, "Yib hoy, snig floy, I am an inter-continental ballistic rissole," - and that's a dead cinch. In fact, I just did it right here in the office. There, I did it again! It's wild! Come on, you have a go. It'll give you a bit of a break - and if you're reading this on a train, it certainly ought to break the ice in your carriage. "But no, enough of all this frivolity," I hear you say. "Does this new EX800 have an integral push-feed tractor and short tear-off bar as standard, with the option of a cut sheet feeder also available?" Wow! What a question. Are you sure you're not in the computer printer business yourself? Hmm. You sound pretty clued-up to me. Anyway, the answer's yes. And before you start asking any more smarty-bottom questions, yes there is an optional colour unit available. For only an extra £55 (RRP exc. VAT), you, yes you, can print in seven, yes seven, glorious colours. Get your reports red! Give your accounts a purple patch!! Send blue suggestions to your business associates!!! Well, maybe not. Still, it's about time we had another character-count to see how far we've got. Any requests for music this time? Something grand and inspirational, perhaps, to lift our hearts and bear us on in triumph to the successful completion of our epic labour? Something that expresses fundamental optimism in the boundless potential of the human spirit? You've got it. Here we go, here we go, here we go. Here we go, here we go, here we go-o. Here we go, here we go, here we go. Here we go-o, here we go. All together now, verse two - here we go, here we ... oh all right, we'll spare you the rest. The news is, the Epson EX800 would have got here in forty-five seconds. Just fifteen seconds to go! (I was always red-hot at maths.) I'd better stick in a couple more product benefits before I finally run out of space. The Epson EX800 has a very large .. err .. umm .. thingy. I mean Whatsit. That is to say, a doodah. Oh very well, a large memory - an 8K buffer to be exact, with the option of an additional 32K also available. (The point of this is to free your computer for other tasks more quickly - but of course I'm forgetting again, you probably know that already.) The EX800 is IBM-compatible ... though why you aren't using an Epson computer I don't know. I mean, what's the point of us going on about how good Epsons are if people don't take a blind bit of notice?? Oh look, I'm sorry. Perhaps I wouldn't get so angry at having to mention a rival outfit if they had a name that took up a reasonable amount of space, but one that uses an abbreviation? That Is Truly Sickening. The final point to make is that the EX800 boasts the proverbial reliability of all Epson printers. Not that the word 'proverbial' means an awful lot, of course. Have you noticed how many proverbs actually contradict each other? There's 'Look before you leap' and 'He who hesitates is lost'. There's 'Many hands make light work' and 'Too many cooks spoil the broth'. Weird. It really is time some of these were brought up to date. How about 'Where there's a will, there's a lawyer'? Or 'A friend in need is a pest'? Yes, that's it. He who laughs last has no sense of humour, people who live in glass houses shouldn't take baths, a bird in the hand is better than one overhead, see a pin, pick it up - all day long you'll have a pin ... but I'm wandering again. What I should have said in the first place was that you can count the mistakes the EX800 makes on the fingers of one foot. But look, we're almost there. The coupon is looming up at last! And the great thing is, we've made it together. We've had our ups and downs, it's true, but you've stuck with us to the bitter end. Terrific. Can't you just feel that bond of comradeship, that deep empathy between us now? Of course you can. And now we've shared so much, we'd do anything for each other, I'm sure. For instance, if we asked you to fill in the coupon and send it to Epson, you'd do it for us, wouldn't you? What do you mean, no? To: Epson (U.K.) Limited, Dorland House, 388 High Road, Wembley, Middlesex HA9 6UH. (Telephone 01-902 8892) Please send me less information on your EX800 printer - quick.

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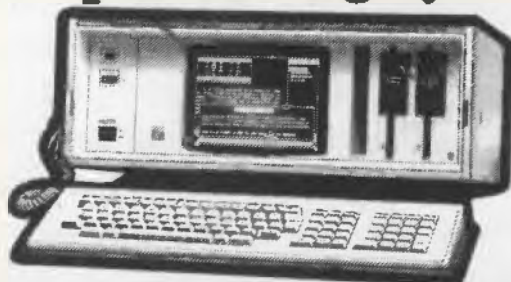
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In nightmares, people have suggested a magic computer keyboard to me, where it doesn't say 'qwerty', and so on, but every key has its own, computer-generated legend on it. At the touch of a bug, they all change.

This keyboard is that nightmare come to life. Every keycap has a little LCD embedded in it, and the computer can tell it what it should look like.

My own computers do such horrible things to ordinary keyboards that I dare not imagine what they'd do to these innocent liquid crystals. Anybody who buys one, let me know how long it is before your system reports a 'write-protect error' addressing the keyboard.

Details from Camdata (0487) 840503.

— on the printer. The printer is device PRN. And I've been faced with a completely dead computer at least once a week, with various machines and various versions of A Mess DOS, simply because the DOS has decided that drive A is an illegal drive, or write-protected, or full, or illegal interrupt, or just beep.

Sober, no-nonsense computer scientists are writing to newspapers these days, and saying: 'Even if Star Wars is only 95 per cent effective, it's worth going ahead with it.'

This is fantasy. The idea of Star Wars is to make nuclear war impossible. If the Enemy can't launch missiles, we don't have to have any ourselves, and disarmament can follow.

But, and forgive me if I'm being simple: surely if the Enemy can get five per cent of his missiles through, all Star Wars does is guarantee that the Enemy is going to build 20 times as many missiles . . . ?

You may say it's just a feeble attempt at humour to suggest that the main control computers are going to send a directive to the laser satellite, and the satellite is going to say 'File not found' — but I'm afraid it isn't funny.

There's a difference between the software for A Mess DOS and the stuff which will be written for Star

Wars. The difference is that A Mess DOS is very, very much more reliable than Star Wars software will be.

Just think: A Mess DOS is now up to version 3.2. It has been tested daily by users — millions of users — for over four years, and yet even today, it still doesn't do what the manual says it does.

How many test runs are we going to give Star Wars? Sorry? Oh, we're going to simulate it, are we? On what? Computers? What kind of computers?

I'm sure the answer is on the disk somewhere, if only I could remember what filename I gave it.

Apricot losses

Apricot has lost all its glorious machines, 180 of its staff, and £15m in the last financial year. The staff losses now are reaching embarrassing levels for a 'successful' computer company, and Apricot's pretensions to being a serious contender in world terms are now, I'm afraid, exposed for the absurd posturing they always were.

The company has launched an IBM-compatible, the Xen1, which is expensive. Apricot reckons it is 10 per cent below IBM's prices, all things considered.

The company has written off all the F series micros, and wrote off the Portable

last year. Now it is ending the bread-and-butter range, the Xi, and hopes to sell off most of its sticks by the end of September.

That market, Apricot says, 'has become a commodity market.' Instead, the company is going to go into business systems.

There's an American company, Altos, which has done pretty well in the space between the micro market and the mini market, selling 80286-chip machines with Xenix operating systems and multiple users.

Apricot obviously reckons this is a good idea. It has a multi-user Xen, which is 'faster than IBM's AT' and includes a few new facilities. It now has an IBM-sized 5¼in disk, instead of the 3½in disk which Apricot has always promoted as the way of the future, and which IBM has put on its lap-held portable, the Convertible.

Can Apricot really, and truly, suddenly become big, profitable and powerful by moving up-market?

Here's my own opinion: the immediate effect of the new machine is to render the old Xen obsolete. Theoretically, there is still a market for the old Apricot-compatible Xen, but only for a couple of months, as people stock up on their extra machines: 'I have four Apricot Xi machines and I need another one for the

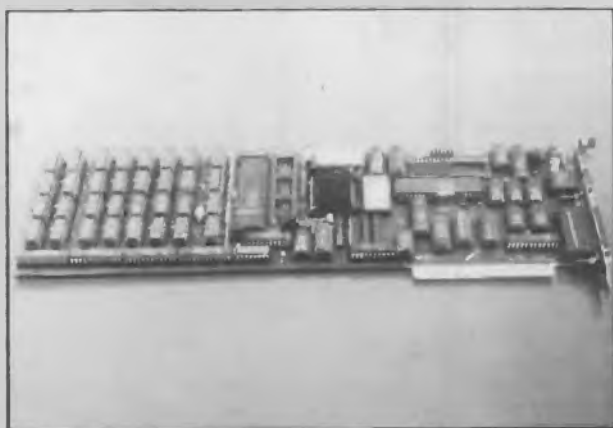
sales manager,' and so on.

At the moment, people wanting an AT machine can go to pretty reputable suppliers like Tandon, Kaypro, Zenith, Olivetti, and so on, and buy a very similar-sounding machine to the Apricot. Or they can go to less reputable-sounding organisations like Hoki-Koki Computers, Control-Alt-Deli, Can-Can Computers, and a similarly-named 'cheap and cheerful' group of suppliers of Far Eastern clones. These people charge less than half the price of the Apricot Xen. Some of them take themselves very seriously; others regard their business as a vast entertainment.

But who can honestly say that buying from Apricot, now, is a safer option? Prove it. 'Well, Guy, you ought to bear in mind that we still have £5.6 million in the bank,' said the managing director, Brian Androlia. 'It's not the end of the world, you know, we're still a stable company.'

I think that from having attempted to be number two to IBM, Apricot has decided to be number two to Altos. I don't rate its chances of hurting other people in that market, even though it's hoping to get a machine based on the super-powerful Intel 80386 chip.

For a start, Apricot has never really impressed me with its ability to build a



In the middle of this board you may be able to see a radiator fin. It is dissipating heat from an enormously powerful 32-bit microcomputer chip, the National Semiconductor 32032, and this megachip is offered by MicroCad as a go-faster device for IBM PC owners.

Microcad says it has sold one to scientists at St Mary's Hospital medical school, and it runs the scientific stuff 30 times faster than the standard 8086 processor.

It pretends to be a Unix-based supermicro, taking calculation tasks away from the PC and feeding the results back.

Full details of the DSI-32 from MicroCad on (0672) 810652.



It's just a memory board, yes, capable of holding 2Mbytes' worth of chips. It's supposed to be quite a bit faster than the Lotus/Intel standard for memory extension on the IBM PC/AT. And it has space on it for chips that give it two input and output ports — either two serial ports, or one serial, one parallel.

The JRAM AT3 is made by Tall Tree Systems (not Tallgrass, note) and is imported by RCS Computer Services on (90252) 333575.

better machine, given the same technology, as its rivals. On paper, yes. In practice, the Apricots have always been slower, and the company has always refused to acknowledge the problem.

Some analysts have predicted that there will be further cuts at Apricot before the end of the year. No information available to me suggests that they are wrong.

If it works, it could be useful

The problem with most communications packages is that it's very hard to suddenly stop them in mid-talk and dip into your word processor, or read disk directories, or whatever. A RAM-resident 'pop-up' package has been launched by Lattice to meet this requirement.

With products like Cross-Talk, of course, it's pretty easy to issue the command 'RUN' and get into a DOS shell. This looks as though you have a naked computer, and you can do DIR, and COPY, and even run other programs. But once you are running something else, you can't just pop back into Cross-Talk — you have to close down the second program, get back to DOS, and type EXIT.

Lattice is better known for its languages: its C compiler is the accepted standard in the micro industry.

Its comms program is something of an innovation, costs £119, and is called Side-Talk. I don't yet have details of UK distributors, but standard Lattice agents should be able to give details. In the US, Lattice is on (312) 858 7950.

Off the beaten path

As promised I have tried out Pathminder, the DOS shell from Westlake Data. I'm badly disappointed.

Firstly, it describes itself as being available in resident mode or virtual mode. Ignorantly, I thought 'resident' meant what everybody else means by resident: invokeable by a single keystroke, like Sidekick or Superkey or PC Outline... but no. It just means a program which loads and runs. It occupies over 100k. The virtual version loads only 4k and overlays other bits when needed, but it, too, is either running or not there.

What I want from a DOS shell is the ability to get into it when my current application lets me down. When I try to read a file under NewWord, and it happens to be in another directory, I need DOS to move the file. When the same thing happens under Crosstalk, I need DOS to find out what it's called.

The only DOS aid that can be invoked from within these programs is Spotlight. It's

copy-protected.

Back to Pathminder. It comes with an amazingly complex 'AUTOEXEC' file which loads it and sets directory paths, and which you have to alter to include your own requirements. When I did this, I kept getting 'Illegal drive in path' reports from the system.

When I finally got it to work, I found the thing very irritating: you can't just type in 'WS' to run WordStar. You have to type C for Compose, and then type WS.

That works — except first, you have to delete the previous DOS command and then type WS. If you get it wrong, you can't retry. No, you have to wait for six seconds while Pathminder reloads itself — rebuilds its helpful screen.

Imagine the following sequence of DOS commands:

CD print Invalid directory

*

CD /print

*

LX

Reading... (No typefaces specified)

Please type the LX command for your printer followed by the typefaces you wish to use. For example, if you wanted to use the Courier and Gothic typefaces:

Epson FX/JX/RX/LQ — LX/E

Courier Gothic

Epson MX — LX/M Courier

Gothic

IBM Graphics — LX/G

Courier Gothic

IBM ProPrinter — LX/P

Courier Gothic

Panasonic — LX Courier

Gothic
ComputerLand Star — LX
Courier Gothic
Okidata 92, 93, 84 — LX/G
Courier Gothic
Okidata 192, 193 — LX/P
Courier Gothic
Star Gemini/Delta — LX/S
Courier Gothic
Star Gemini/Delta X — LX/X
Courier Gothic
C Itoh "E" Series — LX/C
Courier Gothic

*
LS courier gothic
Bad Command or Filename

*
— and at every point where I've put an asterisk, imagine that you have to watch the machine say 'Strike any key to continue' and then spend six seconds reloading Pathminder, before you can type the next line. You'll go mad.

And you can't just run Pathminder by typing PM. Do that, and it tells you primly: 'You did not set the PMDIR environment variable. Please refer to Appendix B of the PathMinder user manual for an example of proper use of PMDIR.' Appendix B is 'Advanced User Installation Instructions'.

The idea of these DOS shells is (I thought) to make DOS easier. To use this one, you have to be a DOS expert. QED. Pathminder may have a full-screen editor, and Xtree may not, but I've got lots of editors, and Xtree just loads and works. If you've lost the manual, it still works.

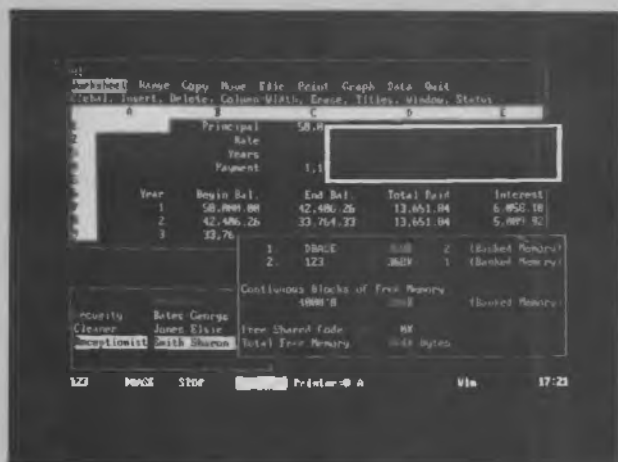
Probably, Pathminder has more features than Xtree. If you want those features, you'll have to work at them.



The EOgraph (see page 116, this issue) would be a pretty decent printer buffer at £600, even if all it did for the money was extract data at high speed from the computer, and then issue it carefully to the printer on its own. In fact, it also turns your printer into a plotter.

A printer which is a plotter can accept output from the very many programs that do CAD plots. This board can accept 'plots' which would cover multi-page spreads of computer fanfold, convert the image into matrix images and scan the paper methodically from the top down.

The plotter it emulates is the Houston Instruments DMP-29 or DMP-41. Details from Accent Computers on (0444) 412334.



In the year since Digital Research discovered that faults on the 80286 chip (the one in the IBM AT) had sabotaged its wonderful Concurrent DOS operating system, the world has changed again, and everybody is doing extended memory in a horrible, convoluted manner called EMS.

Concurrent DOS XM uses the full 16Mbytes of memory which the 80286 can address. Microsoft DOS only addresses 640k, with the option of EMS to feed data slowly in and out of the other 15Mbytes.

But today's Concurrent has to live with this new standard because an awful lot of people have installed it. So, it allows you to use 8Mbytes and supports Lotus Intel Microsoft EMS (extended memory system), too.

Complex? A nightmare? Yes. Worth it?

It's hard to say, until we have a chance to try it out for a few weeks and compare it with DOS. But the picture shows somebody running Lotus 1-2-3, dBaseIII and a system status monitor in concurrent, separate windows.

For me, neither program is satisfactory; I want a RAM-resident program. But in the meantime, I'll stick to Xtree.

Out of court

A very angry Barry Stearn, of Minerva, has complained bitterly that Gemini Marketing is 'harrassing' his company, by telling people that Gemini owns the copyright to Minerva's System Delta.

'A campaign was launched against Minerva in February,' says Stearn, 'when Gemini sent letters to members of the computer industry stating that they were taking legal action to prevent us trading.'

This legal action has not been initiated. According to Minerva, solicitors contacted Gemini and asked them to 'validate' their allegations. They were told that the lawsuit would be started 'immediately'.

As of June, no lawsuit had been started, but, according to Stearn, Gemini's allegations have continued.

'We don't know who has been receiving their libellous literature,' said Stearn, 'but they have yet again embarked on a serious

campaign, directed at private customers.'

Minerva describes its product as 'revolutionary', and says that 'unlike any dedicated database — including the products marketed by Gemini — it is a radical departure, being fully programmable.'

I don't expect a definitive settlement of this dispute (except, perhaps, in legal terms) because people's opinions of what is and what is not a 'similar' piece of software are always pretty subjective. But you can ask Minerva for the rest of the background on (0932) 37756.

Tip for the top

Ben Rosen, venerable American financial guru, has done wonders for his greying image by investing so much time and money peddling the Paradox database around the world. It seems, after all, that the database is succeeding.

Ben Rosen is a partner in a financial consultancy called Sevin Rosen, and his previous triumphs were the launch of Compaq (fastest ever into Fortune 500 lists) and Lotus (biggest software publisher in the world). 'Ah,

but that was years ago,' his detractors said.

So Ben found Ansa software, and showed all his contacts around the world what wonderful stuff it was, and now, he says, it is 'on its way to becoming the next major software company.'

Rosen's detractors in the US are a bitter lot. I've been told of companies who hoped to get mentioned in his newsletter (he's since sold it) and who claim that the interview included a request for founding shareholding. And certainly, when he ran the newsletter, he was always going to be vulnerable to that type of accusation — of favouring companies he owned with better newsletter coverage.

Now Ansa is turning over sums of \$1m per month and more, and Softset (a giant American distributor) has it in the top ten of software sales, in its 'Hot List'.

Talking loud, saying nothing

Expect to hear more from an unknown writer called Kim Tasso, currently employed in a publicity capacity by Honeywell.

Honeywell's success in the micro market is, to put it mildly, limited. It has now launched a range of IBM-compatible machines, just in time to watch the market disappear (if Apricot is right, and I think it is) into the 'commodity' sector.

Tasso describes Honeywell's strategy as 'further asserting its position in the microcomputer market.'

As an exercise in positive

thinking, creative phraseology and felicitous vocabulary selection, I haven't met its like for years. 'Further asserting its position'! How concise an expression of absolutely nothing, in a truly impressive manner!

Commodore UK

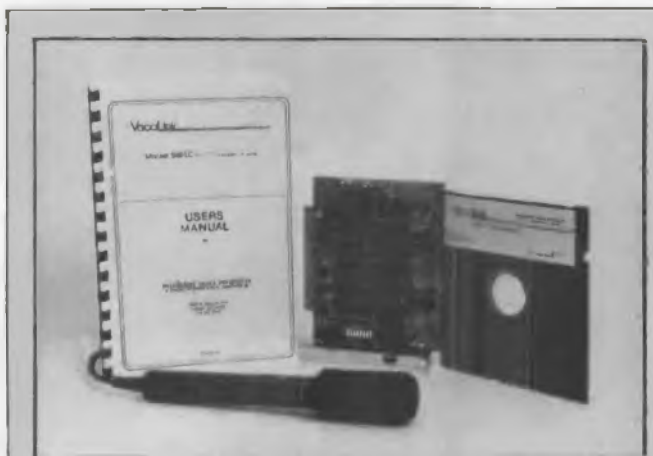
In all parts of the world except the UK, Commodore was shipping the new enhanced version of the 64 within two weeks of its launch at the Chicago Consumer Electronics Show, first week of June.

In the UK, Commodore abandoned its warehousing operations around that time, a few months after abandoning attempts to do computer assembly at the Corby site.

Who can pretend to be surprised at the decision to take the warehouse away from British management? Everywhere else in the world, Commodore had stock levels worked out to the point where customers weren't kept waiting for the new machine while the company got rid of the old one.

And who can pretend to be surprised that only 1000 Amigas were shipped out in the first month in the UK, despite the rave reviews and the long pent-up demand?

'It's a suitable follow-up,' said a recently departed senior Commodore executive, 'to the UK company's triumph in losing more dealers than Apricot, and launching the Amiga at something like 40 per cent above what international management recommended.' I share his opinion. **END**



For a mere £425, this little board, microphone and disk will teach your PC to understand speech. It allows the understanding of 500 commands, says Kode (the importer) and comes ready with appropriate commands for programs like WordStar and Lotus. Kode is on (0249) 813771.



Comdex raid

In a raid similar to a well-coordinated drug bust by the Miami Vice Squad, six investigators from the Federal Communications Commission swooped down onto the show floor of Spring Comdex and slapped labels on computer products that failed to meet federal radio frequency emissions requirements. Over 2500 products were tagged during the three days of the show.

The labels effectively bar the sale of uncertified equipment — not just the specific one with the label, but all others like it. FCC officials also provided manufacturers and resellers with information of FCC certification and labelling requirements.

The Comdex raid is just part of a continuing crackdown on firms which manufacture and sell products that are not certified. Last year, the FCC received about 1000 complaints about radio and TV interference which were traced to micros and related peripherals.

To date, most of the FCC's efforts have been aimed at computers sold by mail-order marketers, most of which don't meet the emissions requirements or carry the required sticker. In April, the FCC shut down the manufacturing operations of PC's Limited of Austin, Texas, a company which had accumulated fines of nearly \$10,000. The company claims it changed the design of some of its products and they are now all certified.

The stepped-up enforcement of the FCC isn't expected to have much effect on the market. Certification testing costs \$5000 to \$7000, some of which will probably be passed along to the consumer. However, there is

so much competition in the market for PC clones that prices probably won't go up by more than a few dollars.

Pricey Data General lap-held

The original Data General One lap-held boasted full IBM PC compatibility, a large screen and a price to match. Although sales were disappointing, the vendor introduced an upgraded version with an optional 10Mbyte internal hard disk drive and improved displays.

The original DG/One had a 24-line display that many customers claimed could barely be read. The new system, the DG/One Model 2, base-priced at \$1795, comes with an improved LCD display or, optionally, a 25-line electroluminescent display for an extra \$1000. Unfortunately, with the ECD display, the batteries require recharging after only two hours of use. The basic machine also has 256k of internal memory and a built-in 3½in floppy disk drive. The optional 10Mbyte hard disk adds \$1200 to the price.

Most serious users will probably want additional memory (640k), an electroluminescent display, a hard disk and a modem, which brings the price to over \$5000. While the machine is certainly more impressive than the Hewlett-Packard, the Zenith and the IBM lap-held, it seems to me that the price is about \$2000 too high for widespread market acceptance, and the company will have a hard time selling the Model 2 outside of its existing customer base.

Rise in desk-top publishing

Software companies are increasingly entering the burgeoning desk-top publishing market, which has been enhanced by the introduction of low-priced laser printers which work

with the IBM PC and compatibles.

Apple Computer is said to have got the field off the ground with its laser printer and Macintosh system which is more graphics-orientated than the IBM PC. Although Apple claims to 'own' the market, recent studies suggest that PC-compatible laser printers are selling at more than twice the rate of the Apple unit.

As a result, software companies are rushing into the market with products that work with the PC and one or more laser printers. For example, Bestinfo is developing a desk-top publishing program that will be marketed by Software Publishing Corp, maker of the highly-successful pfs line of software.

Also, Xerox Corp has stated that it will market a PC-compatible desk-top publishing system developed by Ventura Software. Micropro International, maker of the WordStar word processing software, is preparing a desk-top program that will work in conjunction with its other programs. And AB Dick, one of the earliest companies in the duplicating/printing industry, plans to market Imprint, a high-end interactive page composition system for the PC/AT.

Even makers of Macintosh software are racing to get on the PC bandwagon. Aldus Corp, maker of the best-selling Pagemaker page composition program, is developing a PC-based version. And Manhattan Graphics, maker of the ReadySetGo desk-top publishing system for the Mac, plans to bring out a PC version in early 1987.

The market is thought to be on the verge of enormous growth. Dataquest, a market research firm, projects that sales of Macintosh-based systems will increase from \$8.5 million in 1985 to \$53 million by 1990, whereas IBM PC desk-top systems are projected to increase from \$5.3 million in 1985 to a whopping \$600 million by 1990. Dataquest also estimates that nearly 50 firms will enter the market by the end of 1986.

Random bits

Apple Computer has terminated its long-standing relationship with Chiat Day Advertising and has switched its account to BBD&O, claiming that the new agency has a better strategic 'feel' for Apple's new direction...

Apple will begin beta-testing a new 'open architecture' Macintosh this summer... In addition to committing itself to developing MS-DOS capability on its new machines, Apple also plans to develop a Unix-based Macintosh system for the engineering community and government markets... A bill to protect electronic communication against wiretapping, bugging and unauthorised disclosure has passed a US House of Representatives subcommittee by a unanimous vote and is likely to become law by the end of the year... Illinois legislators have proposed an amendment to the state's software licence law that would allow software purchasers to copy or modify a program for non-commercial purposes, as well as transfer ownership of the program. If the amendment passes, it could spur the passage of similar federal legislation...

Adapso, the computer software and services industry association, has proposed to companies in the software industry that their programs should be warrantied to perform all the functions claimed on the package, in documentation and in advertising. The association proposed that users be allowed sufficient time to discover discrepancies, errors and bugs, and that, if notified, publishers should correct faulty programs or provide a refund... Fastest computers on a recent Benchmark test conducted by Arizona State University: the ARC 286 Turbo from American Research Corp, the ALR Dart from Advanced Logic Research, and the Hewlett-Packard Vectra. All three machines beat the PC/AT, the Tandy 3000, the Z-200 and the Epson Equity III.

END

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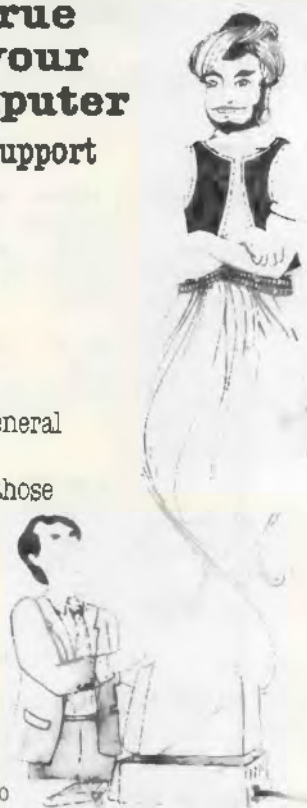
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LETTERS



Time to mature

I largely share Guy Kewney's disappointment regarding the recent decline of the West Coast Computer Faire ('Newsprint', PCW June) which, in years past, was an exciting opportunity to feel the 'pulse' of a young, truly innovative industry — not to mention, of course, the chance to enjoy some terrific parties.

On the other hand, the Faire's slow deterioration may, after all, be a sign of the changing times, a sign associated with the growing maturity of the personal computer industry. To preempt the computer enthusiast who is about to yell 'Sucks!', I know that the word 'maturity' sounds like 'disaster' in the ears of the early hobbyists, the incurable hackers of yesteryear, and those who still believe that a PC primarily belongs in education and in one's home. Southern Californians are already talking about 'computer sociology' and 'computer philosophy' — disciplines which, in true American fashion, debate rather endlessly such 'trends' in the 'evolution' of personal computing.

'Maturity', however, may not be all that bad. While it definitely spells out the end of the shopping rush of the early 80s (which has equipped many an attic with orphans of the Commodore or Apple or even the PCjr variety) and it heralds an era of 'compatibility', 'stability', and 'software conformity' (something that petrifies the true computer nuts), it also creates the conditions for some serious work towards solving the technical problems that seem to make life harder for both private and business users alike: modern standard

specifications, communications software, local area networks, and micro-to-mainframe links, to mention only those which come immediately to mind.

All in all, the personal computer industry, after a decade of frantic activity, seems to have finally settled and decided, or perhaps was forced, to get down to business. Those who decry 'compatibility' and 'stability' as messengers of doom of the 'fun' and 'satisfaction' involved in amateur home computing may have a point — but they also have to digest the fact that PCs are rapidly becoming vital tools in the place of work, a situation which in itself creates a vast majority of users who can happily, if boringly, live a lifetime with hardware-software products that are powerful enough to do the job, yet reliable and relatively simple to use.

Whether we like it or not, we're moving steadily in the direction of an environment where cost control, effective support and hardware compatibility will be the main determining factors. The message seems to be getting through even to successful innovators such as Apple. As I'm sure you've already heard, Apple's next big project is the creation of a 'bridge' with the PC/MS-DOS world, a 'communication link' that will certainly strengthen the Mac's somewhat sagging fortunes. As the Wonder Kids of yesterday grow older, they all seem to realise that 'meshing' with the rest of the world, and striking a balance between new technology and desk-top needs, are the all-important conditions behind company financial-statement health.

Have we, then, sacrificed forever all that which made our earlier computing days so exciting and memorable? I think this is hardly the case. That we may not have one more goofy machine introduced every other month in the years to come, and that we'll be busy creating, improving and

integrating computer systems instead of discarding orphans with all their paraphernalia, could in the end be a much more rewarding job combining 'fun' and 'satisfaction' with practical solutions for real-life problems.

AT Symeonides, Penicuik
You're right; and things will continue to be interesting, in both hardware and software, despite the imposition of an IBM standard. But there is, thankfully, still room for a maverick or two — and we all love an underdog.

Design faults

I hope Acorn paid the going rate for the four-page advertisement in the June issue of PCW under the heading 'Better by Design'. As this is highly unlikely, I feel that it must be taken as a standard PCW article, and as such I feel it is right that some of its content should be constructively criticised.

I can understand why Acorn should want the case of the Master Series to look like the Model B for 'philosophical compatibility', but I fail to see how even Acorn can justify many of the so-called 'design' judgements mentioned in the article.

I would, for example, be very interested to hear how Mr Taylor can justify his statement that the 8086 family of processors cannot handle interrupts quickly enough for Acorn to make a worthy successor to the model B using one of this range of processors. His justification could well cause many micro manufacturers to abandon their use of the 8088/ 8086/ 80186/ 80286/ 80386, as apparently we could have managed all the time with the 6502!

He also seems to be saying that the use of micros with more than 64k of RAM is unnecessary because Microsoft Basic can only offer 59k workspace! However, if you really want to use more than 59k, you can always run Bas128 on

the Master 128! The fact that most of the current range of business packages will not work in anything less than 256k — and many of them demand more — doesn't seem to bother Mr Taylor. Mind you, he then offers users the prospect of MS-DOS version 2(?) as long as you have an 80186 second processor. This appears to offer the enormous memory of 512k to the users. I have to inform Mr Taylor that a large part of the micro world is busy finding ways to overcome the 640k limit of PC-DOS on the IBM PC and clones, because everyone is demanding more than 640k in order to be able to run advanced operating systems (for example, MS-Windows and MS-Net), so forgive me if I fail to be impressed with his offer of 512k and MS-DOS version 2 on a micro that needs a second processor.

We then read of an amazing 'processor power' Benchmark which shows the Master Series to be the saviour of the microelectronic age — processor-to-memory bandwidth (PMB). With this subtle technique, Mr Taylor shows the Master Series to be superior to the Apple II, the Commodore 64/128 and the Spectrum (well, if it isn't, Acorn needn't bother!), and in its 'Professional' disguise, at least the equal of the RM Nimbus and the PC/AT, having written off the Apricot and the Apple Mac on the way. Once again, I have to inform Mr Taylor that the users out in the big wide world are not bothered about 'the width of the data bus (in bytes) divided by the bus cycle time (in microseconds)'.

They are more concerned about whether they have enough memory to run their application and how quickly that application can be run. They might also be interested in how easy the micro is to use, and might want to see an environment like MS-Windows. They may well want to share resources on a professional networking

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system such as MS-Net. Again, they will want to know how much memory is available for such environments. Processor — memory bandwidth is of no help in making these judgements, and sounds to me like a salesman who is trying very hard to find something good to say about his product.

There's more:

— Acorn enables the impossible to become reality — a 65C12 can run machine code written for 6502, and, if you rewrite applications to make use of the extended instruction set, they can be quicker. I wonder how many micro manufacturers didn't know that?

— The Model B and the Master 128 use an internal graphics resolution of 1280 x 1024 in eight colours.

However, this requires 640k of video RAM, which is probably why the maximum graphics resolution is actually 640 x 256 in monochrome.

— The Master Series uses phono connections for audio output. This can be fed into an external amplifier which can be very effective when using a music system. Is this really worth putting into an article about the design of a micro?

— Acorn is looking closely at 3½in disk drives! Why not carry on looking and let the world pass you by?

— The Acorn/BBC diskfile system is true random access, not just serial like AMS-DOS. Mr Taylor does pick his opponents carefully — try comparing DFS with MS-DOS! I am not saying MS-DOS is great, but it is used by 85 per cent of users of 16-bit machines. Even in the 8-bit world in which Master looks destined to stay, CP/M easily outperforms DFS.

— An Econet terminal available at a significantly reduced price of £399! Even more significant is that this was the price of the original BBC B which had many more facilities than the Econet terminal. Most other micro manufacturers are reducing their prices and increasing performance, not the other way around! This does prompt the question — where are the developments that allow for networking in the 16-bit world?

— The Master runs out of space! Basic cannot be made to check if it has a second processor available, as 'the

required number of pointers would occupy too much code space'. This is after Mr Taylor has tried to convince us that the Master 128 has more than enough memory — after all, it does have more than the Model B! Colin Watkins, Moseley, Birmingham

It is not worth saying, although we will, that PCW NEVER prints paid editorial. However, we felt that the BBC Master Series deserved a fair chance against the barrage of criticism it has received, and gave some space to an explanation of the thinking behind the machine. The debate will doubtless continue.

Defending Fortran

I was astonished by the remark by Simon Goodwin (in 'Computer Answers' in the March issue of PCW) that C is a much better language than Fortran for fast, reliable scientific programming. In their article in *Computing Surveys*, 14, 1 (1982), Feuer and Gehani defined eight criteria by which one could judge the suitability of a language for numerical computation. Using these criteria, we find that C fulfils three of them, but Fortran 77 six! The proposed new Fortran 8x will satisfy all eight criteria.

As far as 'fast' is concerned, it is well known that Fortran compilers generally generate efficient object code, and in my book *Fortran Optimization* (Academic Press, 1985) I try to show how programs can be written to take advantage of that fact. To the best of my knowledge, C compilers are not particularly efficient, and if by 'fast' the speed of writing code was meant, I do not consider C to be better in this respect either.

In the case of 'reliable', Fortran does have weaknesses, most of which will be corrected in Fortran 8x. In the meantime, it can be applied sensibly, as I demonstrate in *Effective Fortran 77* (Oxford University Press, 1985).

Language comparisons are always very subjective, and depend on many factors. When made, they deserve to be properly qualified, and not stated as throw-away and misleading remarks. Michael Metcalf, Geneva, Switzerland

Fortran's mathematical prowess has never been questioned, but when it comes to getting data in and out, accessing low-level machine functions and handling text, C beats it into the ground. And we all know the next version of anything will put everything to rights. Wasn't the new Fortran due in 1984?

Practice what we preach

For the last two months, I have been reading in PCW that the biggest problem with electronic mail systems for the common man is that they're totally confusing, complex and generally unusable to anyone who has something more useful to do than play for hours with baud rates, handshaking protocols, and so on.

Lo and behold, PCW sets up its own service (PCW Online), and all I need to do is to type in 171 lines of some coding program! If there is no error in your listing (a not unusual occurrence, as I'm sure you'll admit), then I'm sure to make an error myself, and then I'll have to mess around setting it all up for my machine and... I think I'll watch TV instead.

Perhaps in five years Online will have caught up with your articles, or maybe it won't?

RJ Wallace, Reading
We are all victims of technology; the way files are stored on Online means that downloadable programs must be run through a translator to get them onto the system and a de- translator to get them off. The program listing is for software downloading only — the text files are accessed through a non-confusing, non-complex, usable menu system.

Enigma — a counter-revolution

The major bottleneck in CJ Davis' splendid Enigma simulation program ('Enigma Variations', PCW May) is quite easily eliminated in Basic. The key point is that

the position of each rotor relative to its initial setting is uniquely determined by the 'increment-limit' variables N1, N2 and N3 respectively.

Provided they are constrained to the range 0-27, rather than 1-28, their values can be used as positive offsets in the forward pass and, after reflection, as negative offsets in the reverse pass. This renders superfluous the data-shunting routines (lines 1300-1490).

The reverse pass, comprising three sequential searches, is itself a minor bottleneck which can also be eliminated. This requires three new arrays to hold the reverse links, say, DIM L1(28), L2(28), L3(28), and these should be set up within the 'FIT ROTOR' routine, using the cross-link relationship $R_k(X) = Y \rightarrow L_k(Y) = X$.

Implementation of these changes is quite straightforward, and reduces encipher timings by a factor of five. This may still be too slow for any serious application, of course! Andrew M Simpson, Craigie, Perth

Unilab in education

I am writing to you about the article 'Reach for the sky' which appeared in PCW June. Although the article shows illustrations from our software and mentions Unilab briefly in the text, we have unfortunately been missed from the list of suppliers' addresses at the end.

We are producing whole satellite systems for schools for use with Uosat and with NOAA weather satellites. At present the equipment is on schools trials, an important aspect of our operation because we have to be sure that the equipment is suitable and appropriate for educational use. Suitable materials must also be developed to enable teachers who are not satellite experts to obtain full benefit from its facilities.

If you are interested in the items we are to produce I would be pleased to send you further information. David A Duff, research manager, Unilab, Clarendon Road, Blackburn BB1 9TA. Tel: (0254) 57643

Editorial tendencies

I am prompted by the 'Reader Survey' in the April issue of PCW to introduce myself as one of your readers. I know from my own experience editing a microcomputer publication that a letter is more interesting than a completed questionnaire.

I have been reading PCW since the first issue and rather enjoyed the 'look back' in the April issue, though it was a little self-indulgent in places. At one time I was a subscriber and now, having returned at the end of last year from a three-year stint in graduate school in the US, I purchase it on the newsstand. In the US I used to buy it in the Lane Avenue shopping centre in Columbus, Ohio, home of The MicroCenter (the largest computer shop anywhere, I think) and not far from CompuServe's Dublin Rd 'facility'.

My gut feeling about PCW is that it has this much in common with Byte: it is unsatisfying, often annoying and always worth a look. It suffers from trying to be all things to all users, whether they be schoolboys with Spectrums, teachers with BBCs or businessmen with PCs. The ads are the great common ground. Where PCW scores over other British magazines is in its reasonable regard for the intelligence of the average reader.

I do not think it would be possible or wise to turn PCW into the kind of magazine I would like, because it wouldn't sell. All the same, I'll make just a few off-the-cuff suggestions in case they should strike any chords.

I think the software reviews should be longer: it's one thing to read a review as news, another to read it as a prospective purchaser. Expand 'SubSet': introduce people to different chips and do tutorials on low-level stuff; the British have a much better appetite and aptitude for this than I ever saw in evidence in the US. Increase coverage of the US scene: Ahl's column just doesn't cut it. Increase coverage of telecommunications: unless the British consumer is educated to the point where he becomes a discriminating consumer of telecommunications services and equipment, the UK will

fall even further behind. Finally, cut out the dog-in-the-manger attitude to the US and all things American (I'm not American, but I find this attitude gratuitous and offensive).

The last point may surprise you, so I'll elaborate briefly. Firstly, let me say that it's a failing of the British media as a whole, and not just a quirk of PCW's. I don't have a stock of back issues to illustrate my point, but more than enough illustrative material readily comes to mind for me to feel that there is what the Labour Party calls a 'tendency' in the British technical press. A few more or less recent examples will suffice: (1) Not long ago, *New Scientist* referred to the budget of the Library of Congress as 'positively obscene'. A back-of-the-envelope calculation indicates that the British Library gets rather more on a per capita basis.

(2) *Computer Weekly* referred very snidely recently to 'typical American' attempts to 'buy culture' when reporting on Ross Perot's purchase of a copy of the Magna Carta for the University of Texas. No doubt the damned vulture never heard of the Elgin marbles or...

Now, picking up the two nearest magazines: (3) In *What Micro* (April) two programs, *Brainstorm* and *Thinktank*, are compared. The author writes: 'In contrast to *Brainstorm*, *Thinktank* is only a year old and was written in California. And it shows.' Earlier he claimed that *Brainstorm* was the first so-called 'ideas processor' to appear on the market. Hogwash! *Thinktank* was out years ago. As for the 'As it shows', I don't think much comment is necessary. Don't misunderstand me; fun at the expense of Californians (some of my best friends, and so on) is perfectly OK, but this is poor stuff. Incidentally, the best description of a mouse I've ever come across (in *Computerworld*) is 'the California interface'.

... and *Personal Computer World* (4) In the last PCW, Compaq is patronisingly called an 'undistinguished' company. This kind of pettiness is really unworthy. You and I know that Compaq is the most successful start-up company of any kind, ever — the UK could use a few equally undistinguished companies. What, one wonders is the right word,

for Apricot?

These are merely convenient examples, not necessarily the best. Perhaps, now that I have pointed out the 'tendency', you will also notice it. Paul O'Nolan, Aberdeenshire, Scotland
I was not aware of any such tendency: US products get their fair share, if not more, of PCW's coverage. Brainstorm was out before Thinktank, though...

Micro shock

At one point in the Toshiba 3100 Benchtest (PCW, June), it was stated that the hard disk in the micro could withstand a shock of 70G. This sounds a lot, but it might be interesting to work out exactly what this means.

The figure '70G' is an acceleration. If I let a stone fall to the ground, it accelerates at 1G, or about 9.8 metres per second per second on the earth's surface. Something like a Golf GTi can corner at about 0.7G; an average fighter pilot can pull about 8G in a jet before blacking out. So, a figure of 70G for the hard disk on a computer would suggest that such a disk would be almost indestructible. However, anyone who has accidentally nudged a hard disk will have noted that it isn't necessary to throw it around in a jet to make heads crash and data vanish.

Going back to A-level applied maths (it might be O-level — it was a while ago) to explain this apparent discrepancy turns up this very useful equation: $V^2 = U^2 + 2AS$ where V is the terminal velocity, U is the initial velocity, A is the acceleration, and S is the distance covered.

Imagine someone putting their micro down on a table after a hard day reviewing it.

The table is one metre high. They start putting the computer down, but due to the fatigue engendered by their arduous task, they accidentally drop it the last centimetre (0.01 metre). Although tables are hard, they are not infinitely hard. So, as a rough guide, let us say that when the micro hits the table, the table will give by some small amount: 0.1mm (0.0001 metre).

Using the equation: the initial speed was zero; the acceleration due to gravity is 9.8 metres per second per second; the distance is 1cm (0.01m) —
 $V^2 = 0^2 + 2 \times 9.8 \times 0.01$
 $V = 0.196 \text{ m/s}$
so $V = 0.443 \text{ metres per second}$.

In other words, at the point of impact, the computer is moving downwards 44.3 centimetres every second.

We can use exactly the same equation to work out what happens next. We have just worked out how fast the computer is moving downwards, and we have decided that, having hit the table, it will come to a stop in 0.1mm. This time, we know V, U and S and are interested in the acceleration, A. So,

$V^2 = U^2 + 2AS$
or,
 $A = (V^2 - U^2) / 2S$
 $A = (0^2 - 0.443^2) / (2 \times 0.0001)$
 $A = -980 \text{ metres per second per second}$ (that is, decelerating), or 100G, which is comfortably beyond the 70G limit on the hard disk.

In other words, it's not the swinging it round your head which does the damage, it's the putting it on the table afterwards.

Paul Hardy, Bingley, West Yorkshire

Thanks for the latest bulletin from the Bushlitt research team — we'll try to develop softer tables. Our offices don't have room to swing a computer, anyway. **END**





BANKS' STATEMENT

Information gap

In their haste to get computerised, companies often fail to appreciate the pitfalls involved. Martin Banks provides an anecdotal warning.

Once upon a time I had the occasion to telephone an individual working in a large corporation, whom I wanted to ask about silly things such as management information systems.

Now, you all know what they are, don't you? They are the things which make working life an absolute breeze. Just look at all the adverts for any computer or applications package that is aimed at anything remotely 'business'. It will be roughly along the lines of 'Buy this XYZ and all your management problems will disappear.'

As if by some miracle, said XYZ will bring forth everything you ever thought you ever might need to know, regardless of whether you need it or are even in a real management position in a company, and make your life wonderful. Everything becomes so easy, and so damned right, that you will win lots of bonus points and be off down to the golf club with the managing director discussing that special directorship and saffron-coloured BMW you've always wanted.

So, I rang this chap at the large corporation whom I had been told was a real whiz at management information systems. (He was, after all, a genuine user of such stuff and had been responsible for installing an extremely large one.)

'Go on,' says I, using my best interview technique, 'tell us all about it then — this management information system stuff.'

And he did, or more accurately he didn't. What he said was that he and his company had, like so many others, fallen into a most obvious trap; they had actually taken the advertisement at face value.

This meant that he had gone off and ordered a large and complex management information system, based around networked personal computers and large file servers, and stuff like that. Lots of fancy information management software was purchased and installed, and the redundancy notices for thousands of clerical workers were made out, ready for distribution.

Everything was, therefore, going

according to plan, or at least the outline of a plan as established by the advertisements. The systems were installed on managers' desks, the software was installed and run; everything was ready. Everybody worthy of the name 'manager' in the corporation got a machine and, by definition, access to all that lovely 'management information'. They all sat at their desks with fingers poised over RETURN keys waiting for the big off. Soon, they would be able to get any cut they wanted from all sorts of information about the corporation. As you can imagine, the excitement was intense.

The big moment came and the managers started hitting those keys. 'Given the average rise in car prices over the last three years,' keyed in one eager managing director, 'what growth rate is needed in our own gross margins to keep me in new Rolls Royces?' (It seemed a fair question, I suppose.)

Back came the answer, or to state things more correctly, back didn't come the answer.

It soon became clear what the problem was; the nature of the trap into which the large corporation had fallen. It had installed, as the adverts suggested, a management information system for the managers. What they had totally ignored, because no-one had stated it explicitly, was the other half of that double-barrelled name... information.

There was everyone doing extremely clever searches of a database in which there was no data, mainly because no-one had ever mentioned it should be there. Now — this might sound obvious, especially to anyone working in a company with a wealth of information already available, and in use — what this large corporation had ignored was the simple fact that implementing a computerised information system is like starting all over again, just like being a new-born babe.

The redundancy notices for the thousands of clerical staff were quietly put through the shredder. The smart new personal computer work-

stations were gently prised away from the clutches of the managers (well, you know how managers love their status symbols) and placed instead on the desks of the clerical staff. 'Generate', they were told in no uncertain terms, 'information.'

And so they did. Before any of the decision-making management could get their hands on the system designed specifically for them, they had to sit and wait for the company's clerical staff to load up all the information they were likely to need. All those invoices and purchase ledger details going back into the dim and distant past had to be provided — for example, not just entered but translated from an old presentation format into one decreed by the database management system.

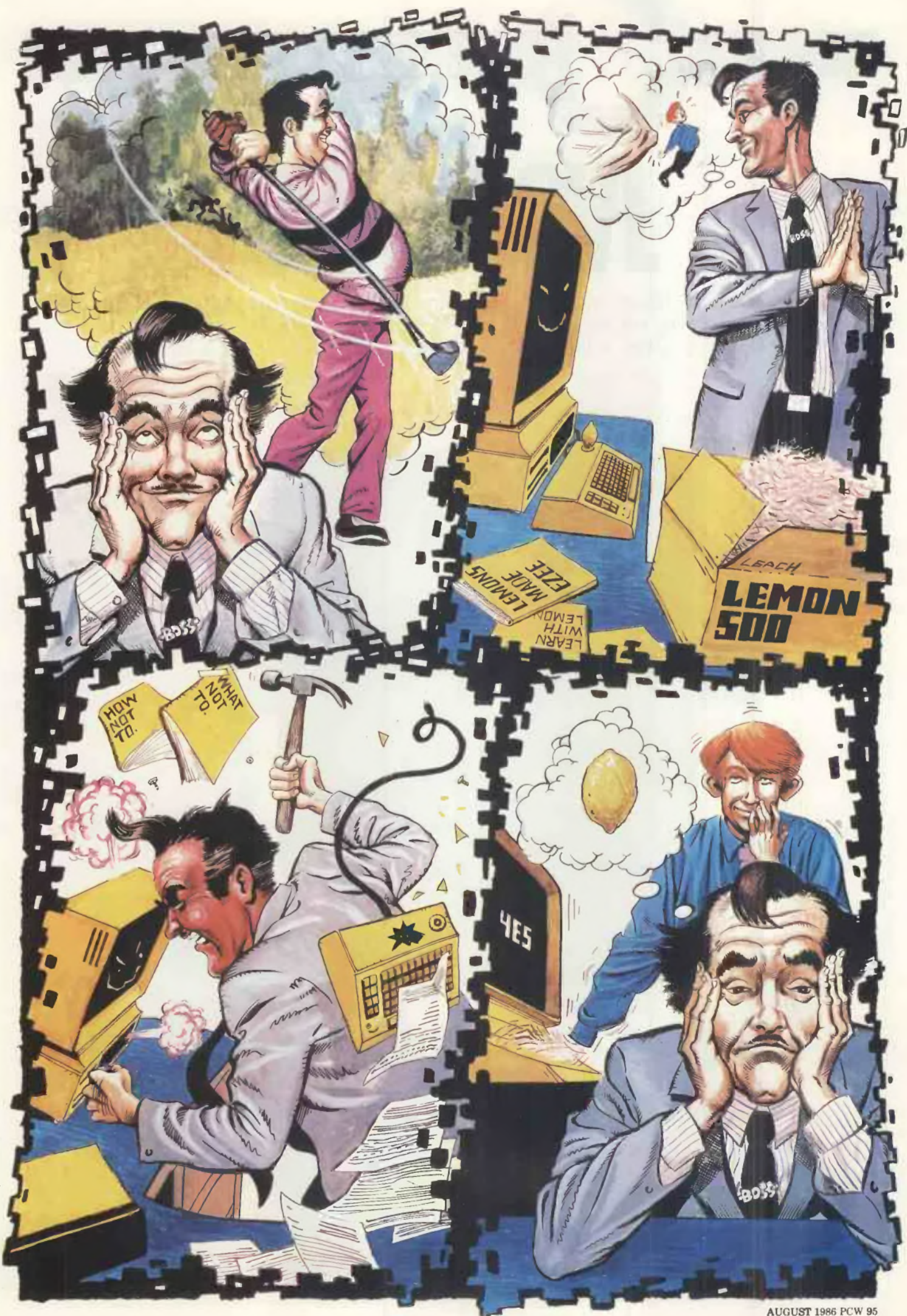
As far as I know, and I admit that I haven't gone back to ask, the clerks are still there, keying in the relevant data for the managers. If they are lucky, some of the low-level managers (the information filters for the top-flight whizzos) will by now have got their hands on the occasional workstation. As for the managing director's high-priority personal enquiry, however, that will have to wait a while yet, I suspect.

This might have been an interesting story about a large corporation that 'got it wrong', had it not been for a recent survey carried out by Cambridge University's engineering department.

This showed that the more a company uses computers in its operations, the higher the proportion of clerical staff is likely to be. Such companies also demonstrated the wonderfully egalitarian ideal of having fewer managers as well, compared to equivalent companies that were not-computerised. Not only that, but their decision-making processes were far less centralised, proving conclusively what we already know: the indians always know more about what's happening than the chiefs.

Lastly, these companies grew faster than the others, which just shows there is hope, despite what the advertisements state.

ENO



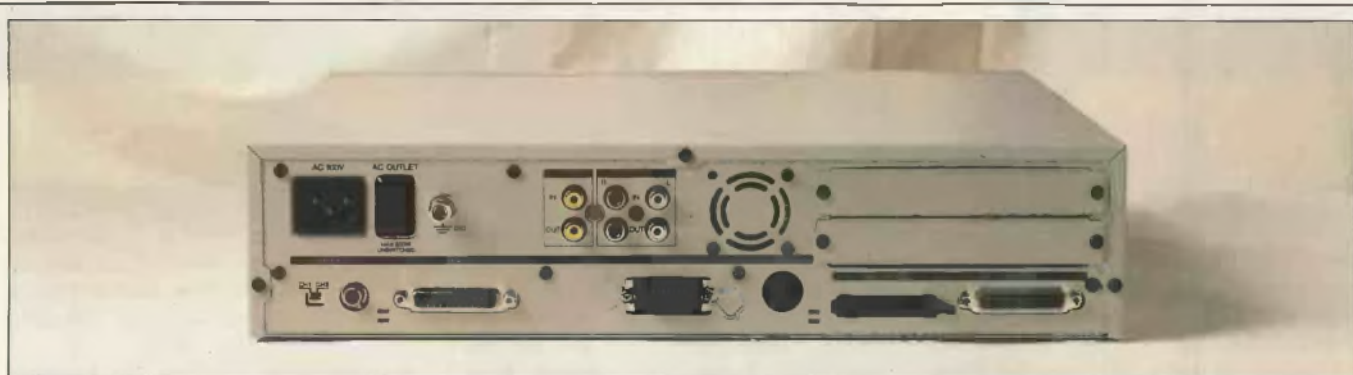


BENCHTEST

JVC HC-95

The JVC HC-95 is part of the second Japanese attempt to make a niche in the UK market-place for MSX. With its goal the interactive video market, will the HC-95 succeed? Nick Walker takes a look.





The back of the HC-95 closely resembles the back of a video recorder, and features a wide range of ports

MSX came, MSX saw the market potential, MSX totally failed to conquer — all within the space of a year. Another year later and a small, inconspicuous comeback seems to be happening, using MSX as a vehicle for more specialist (vertical) features. Last month I Benchtested the Spectravideo MSX machine (the X'press) which is being marketed on its ability to run CP/M business software. This month it's the turn of the JVC HC-95, an MSX2 machine which carries a sophisticated video interface.

When the original MSX machines were introduced, there was much speculation about the wonderful peripherals that were to follow. Given that the majority of manufacturers were associated with consumer electronics, it perhaps wasn't that surprising that one of the greatest areas of research was that of interactive video. By controlling a random access video device (such as a video disk player) with a computer, a number of exciting applications became possible. Simulations could become many times more realistic; expensive or dangerous industrial processes could be taught more easily; advertising could become interactive; and many other possibilities seemed likely.

Although MSX failed in the UK, it didn't fail in Japan — this market alone was large enough to justify continued research. Interactive video in this country has remained an expensive vertical market, and while I don't expect the JVC to make any

inroads into the home computer market, it may well be a threat to interactive video. The economies of scale which the home Japanese markets create could make such a system very competitive.

The advantage of targeting a machine at vertical markets is that it isn't important that the underlying hardware conforms to a recognised standard: as long as the hardware is capable of supporting the specific vertical applications, it doesn't really matter. The original MSX specification, while capable of the video control function, didn't have the graphical capability for digitisation. The main thrust of MSX2 seems to have been an effort to rectify this as well as stating a standard for optional video superimposition; that is, the ability to overlay a computer signal on a video signal. The JVC HC-95 conforms to the maximum graphics specification and can also handle video superimposition, as well as adding additional video and processing features. As such it's an interesting example of a new MSX2 interactive video design which may be marketed by other MSX manufacturers, if it's in any way successful.

Hardware

The earlier MSX machines were designed by manufacturers of hi-fis and TVs, in a style to match their hi-fis and TVs. The HC-95, however, has a far more purposeful and business-like appearance due to its two-box design and an office-grey finish.

Reviewing desk-top IBM PCs and their compatibles has given me a false sense of computer system proportions. The HC-95's main system box is about 15ins square, which makes it seem unusually small, and yet all systems would have been this size if the IBM PC hadn't frozen the progress of business machines five years ago. The case is mainly pressed aluminium with grey plastic at the front. The build quality is typically Japanese — well-made and logically laid out, but uninspiring in design. Although the aluminium is not of the strongest quality, it will comfortably support a small monitor.

The keyboard is extremely light, 100 per cent plastic and doesn't continue the business-like quality of the main unit. It's more like a keyboard from an original MSX home computer, which wouldn't be so bad if it wasn't that, disconnected from an MSX machine, the HC-95 keyboard is almost too light to use.

When you've found a place to hold it down firmly, the feel of the keyboard is not at all bad. There's no positive click to inform you that a key has been registered, but the hollow noise which occurs when a key reaches the end of its travel is reassuring enough. The overall feel is reminiscent of the Apple Macintosh keyboard, which is a compliment to JVC as the Mac's keyboard has been widely praised.

No change in keyboard layout is needed from MSX to MSX2, so the layout of the JVC will be familiar to



With a high regard for simplicity of design, JVC has positioned the frequently accessed ports at the front of the unit

BENCHTEST

many. Two shades of grey are used on the keyboard: all control keys are dark grey and the rest of the keys are light grey. The MSX keyboard layout comprises 73 keys, made up of a 16-key numeric keypad, five function keys, a four-key cursor cluster, and a main alpha section surrounded by the usual control keys. Both the Caps Lock and Graph keys have built-in, red LEDs which light up when they are selected.

It was only recently, when running WordStar on an MSX, that I fully began to appreciate the layout of MSX keyboards. When used with a word processor everything is in the right place, and no obscure function keys are accidentally hit. This is a problem that often plagues home computers which have grown up to become something more serious.

A wonderful simplicity has gone into the placing of the ports and switches on the JVC HC-95. All the ports which are accessed frequently are placed at the front, and all the ports which are accessed rarely are at the back. The sides are blank. A thick ridge running across the front of the unit houses two disk drives to the right and a single cartridge port hidden under a flap to the left. The drives are Sony 3½in, double-sided units and are capable of holding up to 720k of data. I can't find any specification of disk format anywhere within the MSX standard, which seems strange. However, I tried a single-sided, 360k disk from another MSX machine which seemed to work fine, so some standard is being adhered to. The disk drives seem to be the wrong way round, with drive B on the left, and drive A on the right, but this is probably because

the Japanese read from right to left.

Running along the bottom of the main system unit is a recess which houses all the other regularly-accessed features. From left to right these are: a reset switch; two joystick ports; a switch to change between 'Turbo' processing and normal processing (more on this later); three rotating knobs labelled Enhancer, Audio Mix and Tint; and an on/off switch with a red LED.

The three rotating knobs are the only things which are not self-explanatory, but their function becomes clear when you consider the machine's interactive video nature. Enhancer allows you to soften the harsh lines of a computer image when displayed over a straight video picture, or, at the other extreme, harden the signal from the video. Audio mix is a balance control when the system is connected to a stereo sound system; and Tint, as its name implies, tints the picture towards blue or green.

The back of the machine looks more like the back of a video recorder than a computer. Once again from left to right, the back of the machine contains the following: mains power-in; a mains power-out source capable of driving a monitor or video signal source; video-in and out mini-phono DIN sockets; audio-in and out for both left and right channels, once again mini-phono DIN; an RGB connector carrying both RGB-out and RGB-in signals on one socket; a non-standard parallel printer port; an MSX cassette port; the keyboard's 10-pin socket, and an RS-232C serial port. Also on this panel are two blanking plates where it's possible to install expansion cards.

The expansion cards are of JVC's own design, and are not an MSX standard. Apparently there are cards available for the HC-95, but a JVC spokesman was unable to find out what these were. Hopefully it will be possible to expand the main memory substantially, and so save the cartridge port for other uses.

A two-button mouse is supplied with the HC-95. I haven't yet become an expert at distinguishing a good mouse from a bad mouse, and my only valid observation so far is that a rubber ball inside the mouse is better than a metal one, despite needing regular cleaning. The JVC mouse has a rubber ball, and in the software I saw, the two buttons had consistent functions — the left being 'do' and the right being 'undo'. Mouse support is only available on MSX2 machines, as it requires an extra signal on joystick port one.

Getting inside the JVC is not in theory a difficult task; unscrew six Phillips screws and the lid should just lift off. However, there's a special lift and pull technique without which the lid remains firmly down. I didn't use this technique and went in search of further screws to remove. After removing about 30 screws I finally cracked it, but by this time the fan was loose, as were a number of ports and a large base plate. I must apologise to JVC for any rattles which I was unable to rectify.

Not that the HC-95 is very exciting internally, anyway. All that's visible is the top of the two (sealed) disk drive units, the power supply (also sealed) and the recess where the two expansion cards fit. Only (approximately) six square inches of the PCB are visible, but within those six inches there's a tiny bus carrying equally



The keyboard detracts from the HC-95's business-like design quality, and is not ideal for use on its own

tiny cards which are decidedly smaller than, and in no way connected with, the expansion card bus. On the review machine this mini-bus contained a RAM card and a disk controller card. It's possible to expand the RAM by adding two further RAM cards, but this will only give you an extra 128k. On the whole, you'll have to take JVC's word for the following description of the internal architecture.

Possibly the most interesting aspect of the HC-95's internal architecture is the fact that it's a two-processor machine. Remember the switch on the front panel marked 'Normal' at one end of its travel and 'Turbo' at the other? The function of this switch is to select between the usual MSX standard Z80A running at 3.5MHz and a custom JVC processor running at 6MHz. This faster JVC processor, called the HD64180, is Z80-compatible and hence MSX-compatible. The slower processor can be switched in if there are any compatibility problems from MSX software.

There is 80k of ROM on the HC-95, broken down into MSX 2 Basic in 48k, additional disk Basic commands in 16k, and a system ROM of 16k. RAM is divided into two logical blocks, main system RAM and video RAM. The original MSX specification stated a minimum of between 16k and 4Mbytes system RAM, and between 16k and 64k video RAM. With MSX2 the system RAM definition remains the same, but video RAM is now either 64k or 128k. As you might expect from a machine purporting to specialise in interactive video, the HC-95 has the full 128k of video RAM and 64k of system RAM; this enables the system to support all the new high-resolution graphics modes specified in MSX2. Interestingly, it's still the same graphics chip as used in the original MSX formula, only now it seems capable of supporting two further graphics modes in addition to the original six. Like MSX1, this chip also controls 32 hardware sprites.

MSX2 specifies a new memory mapping system. The old system broke all memory down into 16k chunks, which could then be pulled in and out of page three of the Z80's memory map. With the new system all four pages are available to swap as you require, giving more flexibility.

Accidentally pulling the base plate off the machine did have one advantage — I discovered that there are two PCBs within the HC-95. I can't confirm this, but it looks likely that one card is purely MSX and the second is purely additional video functions: one card looks more like the inside of my video recorder, and the other more like a computer. Anyway, it would be logical, wouldn't it?

There are effectively two tasks the video circuitry performs, known as frame-grabbing and digitisation. The function of the frame-grabbing software is to synchronise the computer with the timings of the video signal. Without this it would be impossible to capture an entire frame or picture, and the superimposition of computer graphics would be extremely difficult. The digitisation component turns the 'grabbed' frame into the pixels which make up the machine's memory-mapped graphics. As it does so, it has to determine the nearest approximation in terms of colour for every pixel in the picture.

There are two ways in which you can connect the system to a monitor/

'Possibly the most interesting aspect of the HC-95's internal architecture is the fact that it's a two-processor machine.'

TV and video source. Firstly, you can input the video source picture to the computer via the mini-phonon DIN sockets and then feed the output from the computer to the monitor via RF-out, RGB-out or video-out. The ideal set-up is to use a monitor which uses the Scart/Peritel socket; with this, you can pass the video source straight to the monitor using video-in and then pass it back out to the computer via the Scart socket. With interactive video applications it's also necessary to control the video source from the computer, typically via the MSX cartridge/expansion port.

A word of warning about Scart/Peritel, however. The original idea was to produce an international standard for the I/O of video signals, whether they be TV pictures, RGB signals or composite video signals. The idea is great, but sadly, somewhere along the line it seems to have suffered. I've had four monitors over the last six months which claim

to adhere to the standard, and yet all four have had differences. If you are the proud owner of a Scart/Peritel monitor, ask to see a lead working with your particular monitor to avoid disappointment.

System software

The disk operating system on disk-based MSX machines is, surprisingly enough, called MSX-DOS. MSX failed in the UK well before disk drive machines made their appearance, so consequently little has been written about MSX-DOS. This is a shame, as it's a very good home computer operating system.

Of all the home computer disk operating systems, MSX-DOS is the one most likely to be able to withstand the transition from home to semi-business. Micros such as the Atari 800, the BBC and especially the Commodore 64 have a cruder, 'grafted-on' feel to their disk operating systems, which is usually all right for home use but flounders under more intensive use. (To be honest, the Commodore 64's disk operating system is not even suitable for home use). MSX-DOS, however, was designed from the outset to be similar in operation to business operating systems such as MS-DOS and CP/M.

MSX-DOS's similarity to today's business operating systems is more than purely functional: in operation, MSX-DOS is practically identical.

This is perhaps not too surprising when you consider that the whole MSX concept is a product of the software house Microsoft, designer of MS-DOS.

There seems little point in writing an in-depth review of MSX-DOS; I refer readers to one of the many texts on CP/M or MS-DOS if they want this information. For those familiar with CP/M or MS-DOS, everything in MSX-DOS is as you would expect — commands are issued at the infamous 'A>' prompt, a file named AUTOEXEC.BAT will run when the machine is booted up, '*' and '?' are the wild-cards in file names, and so on.

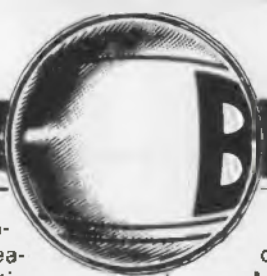
The most obvious improvement that MSX2 offers over MSX is the addition of two new graphics modes: Screen 7 offers 512 by 212 pixels in 16 colours; and Screen 8 offers 256 by 212 pixels in 256 colours. It is Screen 8 that is particularly suited to video digitisation, giving sufficient colours at sufficient resolution.

MSX Basic is a derivative of GW-Basic which itself is a derivative of Microsoft Basic, the nearest we have ever come to an industry standard for Basic. In addition to the usual features of Microsoft Basic, MSX Basic offers an extensive range of commands to get the most out of the MSX sound and graphics facilities. There is, however, little in the way of

Benchmarks

	Normal processor	Turbo processor
BM1	2.1	0.9
BM2	6.3	2.7
BM3	17.4	7.6
BM4	19.2	8.4
BM5	20.4	8.9
BM6	32.9	14.6
BM7	47.8	20.9
BM8	217.7	93.5

All timings in seconds. For a full listing of the Benchmark programs, see page 185, January 1985 issue



BENCHTEST

structured control constructs or any other features which help in writing good structured programs.

I'm sure that the majority of PCW readers have had some contact with Basic, so I'll concentrate on the specific features of MSX.

Most useful is the provision to run interrupt-driven Basic routines by means of the ON INTERVAL command. This defines time interrupts, generated by the display chip, at which subroutines are called. On the English PAL television system the minimum time interval is one-sixtieth of a second, so to run a subroutine every 10 seconds, you would issue the command ON INTERVAL=600 GOSUB 9000. This command would be given at the start of the program and would become enabled with the interval on command. At a later stage, if you want to disable the subroutine, you can issue the command INTERVAL.

A number of specialised interrupt-driven commands are also available in response to certain criteria: ON SPRITE lets you run a subroutine upon a sprite collision; ON ERROR when a program error occurs; and ON STOP when someone attempts to stop the program with the Stop key. The ON SPRITE command is particularly powerful since, without it, it would be impossible to monitor all

32 sprites while performing other functions.

Many graphics-specific commands are available, including the usual LINE, CIRCLE, PAINT and FILL commands and a number of sprite-driving commands. A graphics macro command language is available in an attempt to add some of the simplicity of Logo to graphical programming: for example, U20 draws a line 20 pixels long up the screen. There are similar commands for left, right and down. The instructions are then placed in a string which is an argument to the DRAW command, so DRAW "U0L20D20R20" would draw a square box of 20 pixels.

Overall MSX Basic is a pleasure to use, providing the programs you write don't get too lengthy. My only complaints are the pitiful 23k programming space, and the lack of additional commands to access the video interface.

Applications software

MSX applications software is a bit thin on the ground in the UK, but if you scout around you'll find a decent selection. Sadly, the only MSX machines which sold in any quantity in this country are all cassette-based, so any available software is on cassette.

There are two ways in which software may be incompatible with the

HC-95. Firstly, many software houses ignored the warnings about expanding MSX Basic into MSX Disk Basic and may consequently use areas of memory now in use by the disk drive. Secondly, JVC warns that there may be incompatibilities when using the faster HD64180 processor. I tried eight cassette-based MSX programs, one disk program and one cartridge program, and they worked perfectly in both Turbo and Normal mode. I did, however, have cause to switch from Turbo to Normal in order to slow down some arcade games and make them playable.

It isn't certain what, if any, applications programs will be bundled with the HC-95, but it seems likely that a paint-like program which interfaces to the video signal will be included. With this program it will be possible to grab a frame of any video source and use it as the current picture. Other than this, it's a fairly ordinary if comprehensive paint package which works in either Screen 7 or Screen 8.

Documentation

The only documentation supplied with the HC-95 was a flimsy manual of the paint program which unfortunately was written in Kanji (Japanese). Obviously, when the machine is available in the UK there will be an English version.

Prices

The machine I tested was a prototype of a machine which is now being sold in Japan. JVC thinks it likely that the machine will be sold in this country with a greater specification than the review machine, probably with more system RAM. No firm availability date or firm price is forthcoming from JVC at the time of writing. The machine as reviewed sells for 19800 Yen (approximately £800), but allowing for export cost, PAL television system conversion and the additional specification, it would seem likely the final price will be around £1100.

Conclusion

The MSX side of the JVC HC-95 is technically fine but suffers from the failure of MSX to establish any real market in the UK. Without its video components the machine would have to sell at around £350 to be viable.

However, to those who are involved, or who want to be involved, in interactive video, the picture is very different. Due to its frame-grabbing, digitisation and superimposition facilities, the HC-95 becomes a very real proposition at an attractive price.

END

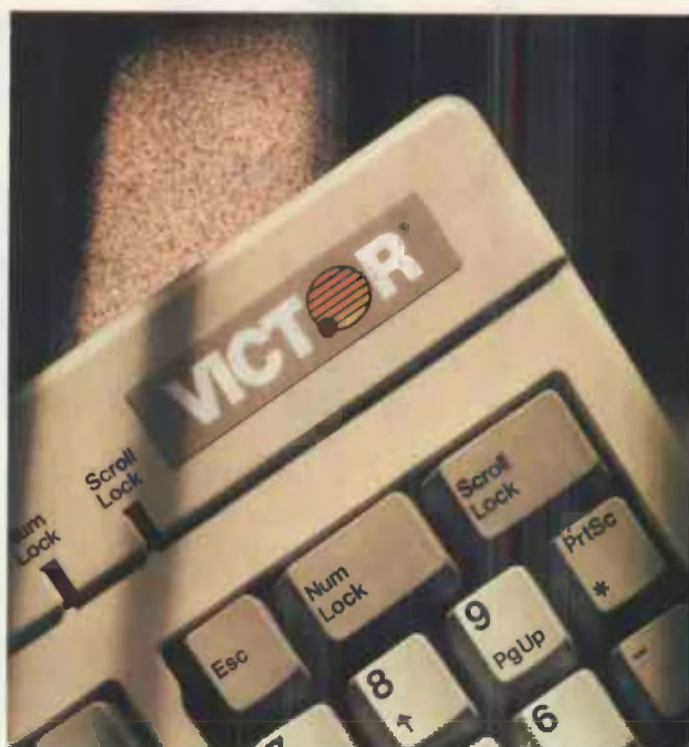
Technical specifications

CPU:	Z80A running at 3.5MHz; custom JVC HD64180 running at 6MHz
ROM:	86k; 48k Basic, 16k disk Basic and 16k system
RAM:	192k; 128k video RAM and 64k user RAM
Keyboard:	Detachable 73-key, full-stroke MSX standard
Size:	16ins x 15ins x 3ins (main system unit)
Weight:	14lbs
I/O:	Parallel printer port, MSX cartridge slot, cassette DIN socket, RS232C serial port, RF modulated-out, composite video-in and out; audio left and right, channels in and out, RGB in and out (combines in/out socket) two Atari-standard joystick ports
DOS:	MSX-DOS
Mass storage:	Two 3½in 720k floppy disk drives
Peripherals:	Unspecified expansion cards
Power:	240V A/C

In perspective

Interactive video in the UK remains a very specialised area, and what few machines there are which directly compete seem grossly overpriced (typically, over £3500). However, I must confess to being ignorant of this section of the market-place, so it could well be that these systems offer much more.

Back on my home territory, the close threat to the HC-95 from the mainstream computing market is the Commodore Amiga. This machine already has the video superimposition function (GenLock) and certainly has sufficient graphics power to digitise video images. However, you would have to purchase frame-grabber and digitisation software as an extra. This Amiga set-up would cost at least twice the price of the JVC, but it does offer considerably more computing power.



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BENCHTEST

Arc Jet Turbo

The Arc Jet Turbo is a made-in-Taiwan PC-compatible with AT/XT expansion, which, as well as being fast and reliable, is backed up by a strong international support network. Peter Jackson sees how it runs.



The American Research Corporation, you will not be surprised to learn, is based in the US. But the surprises come elsewhere; this US company is now selling in the US a range of PC-compatible machines made in Taiwan, finally assembled and checked in Croydon, and backed up here by a limited but free on-site maintenance scheme and local technical support. And the company sells its PC clones on their speed, rather than their price.

All this is strange in a market where the standard mode of operation is to ship in either kits of parts or entire machines from Taiwan or Korea, and sell as many as possible as cheaply as possible — preferably by mail order. This way the user gets a very cheap and more-or-less compatible, more-or-less legal IBM PC clone that may or may not be reliable and may or may not get any further support from the importer. The importer gets quick cashflow, higher margins thanks to low support and distribution costs, and no comeback from users. After all, who expects an engineer on 24-hour call-out when the entire system costs less than £1000?

The problem with this system is that the users do not know what they are getting; they only know that it's cheap, and that's the only feature that counts.

Arc's approach has been different. Its machines are not the cheapest clones around, but the company claims that they are fast, reliable, and backed up by a company which intends to stay around in the micro market.

Giving the customers confidence is the name of this game, since that could just be the factor which tilts them away from safe and stodgy IBM and into the clone camp.

Arc certainly thinks so. It has its headquarters in Alhambra, California, and has research and development operations there and in Taiwan and Japan. Its UK office in Croydon has been set up to monitor the European market for the future as well as to sell and support machines locally, and dealer recruitment is under way.

The machines already available are the Turbo PC — an IBM PC clone with an 8MHz 8088 rather than IBM's 4.77MHz chip for faster processing — and the Turbo 286, an AT clone with an 8MHz 80286 processor rather than IBM's basic 6MHz chip.

The new Jet Turbo, just appearing on the market, fits somewhere in-between these two. Arc claims that it is compatible with both the PC/XT and the AT, with a BIOS (ROM-based system software) that can look like both machines and give users a very, very fast PC clone and a fast AT clone in the same PC-sized box.

That sounded interesting enough for a closer look.



The Jet Turbo's combination of PC AT/XT features is evident



Expansion slots include a combined memory/input-output board

Hardware

There is beginning to be something awfully familiar about micro design. Like so many other systems the Jet Turbo is modelled on the IBM PC, although even here it shows a combination of XT and AT features. The Arc name badge, barrel lock, and disk and power-on indicator lights at the left-hand side are from the AT, while the fact that all four half-height disk slots — or both full-height disk slots — are accessible without removing the system cover is reminiscent of the XT.

The size of the case, though, is definitely XT-style. The Jet Turbo is roughly identical to that machine in width, depth and height, and feels smaller than the bulky sit-up-and-beg AT.

Arc, like other clone makers, has received a warning from IBM about any possible physical resemblance

between its products and the official IBM cases. It's possible that the Jet Turbo's combination-style design will shield Arc from any possible copy-right trouble.

The review machine was fitted with two floppy drives which looked rather odd, since the latch mechanisms were distinctively different on each drive. The oddness is explained by the fact that the top drive, drive A, is in fact a 1.2Mbyte high-density drive made by NEC, while the lower drive is a more conventional 360k drive from Mitsubishi.

Also fitted was a half-height 20Mbyte Winchester drive in the lower of the two spare drive slots, while the upper slot remained empty and was covered by a black plastic panel.

Removing the system unit cover — another awfully familiar task involving unscrewing five Phillips securing screws from identical positions to those on the IBM PC — reveals the

electronics of the Jet Turbo. A large 135W power supply, complete with fan, sits at the back behind the floppy drives and provides power outlets for four floppy or hard disk drives as well as for the motherboard.

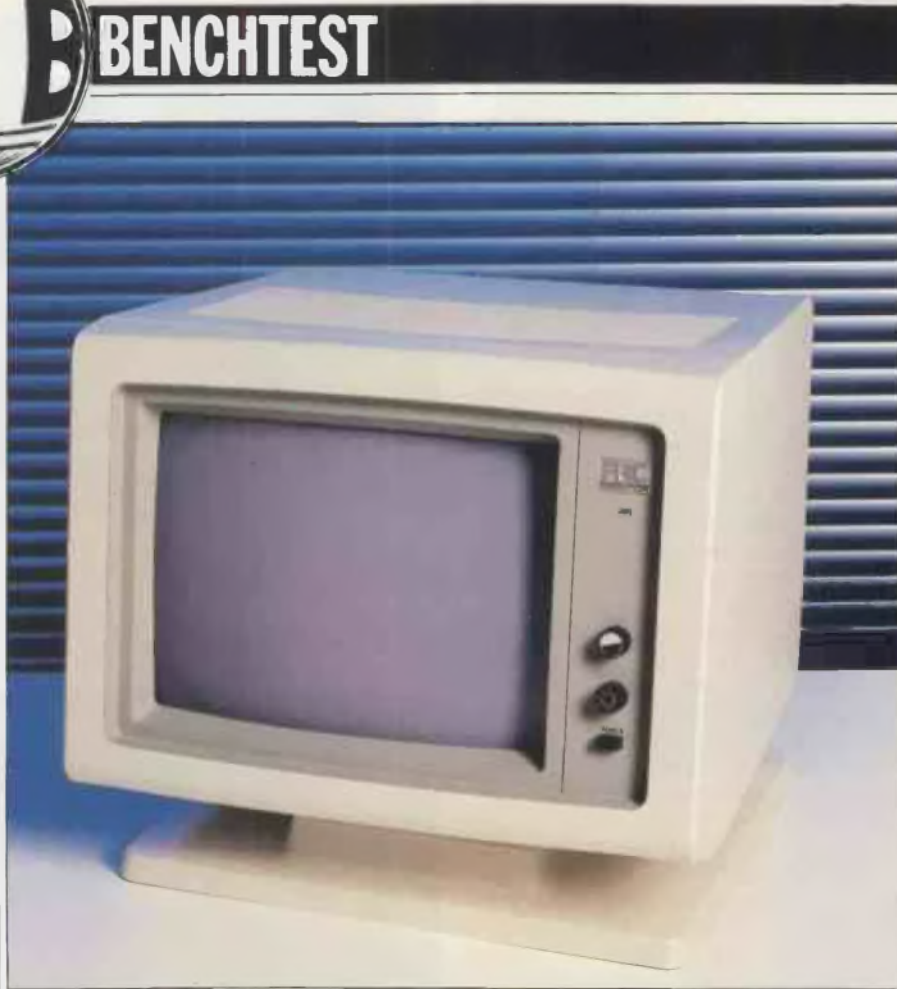
The motherboard sits at the bottom of the case, partly under the hard disk drive and butting up against the power supply box, and is smaller than the official IBM AT system board. This is partly because the smaller case dictated a smaller board, but also because Arc has decided to split the functions of the machine between the motherboard and various expansion boards.

In fact, the basic Jet Turbo system comes with three expansion boards already fitted, while the review machine had four. There is some disappointment in this, since there are just eight expansion slots on the motherboard and only half of them are available to the user if a hard disk is in use.

Of the eight slots, five are standard IBM PC sockets, while three have the extra AT expansion socket to handle the 16-bit data and expanded addressing of the heftier microprocessor that identifies the AT.

That microprocessor, an Intel iAPX 286 (or 80286) running at 8MHz rather than the 6MHz of the processor in the non-enhanced AT, is on the motherboard along with an empty socket for an 80287 maths co-processor, the IBM-compatible BIOS ROMs and a real-time clock/calendar.

As usual, the 80286 is packed in a square 68-pin package with connec-



The own-label monitor is designed to match the IBM mono/colour monitor

tions on all four sides, while the 80287 socket is a more conventional dual-in-line model.

The BIOS ROMs, containing the low-level software that makes IBM-compatibles compatible, are labelled 'Access Methods Incorporated' along with an Arc logo, but with no country of origin; it turns out that the BIOS

comes from the US rather than Taiwan.

The extreme-left expansion slot, furthest from the power supply, is a PC-type and holds a monitor/printer adaptor board. Next to that, in the first of the three AT-format slots, is a combined memory/input-output board; the memory has to go in a



The lightweight keyboard is 'spongy', with no positive tactile feedback

16-bit address slot (if it isn't on the motherboard) to support the extended addressing range of the 80286 processor.

Beyond that come the other two necessary boards to run the machine — the floppy disk controller and the hard disk controller, both in standard PC-format slots.

The display adaptor board gives straightforward monochrome character-based output along with Hercules-compatible monochrome graphics, and also has a parallel printer port built-in, while the memory/input-output board has one serial port and one parallel port alongside the banks of RAM chips.

The review machine came with 1Mbyte of RAM built up with 150ns 256-kbit chips, even though MS-DOS can only recognise 640k. We will see how the machine copes with the extra 384k later. As with the entire IBM PC range and many other clones, the RAM is arranged in banks of nine chips with the extra one in each row used for storing parity information. This is used at memory check time to detect glitches and bit drop-outs in the RAM area, and to identify the location of any fault.

Arc's plan for the Jet Turbo was to keep as much XT compatibility as it could within an AT architecture, and the use of so many expansion boards rather than building functions into the motherboard is part of that plan. The multifunction text/graphics/printer board in the Jet Turbo is identical to that in Arc's XT clone, as are the floppy disk controller and the hard disk controller, even though the former needs to be able to handle the high-density 1.2Mbyte floppy drives as well as 360k, and the latter needs to handle drives of higher capacity than the XT's standard 10Mbytes.

According to Arc, the idea is that users can upgrade from an XT to an AT simply by replacing the motherboard, plugging in the 16-bit address bus memory/input-output board, and putting all the existing XT boards back into their slots. All the peripherals such as hard disks, monitors, and floppy drives will then work happily with the AT motherboard, and if the XT is being used with the combined XT/AT keyboard described below, there's no need even to change that.

The keyboard for the Jet Turbo is something of an oddity. It is made in Taiwan, although there's no maker's name either on the keyboard itself or on the documentation that goes with it, and it has a strange, concave look to it rather than the familiar aeroplane-wing shape of the official IBM board and clones from Key Tronic, or from various other Taiwanese sources.

The keyboard supplied is compatible with both the IBM AT and the XT, which is worth pointing out since the

IBM AT cannot use the official PC keyboard, and vice versa. The usual LED indicators for Caps Lock, Num Lock and Scroll Lock are in the usual position; the Scroll Lock feature is for the AT only, as is the Sys Req interrupt key at the top-right of the numeric keypad.

According to the keyboard manual, the way the keyboard behaves — as an AT version or an XT version — is fixed by a software switch. But as with all Taiwanese keyboard manuals, there is rather too much on the electrical details of the keyswitch wire matrix and rather too little on how you might use things like that software switch. There is even an exploded diagram of the board, like something from the old *Eagle* comic, which will be of interest only to Airfix kit fans.

The manual also explains how the function keys are set up as a default, and it seems as though the board is only intended for Basic programmers since the functions cover things like LIST, RUN, TRON and TROFF. Of course, most software packages set their own function key arrangements.

The feel of the keyboard is miles away from the IBM clatter-click, and is rather soft and spongy with no positive tactile feedback. In fact, comparing it side-by-side with another Taiwanese IBM-compatible keyboard on a second clone showed that there's no real need for cheap — or shall we say 'low-priced' — keyboards to feel that way. The other board had a much more solid feel. The Arc's board is also very light, without the metal ballast that the official IBM board and my other clone board have.

Still, it didn't suffer from the problem that so many clone keyboards have; the function key templates supplied with various business packages actually fit over the keys as they are meant to. On most other clone keyboards, including my spare one, the function keys are set too close to the main qwerty key section, with no dividing ridge, for this to be possible.

Arc supplies own-label monitors for the entire range, and the review machine came with one of these. This one was built for Arc by Fortronics in Taiwan, and came with an amber phosphor although the same

model is also available in green. It's designed to match the standard IBM monochrome or colour monitor, with the distinctive rounded front bezel of those units, but was distinguished from them in this case by the inclusion of a tilt-and-swivel base that is available as an option.

The display on the monitor, thanks to the Hercules graphics built into the display adaptor card, is double the resolution of the normal IBM display. Although the monitor displays the usual 25 lines of 80 characters, each character is built up as a matrix of 14 dots by 9 rather than the usual 7 by 9. This gives the text display a nice, condensed look, and it's certainly more solid and readable than the rather blocky text on a normal PC or clone.

The high-resolution display adaptor also means that the Jet Turbo can display both text and graphics on the same screen, as the Compaq range of machines have always been able to do.

Arc calls the adaptor the LGA, for laser graphics adaptor — the idea of the name is that you can print-out text in high-resolution on an ordinary dot-matrix printer like the Epson LX80. It's not quite laser-print resolution, but Arc likes to think it gets a lot closer than ordinary matrix output. The printer port on the display board, designated LPT1, is meant to be used for this purpose.

In use, with the monitor perched on its tilt-and-swivel base on top of the system unit, there was some wavering in the text display. This was characteristic of power supply or other interference with the monitor display signals, but was not too obtrusive. I have seen much worse on other Taiwanese monitors on cheap clones, and have even used one where the entire text display was tilted at an angle to the monitor's case, and needed a pencil under one side of the monitor to bring the text lines level. A bit of wavering, although irritating, is not much of a problem compared with that.

Expansion As we have already seen, the number of boards necessary to get XT/AT compatibility means that only four slots are available for expansion, or five for a system without a hard disk. Of those, two are long AT slots and two are standard PC slots.

With the boards I tried in the system, there were some problems. Firstly, there was a slight drawback with AST's RAMPAGE AT. This is one of the various memory expansion boards designed to take the PC beyond the 640k RAM limit imposed by PC-DOS, and comes with up to 2Mbytes of extra RAM that can fill the PC's RAM space up to 640k and then go beyond, using paging techniques. The AT version of this comes with the extra connector for the lon-

Benchmarks

BM1	0.35
BM2	1.55
BM3	3.15
BM4	3.20
BM5	3.50
BM6	6.10
BM7	9.45
BM8	9.60
Average	4.61

All timings in seconds. For a full listing of the Benchmark programs, see page 185, January 1985 issue.

ger expansion slots of the AT, and it fits quite happily in one of the spare AT slots of the Jet Turbo.

However, AST has also taken advantage of the larger case size of the AT to make its board around half an inch higher than the RAMpage PC version, and with the RAMpage AT in the Jet Turbo the system unit lid will not go back on the base. Unless you want your desk to look like an electronic test bed, the RAMpage AT is out. Of course, the PC version would fit in one of the shorter slots, and the lid would then fit.

The other problem came with Symantec's short 256k RAM board, which is a handy and cheap plug-in-and-go memory expander for the PC. After installing this in one of the short slots, re-booting the system with a memory test showed a total RAM capacity of 256k even though there was in fact 1280k present. It seems that without RAM on the motherboard, the Jet Turbo searches along the expansion bus looking for a memory board — and when it found the Symantec, it thought that that was it.

Apart from that there were no problems with the boards I tried, including a hard disk board (see the review of these boards in *PCW*'s June issue).

System software

The only software Arc supplies with the Jet Turbo is MS-DOS version 3.1, which has only just been superseded by the new version 3.2 supporting the 3½in floppy drives of the IBM PC Convertible. Booting-up follows the usual PC pattern; turn on the monitor and then turn on the big red power switch in its standard position at the right-rear of the case.

As usual the system goes through a memory check and system diagnostic routine at first power-on, but the Arc test is unusual in two ways. Firstly, and most important, it lets the user bypass the memory test simply by pressing down and holding the Escape key at any time during the test. Anyone who has waited while an IBM PC loaded up with 640k of RAM checked the chips at power-on — let alone a PC filled up with another 2Mbytes on an Above Board or RAMpage — will send up prayers to the Arc hardware team.

Secondly, the boot routine tells you precisely how much RAM you have in your machine and exactly where it is in the system's memory map. That might not seem very important, but in these days of expanded and extended memory systems above the MS-DOS limit, it's vital to know where your memory is

and how much of it exists.

On the review system, the memory check showed up 640k — the software limit — as 'memory below 1Mbyte' and 384k as 'memory above 1Mbyte'. If you add up the actual physical RAM in the machine you get 1Mbyte, but as far as the system is concerned, you can only have 640k of usable RAM below the megabyte line in the memory map, and the rest is positioned above that line.

This is because of the way the 80286 processor chip addresses and accesses memory. When the chip is first powered-on or reset it enters what is called 'real mode', which is the mode that gives it compatibility with the 8088 in the IBM PC and also with the 8088's 16-bit-bus brother, the 8086. In this mode the 80286 acts just like an 8088, accessing a maximum 1Mbyte of RAM using segmented addressing. However, the 80286 outperforms the 8086 by a factor of up to six; with an 80286 running side-by-side at the same clock speed as an 8086, the newer chip should be two-and-a-half times as fast thanks to improved internal design.

However, the 80286 can be switched into what is called 'protected mode' by changing a single bit in one of its registers, and in that mode the chip can address 16Mbytes of RAM directly, with access to a total of 1Gbyte (gigabyte, 1024 megabytes) of virtual memory space. So far, this protected-mode memory can only be accessed on the AT under Xenix, Microsoft's multi-tasking, multi-user Unix-lookalike.

With MS-DOS, at least in its present incarnation, there is no truck with protected mode; hence the memory restraints which things like RAMpage are aimed to circumvent.

Hence also the importance of whether your RAM is above or below the megabyte line. Below it, the 80286 and MS-DOS can get at the contents directly; above it, and MS-DOS will never know it's there unless some extra software tells it.

Arc's attitude to the extra 384k above the megabyte line in the Jet Turbo is that, first of all, you don't have to have it. The base machine comes with just 512k of RAM, and although the chip sockets are there to double that, there is no reason to go beyond 640k if your software can't find it if you do. Secondly, the attitude is that it's for programmers to work out ways of accessing the extra memory. Indeed, MS-DOS 3.1 comes with a RAM-disk program called VDISK (sort for virtual disk) which can be used to access the extra 384k and turn it into a disk drive as far as MS-DOS is concerned — although

VDISK was not provided on the MS-DOS system disk shipped to me with the Jet Turbo. Then again, Arc believes that more and more software houses are adopting expanded or extended memory specifications, and that the extra RAM can easily be included in those. Lotus, in the new versions of 1-2-3 and Symphony, Ashton-Tate and Digital Research are among the big software names following one or other of the big-memory specs.

Another area where the extra RAM could come in handy is in networking, where it could be used for print spooling or for file caching on a central server.

The conclusion is that there's never too much memory in any system, and that just because the operating system can't recognise it is no reason to abstain.

Following the memory and system tests, the screen comes up with a message crediting Falcon with the hard disk RAM BIOS, and the software goes off searching for MS-DOS. Due to the mixed architecture of the Jet Turbo, the search is longer than usual since it has to check both the 1.2Mbyte and the 360k floppy drives just in case. With some applications it's necessary to boot the software from the master floppy, and this is always on a 360k disk. Checking both drives is a neat touch and could save time.

Eventually the Jet Turbo boots from its hard disk, reads the real-time clock-calendar for the date and time, gives you a chance to correct them, and then... well, you're in MS-DOS with all its strong points and all its faults, as rehearsed in *PCW* on many occasions (and stressed again in 'Newsprint' this issue).

There's no need to go into any more detail, since MS-DOS 3.1 is MS-DOS 3.1, and by any other name would smell as strong.

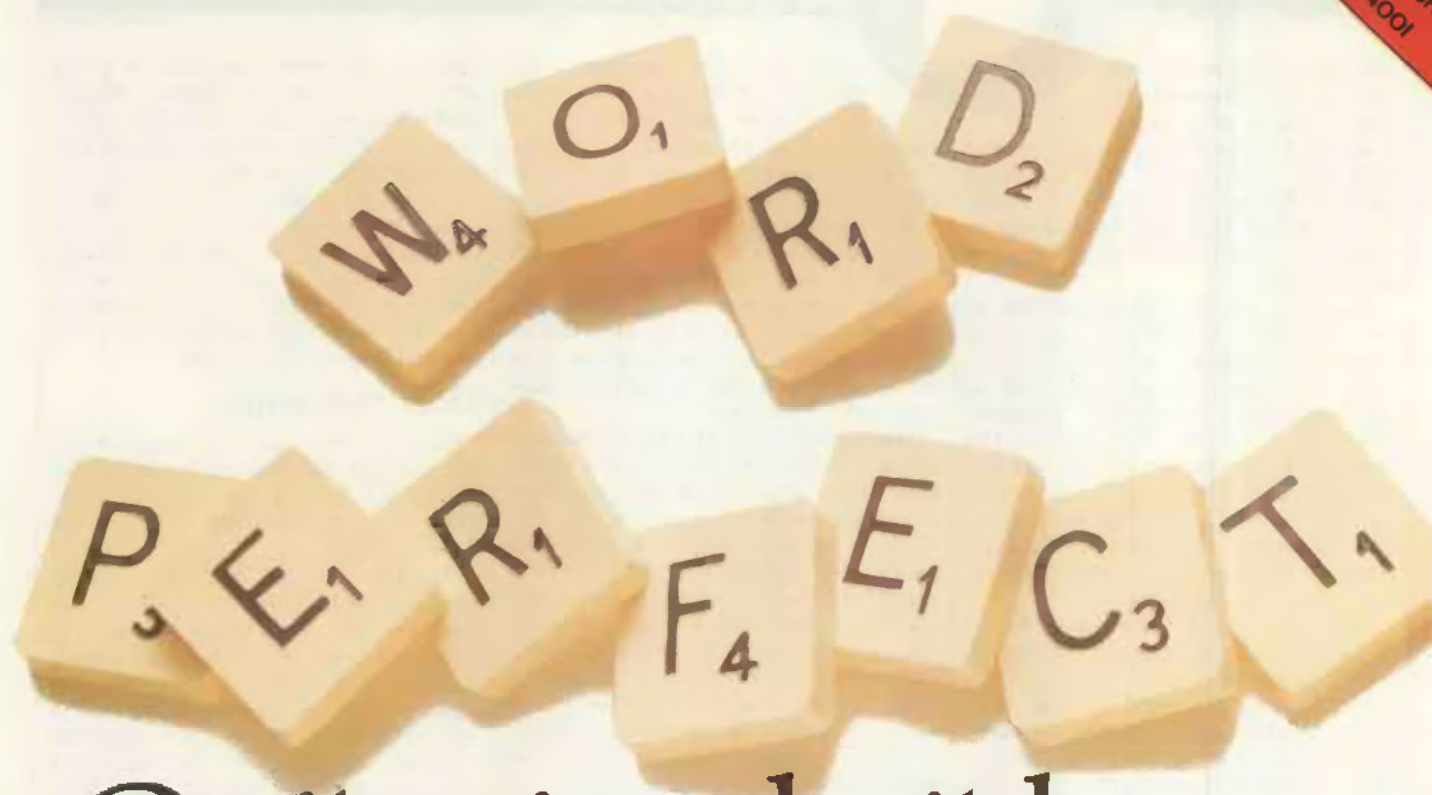
Applications software

With any IBM-compatible machine, there's always a strong temptation to scour the shelves for awkward and ill-behaved software in an attempt to uncover any incompatibility. This is, of course, easier with AT clones than with PC clones, since some PC software won't even run on the official AT, let alone a copy.

In particular, PC software which uses memory-specific commands like POKE, uses program loops for timing or tries various tricks with input and output, and the stack will not run on an AT.

Of the packages I tried, only a very few caused any trouble. The main one was an old version 1.0 of

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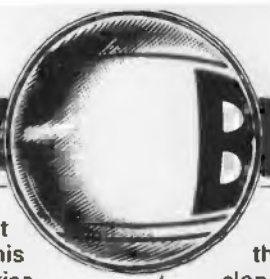
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BENCHTEST

pfs:File, which would not even load; however, this wasn't much of a surprise, since this version was on the official IBM list of software that wouldn't work at the launch of the AT in 1984. I'm sure that this has been fixed in Software Publishing's later versions of the database.

The only other trouble seemed to be with Borland's Turbo Lightning; 'seemed' because it was intermittent. With the memory-resident spelling checker and thesaurus installed, pressing a function key to use the thesaurus sometimes caused the entire keyboard to lock up, even including the ersatz Ctrl-Alt-Del system reset. However, the same company's Sidekick RAM-resident package worked fine on the Jet Turbo.

Other packages tested and found to work are Autodesk's Autocad, much used by Arc to demonstrate the Hercules graphics on the text-and-graphics monochrome screen; the entire Smart suite from Innovative Software, although the title screen looked a little odd thanks to some graphics driver software incompatibility; the Powerbase database, now distributed in the UK by mainframe house Namic; Microsoft's RBase 5000; and Word Perfect word processing from SSI Software. Naturally, the big-name packages like Lotus 1-2-3 and dBaseIII will

run on the machine, although I didn't try them. Any clone maker who launches a machine, AT or PC, which won't run these packages will not survive in the market for long.

As with any IBM-compatible machine, there's only so much checking that a reviewer can do among the thousands of business and other applications on the market. The only rule is buyer beware, and make sure you see a package running before you buy.

Performance The Jet Turbo's Benchmark timings are given in the table, and show that it's a fast machine along the lines of a souped-up AT. This is as you would expect, but gives no indication of how the machine actually works in a real application. Since I had a second clone handy, this one based on a 4.77MHz 8088 and as compatible as an XT copy can be, it was instructive to set up a selection of software on each machine's hard disk and run the same applications side by side.

Doing this was an interesting exercise, but the results are purely subjective and incapable of sensible reproduction. However, the Jet Turbo feels like a very sharp mover indeed, and not just thanks to the 8MHz clock and the fast architecture of the 80286. The hard disk seems very quick, although no official access

time figures were available at press time, and the screen display refresh and scroll were also noticeably faster than the Philips monitor attached to my spare PC clone. And although I'm not a fan of amber monitors — whatever happened to my favourite white-on-black? — the fast display rate combines with the double-resolution to make it much easier to use for extended periods than the normal flickery IBM model.

Documentation

I think the best word to describe the Jet Turbo's documentation would be 'slim'. But I think the best hyphenated word to describe it would be 'non-existent'.

To be fair to Arc, the review machine was only the second one into the UK, and came straight to me. However, the lack of a system manual was disturbing, and I am assured that Arc is putting that right. As mentioned earlier, the separate manuals shipped with the keyboard and the monitor are to the usual Taiwanese standard: that is, they are thorough where there's no need to be and vague where they shouldn't be, the whole thing couched in wonderful Taiwan English.

Prices

The base price for a Jet Turbo with 512k RAM, one 1.2Mbyte floppy, one 360k floppy and a monochrome text/graphics monitor is £1995. A 20Mbyte Winchester adds £800.

Conclusion

Arc prides itself on being an engineering company, and the overall feel of the Jet Turbo — with the exception of the flimsy keyboard — is solid. It combines the speed of an 8MHz AT with the physical size and some of the hardware and software features of an XT, and offers owners of Arc's earlier machine to upgrade with as little fresh outlay as possible.

As AT clones go, this is not the most compatible — the physical size limitation with boards like the RAM-page AT is enough to prove that. But as far as software goes it seems to be as compatible as the other AT copies are, and it certainly flies in use.

There are some neat and helpful touches in the way the system software is implemented, and Arc seems to know where to leave off and let the programmers get going.

With its local support, free 90-day on-site maintenance warranty, and ready availability of spare parts and expansion units, the Jet Turbo has a lot more going for it than most IBM-compatibles.

END

Technical specifications

Processor:	Intel 80286, 8MHz
ROM:	40k
RAM:	512k, expandable to 1Mbyte on standard expansion board provided
Mass storage:	Up to four floppy drives, 360k or 1.2Mbytes; up to two Winchester drives, 20Mbytes
Keyboard:	83-key, IBM XT/AT format
I/O:	Two Centronics parallel ports, one RS232 serial port; five XT expansion slots, three AT expansion slots
DOS:	MS-DOS 3.1

In perspective

With most AT-compatible micros, the manufacturer has gone the whole hog and followed IBM's lead slavishly. Unfortunately this has led to trouble since the AT and PC hardware, software and peripherals are not absolutely identical, and users have often had to buy new machines to get AT performance — or, of course, add an 80286 speed-up card.

The Jet Turbo is an attempt to get round the problem, not by plugging in a new add-on card, but by replacing the whole motherboard. In the Arc design the motherboard does not have much more on it than an add-on, in any case.

In that way, the user gets AT expansion slots as well as the 80286 performance boost, and can use existing casings, power supplies, disk drives and other expensive things.

The only other machine to attempt to bridge this gap is ITT's Xtra XP, which also has an 80286 but acts like an XT. And Arc, thanks to Taiwan, has a price advantage.

But the Jet Turbo is not selling on price, and Arc does not intend to be gone tomorrow. The company has enough confidence to set up a UK office with support, spares and maintenance facilities, and that's rare in the clone business once you get outside the big boys.



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Tandy 102

The 102 lap-held is the upgraded version of the Model 100 and, with its built-in modem facilities, is part of Tandy's attempt at more versatility among its range of micros. Menno Aartsen sees how well it travels.

I've been moaning about it ever since I acquired an American standard Model 100 lap-held: why didn't Tandy Corporation introduce the US version with a European CCITT modem, rather than the limited version we've had to satisfy ourselves with? Tandy's CEO John Roach has always insisted that the problem was with the approval, and that 'taking the modem out cost us as much as putting it in in the first place.' I've always felt that Tandy needed the quick cash in the first place, and that the US market had to pay for the return on R&D in the first place. Having insisted that a 100 with modem wouldn't be on the cards, and the

new 200 being somewhat of a compromise machine, what was to be next?

Background

The answer is now in the shops on the Continent, and will be in the UK towards the latter part of the year — the second version of the 100, appropriately called the Tandy 102. Tandy has now dropped the 'Radio Shack' and 'TRS-80' bits, and seems set to spin off its Tandy division as completely computer-orientated, having introduced quite a substantial range of new machines over the past year: the 1000, the 2000, the 3000 and the 200, and now the 102. Run-

ning everything under the sun from NOS (No Operating System) to Xenix, Tandy's equipment is having a pretty decent attempt at being one of the most versatile micro ranges on the market, with good IBM compatibility combined with specialist applications (most of which are only available in the US).

Hardware

Tandy has taken the opportunity to redesign the 100 box, which is now slimmer and slightly more slanted towards the user, which makes for easier reading of the 40-character by 8-line display, and has also improved the operating system, which is faster — especially handy when you're scrolling through long text files or using the editor in Basic. The Basic interpreter remains the same and the Benchmarks are unchanged from PCW's earlier review of the Model 100. Another improvement is the addition of a system bus on the back of the machine — the expansion port in the bottom of the casing was never easily accessible and didn't allow for easy interchanging of peripherals such as the Video-Disk interface, a problem that has now been solved.

The original design of the 100 had a number of very strong features, now emulated on the European 102: telephone line seize-and-dial facilities, and autodial/autolog-on for the built-in modem, which can, with two telephone handset clamp-on shells, also be used as an acoustic coupler. This is a necessity for a portable, since the user must be able to use the modem facilities on payphones and in hotel rooms, where the telephones have often been hardwired to prevent theft.

On your desk, parked next to the inevitable PC, the 102 will connect to the telephone socket and telephone, and is ideal for use as a 'look up and dial' telephone directory.

The 102 has virtually the same



dimensions as the 100: it's slightly lower, especially at the front; the keys are raised slightly more; and it is, surprisingly, even lighter than the 100. On the left-hand side we find the control switches for the modem (ANS/ORIG and DIR(ect)/AC(oustic)), while the right-hand side has a switch for ON-OFF and a thumb-wheel for the LCD polarisation next to the 6VDC power socket — nothing new there. The back now proffers an array of sockets: phone, cassette, printer, system bus and RS232C. Still in the bottom of the casing: two expansion ports, one of which takes ROMs such as Tandy's plug-in Multi-plan.

Tandy has had to admit that not as many 100s were sold around Europe as it would have liked. The price war with NEC and Olivetti, both selling a similar machine (all manufactured by Kyocera of Japan), added to the fact that the NEC lap-held came with a substantially larger RAM (which could be expanded, to boot), effectively made the 100 'third choice'. Tandy always had one advantage it never chose to exercise — the modem option. The agreement with Kyocera stipulates that only Tandy has the right to sell the modem version, although this agreement was primarily aimed at the US market where neither Olivetti nor NEC are at home. Interestingly, John Roach last year mentioned to me that he 'doesn't know how the competition will react to a European modem version,' a remark which might indicate that NEC and/or Olivetti may introduce a US version with a built-in modem as a response to the new European 102.

On the other hand, Tandy will have amortised the development cost of the 100/200 series, and can now afford to begin to enhance.

Portables for travel

I have often advocated the use of 'simple' portables for field work, as opposed to the more complicated machines with desk-top emulating software such as Epson's PX-8, and 'heavier' examples such as the Data General One and the IBM Convertible. The absence of a sophisticated operating system and convoluted software means that 100-like machines are difficult to crash (what-ever Guy Kewney says — we all mis-read our manuals at times ...) and easy to use. The concept of having a lap-held to travel with, used in combination with a PC or a modem back at the office (or home) and an electronic mailbox to communicate with staff or colleagues, gives the user the best of both worlds, with complete flexibility and sophistication at the same time. The 102 is here, and high time, too. With customised software the machine will prove a boon to sales reps and other travellers, who



The slimmer, lighter Tandy 102 — an attractive travelling companion

will now be able to call into the company mainframe to down- and upload the day's data without having to wrestle with a separate acoustic coupler. As there's a portable disk drive for the 100/200 series, temporary data storage is less of a problem than it used to be, but I should emphasise that any serious use of the 102 does require the full RAM complement of 32k (29638 bytes for data and/or software). Real fanatics can add a portable printer — my own 'travel kit' consists of a 100, a disk unit, Apricot Writer 08 and a box of diskettes, thus yielding 1.2 communicating megabytes, and fits in an ordinary briefcase with room left over for papers and other things.

Software

The 102 retains the same fairly crummy Basic that the 100 came with. It's a standard Microsoft interpreter lacking almost all the niceties from RE-NUM onwards, although the manual now offers a routine for this. Basic does address the built-in modem and is thus capable of automated mail system access and pull-down, but any sophistication is beyond it. This may be due to the limited memory, but allowing the choice would have been nice, considering Tandy was updating the operating system and ROMs anyway.

The 102 offers a number of file transfer possibilities which are not, or hardly, explained in the manual. I'd like to dwell on them for a moment, since they allow the transfer of embedded 8-bit codes that the Terminal program won't handle. From any text file, the SAVE option can be used both with printer and communications parameters as follows: press function key F3 for the SAVE TO: command, and then type LPT: for printer output, or COM:(setting) for modem or RS232C output.

Care has to be taken that files to be transmitted do contain carriage returns or that the receiving peripheral wraps for the 102: a width setting as in [SHIFT]PRINT or TERM isn't available, but printer and screen control codes are passed through unhindered, even on 7-bit settings. Equally, the LOAD function will accept input from remote sources — often this method is considerably

faster than using the TERM program. End-of-file characters are read in this way, so the 102 and CP/M or MS-DOS-based systems do now understand each other, after a fashion. The 102 as a terminal adheres to the DEC VT-52 protocol, and a nice new feature is that it can identify itself: send it an [ESC]I and it will answer with 'ERSM102'.

Unfortunately, the operating system for the portable disk drive is still not accessible from applications programs, unlike that of the video disk interface. London-based Zeotek does offer another operating system, but this is ASCII-based and therefore unmercifully slow. Microflopies written to by the Zeodisk DOS can only accept text files, but the routine can be used from Basic or embedded in other utilities such as the portable Scripsit word processor. Tandy's own DOS will not write from modem or RS232 to disk and vice versa, but then that would let you store files longer than the RAM can handle without any way of breaking them up, so perhaps it's just as well. The video disk interface will allow this, and so enables you to write files from disk to disk or from modem and back — this can be useful for file transfer applications, which can be very easily implemented on this cheap-and-cheerful Basic-based lap-held.

Price

Tandy is not yet revealing the cost of the 102, but if European experience is anything to go by, the 102 will be a little more expensive than the current 100 — at least as far as the recommended retail price is concerned. Those who do not require the 102's built-in modem facilities may continue to buy the 100 for some time to come — it's fairly heavily discounted today.

Conclusion

The 102 is a welcome replacement to the 100 and its NEC and Olivetti equivalents. I'd have liked it if a little more sophistication had been provided — Tandy should know by now what the client wants, and could have provided more of an upgrade. But for those needing a simple, solid travel machine, the 102 should be favourite, if only because it's now as debugged as it ever will be. **END**

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EOgraph

If you're interested in computer-aided design but deterred by high plotter prices, then the EOgraph board for the IBM may be your salvation. Stephen Applebaum puts you in the picture.

If you have an IBM PC and are considering using it for computer-aided design (CAD), you've no doubt thought about buying a plotter in order to produce accurate copies of your work. You may, however, have been deterred because of the large amount of money involved in purchasing a good-quality one.

The Dayton, Ohio-based Eotron Corporation has been keen to make the most of this opportunity and has come up with EOgraph, an ingenious add-on board for the IBM that literally turns a dot-matrix printer into an above average plotter, for around £600.

EOgraph is already configured to work with an IBM PC, XT and AT, and with Epson printers, models RX80, RX100, FX80, FX100 and the colour JX80. All you're required to do is assign it to one of the IBM's two asynchronous serial ports, COM1 and COM2, by moving a jumper on the board itself. That done, you simply plug the card into one of the micro's expansion slots.

Onboard EOgraph, the salient features are a 7220 graphics processor,

a Z80 processor and 512k of RAM, the relevance of which soon becomes clear. On the edge of the card is a parallel printer connector which protrudes out of the back of the IBM when EOgraph is in place.

At this point you might be thinking: 'Why do I need all this hardware when I can already print graphs and charts on my dot-matrix printer?' The twofold answer is: speed and accuracy.

The problem with dot-matrix printers is that they hold up the computer while slowly chugging away, drawing a circle or a bar chart point by point. Secondly, they're extremely inaccurate, compared with a plotter. To realise why this is so, you have to understand how printers and plotters function.

In use

EOgraph's ability to address a printer as a plotter comes from the way that it's able to convert plotter-language characters into printer graphics data.

EOgraph is sent ASCII characters by the computer, in the form of a language which can be understood by a

plotter. Hidden within what appears to be an incoherent mass of characters are such subtle details as line lengths, positions and styles, the positioning of a pen and even colour. This information is fed to EOgraph at a very high speed, where it is converted into printer graphics data. The result is data that describes the original plot on a dot by dot basis. Because EOgraph has half a megabyte of RAM onboard, it is able to accept several plots simultaneously.

The preconversion form of data is called the Vector description of a drawing. The dot by dot version, which is the corollary of the conversion, is called the Raster description, and contains much more information than the former.

What EOgraph is doing, in effect, is fooling the computer into thinking that it is a plotter. Therefore, as soon as it has sent the Vector description to the board, the computer returns immediately to its normal mode of operation.

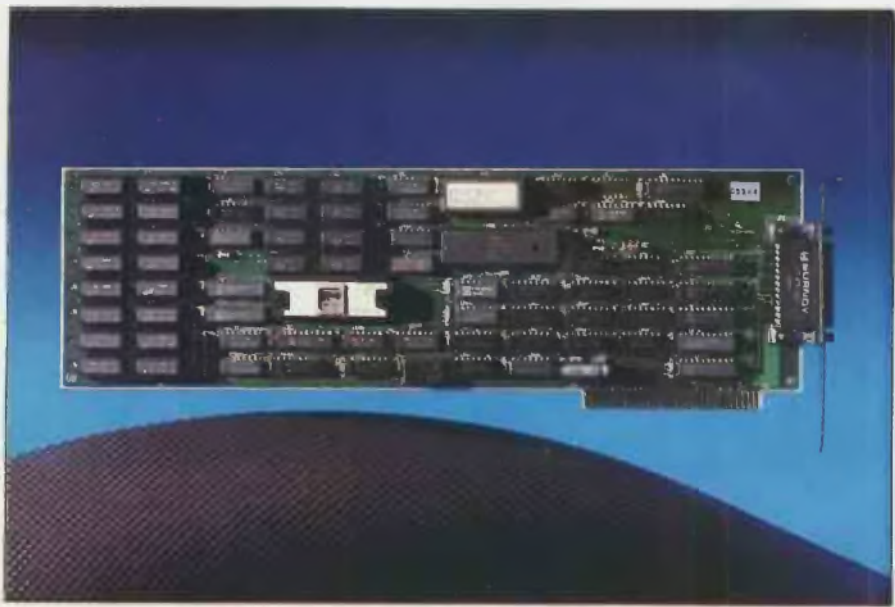
EOgraph isn't the only product to perform such a task; some graphics packages do a similar job. However, the latter use the computer to do all the donkey work of converting the different kinds of data, and don't release it back to the user until the printer has finished printing.

As well as acting as a pseudo-plotter, EOgraph is also capable of spooling vast amounts of text. It does so in a fashion similar to that in which it deals with graphics data, except that the text does not have to be converted before being sent to the printer.

When using EOgraph as a spooler, Eotron warns that there could be a compatibility clash if you already have a spooler installed as part of another package in your computer.

The *EOgraph User's Guide* advises you not to use this other spooler because:

(a) it probably utilises main program memory to perform the same spool-



ing function as EOgraph;
(b) it has to handle text data twice, before moving it to EOgraph; and
(c) many software packages with their own spoolers are preset to use a particular printer port, preventing you redirecting the printer output to EOgraph.

Together, these three properties reduce the time that the computer is working on printing, when it could just as well be doing something else.

Initialisation

Before you can print text, you have to go through a short initialisation procedure to allow your Epson printer to print from any PC-DOS print command. The initialisation process also enables proper printing from software using the PC-DOS PRINT command. Software utilising this function includes Lotus 1-2-3, WordStar and Sideways.

The first phase of the initialisation is to remove any non-formatting spoolers which have been installed in your system. Non-formatting spoolers accept text directly from programs, unlike formatting spoolers, which only operate on specified disk files. Both the Quadram and AST boards contain a non-formatting spooler, so if you have either in your machine, you must make sure that their spoolers are disabled before using EOgraph.

To assign your printer to EOgraph, you type either `MODE LPT1=COM1` or `MODE LPT1:=COM2`, depending on whether you've installed EOgraph as COM1 or COM2 respectively. Adding one of these statements to an `AUTOEXEC.BAT` file automatically assigns the printer at boot-up.

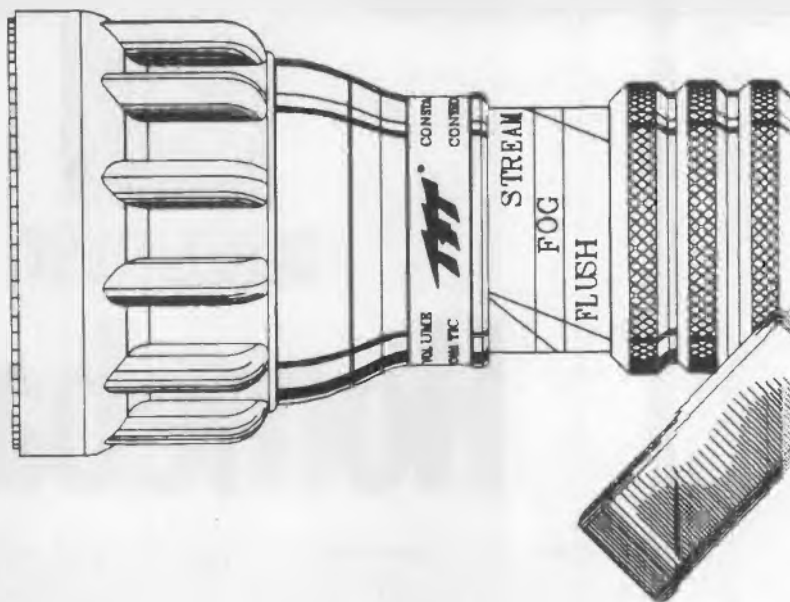
When EOgraph accepts data from the computer, it does so at a very high rate. When it sends it to the printer, however, there are short intervals when it stops to continue converting the data from plotter to printer language.

Nearly all software available for the IBM PC, including the popular Lotus 1-2-3, can be used with EOgraph, if it is correctly configured. Taking Lotus 1-2-3 as my model, I'll describe how a program can be customised to make the most of EOgraph's print spooler and plotter functions.

Customisation

The first thing to do is initialise EOgraph's print spooler for automatic printer assignment at boot-up, by the above described method. Similarly, you must initialise Lotus' default printer to agree with the automatic printer assignment. This can only be done after the Lotus system disk has been installed, and unprotected.

To initialise Lotus 1-2-3's default printer, you have to assign its default printer setting to LPT1, in accordance



An example of what can be done with, say, AutoCad and an Epson-compatible Brother printer. Surprisingly, this print took little over five minutes to produce

with the automatic printer assignment just mentioned. This is performed by selecting Lotus' Interface Menu. Here you'll find four settings, the first of which is the one you require. After setting the default printer, you proceed to the Update Menu and save the configuration by selecting the update option.

Initialising EOgraph's plotting functions is similar to configuring for a printer, except that all the various options that need to be selected are found in PrintGraph: when EOgraph performs as a plotter, it emulates the Houston Instruments DMP-29.

Page size must be set in relation to the width of the paper used by the various kinds of Epson printer that are compatible with EOgraph. Lotus itself limits the width to 14.6ins, but even this is too long for most Epson printers. For instance, the JX80, RX80 and FX80 have a maximum width of 8ins, while the Epson RX100 and FX100 increase this to 13.6ins. It doesn't matter which printer you use, because Lotus can be configured to work with any of the various width sizes.

Finally, when everything has been correctly configured, a serial port must be selected. If EOgraph has been installed as COM1, then serial port 2 must be selected; if it has been installed as COM2, on the other hand, serial port 4 is used. Once you've selected a serial port, you must set the baud rate to 9600 baud. This is for the sake of Lotus, and has no effect on EOgraph.

Plotting with EOgraph is quite simple, and the results are comparable to many of the more expensive plotters on the market. One of EOgraph's greatest attributes is its ability to plot

in colour, using Epson's JX80 colour printer.

Owners of this printer must enter a different pen colour for each pen number entry in the plot set-up, otherwise EOgraph will think that the printer is monochrome, and print in one colour only.

When installed, EOgraph can be controlled via a series of control strings, using the escape ASCII character, decimal value 27. Each string contains the sequence Esc E O, which informs EOgraph that the following string is intended for it. Some of the more important control strings are as follows:

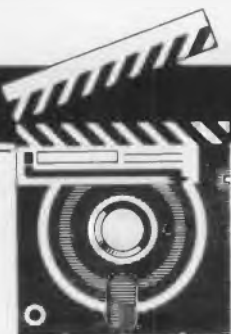
- EscEOA Cancel or abort present operation
- EscEOB Abort and restart plot
- EscEOB0 Disable plotter mode
- EscEOB1 Enable plotter mode
- EscEOD1 Single-sheet text mode
- EscEOD0 Continuous form text mode
- EscEOE1 Single-sheet plot mode
- EscEOE0 Continuous form plot mode
- EscEOH Reset EOgraph

Documentation

EOgraph's documentation is useful, although rather irksome, as it repeats itself several times in order to make the simplest of points. A liberal smattering of graphics makes installing Lotus 1-2-3, Symphony and AutoCad quick and easy, and obviates most questions that you might have.

Conclusion

An EOgraph and a printer together make a good and economical replacement for a plotter. Although perhaps not as high in quality as the drawings produced on an expensive plotter, EOgraph plots should still be of interest to designers. **END**



SCREENTEST

Homebase

Homebase is a co-resident, multi-function utility program which provides a set of useful, pop-up 'housekeeping' menus for PCs. Simon Williams tests its organisational abilities.

The idea of a co-resident 'do-it-all' suite which sits in your PC until called is not new: the best-known name is probably Sidekick, which was released over a year ago. Time moves on, though, and most software gets bigger and better. Homebase, from American-based Amber Systems, tries to do just that. Where Sidekick offers a handy onscreen calculator, Homebase gives you 26 variables and a formula evaluator. Where Sidekick can hold notes and memos, Homebase has a structured database in which you can define a pre-set record, or enter 'freeform' notes. In addition it has a calendar, a terminal emulator, and a DOS interface similar to Autodex.

As you might imagine with all this going on, Homebase isn't small. It's loaded from two disks, the second of which has to remain in drive B of a floppy-based PC while you're running it. In fact it takes about 135k of RAM, plus a full disk for overlays and data files. Hard disk installation is rather easier, and space is not then much of a problem, but you'd be advised to have about 512k of RAM if you're running anything substantial alongside Homebase. For all this, though, it sits out of the way until called from within an application by pressing '[Alt][Shift]H'.

The first Homebase display consists of a horizontal menu and a window showing the main Homebase options: calculator, calendar, DOS services, editor, notebase, quick-term and cut. You can move around Homebase menus with the cursor keys and select with [RETURN], or plug in a mouse to point and click. The main functions in Homebase can also be selected directly from an application program by using [Alt][Shift] sequences.

Each menu within Homebase is a line of options along the top row of the screen, with one highlight. The line below the menu gives brief details of the highlighted function, and changes as you move along the menu. This, coupled with copious help files, means you don't often need to refer to the manual.

The calculator

When the calculator is selected, Homebase displays three windows. These provide a list of variables and their contents, a 'tape' of the last 13 entries and results, and an entry window where your calculations appear.

The calculator has two modes: calculator and adding machine. In adding machine mode, each number you type in is added to the current total on pressing [Return]. The sequence of numbers scrolls up the 'tape' window and the total is displayed in a small window at the bottom. It's all very easy to use, and Amber is right in thinking that a lot of people use calculators mainly for addition.

For those who don't, the calculator mode supports the four arithmetic operators and exponentiation. You can type in a calculation as you would write it, and the result appears in the 'total' window on pressing [Return]. Alternatively, you can set any of the 26 variables and use them in your calculations. The variables are really 'memories' and only hold numeric results. You can't, for instance, assign variable C to be A/B and then feed in different values for A or B.

The calculator also provides a hex-to-decimal converter, and can print the results of calculations. Sidekick and GEM both offer a calculator accessory which is displayed like a calculator, and with the same func-

tions. Homebase's doesn't try to maintain its links with a physical device, but does offer more facilities. Which approach you prefer will largely depend on your needs.

The calendar

This is really several calendars. It can show you a monthly or weekly table and a daily diary. An entry in the diary can be set to give an alarm, and these alarms interrupt any application to display your pre-set message and bleep at you. Before any of this works, though, you have to set the current date and time when you boot Homebase, or run a program such as Timer, if you have a battery-backed clock in your PC.

The monthly calendar displays a single month at a time, and highlights the current day and date. You can flick through the display by day, month or year, using the cursor keys and [Pg Up] and [Pg Dn]. Pressing [Return] on any day switches to the diary display for that day.

The weekly calendar shows the seven days of the current week and highlights the times of any appointments set. The current day is framed. Again you can switch straight into the diary display.

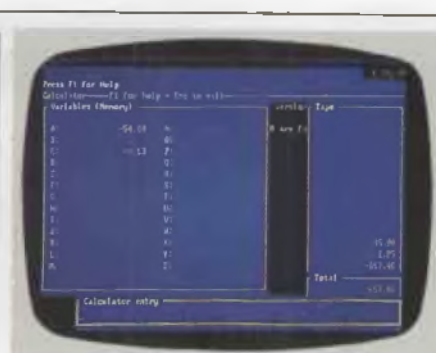
The diary is the main part of the calendar function, and allows you to insert and delete appointments or other notes for any time of the day, together with expenses you might charge — a comforting thought.

Along with the appointments display is a 'To Do' list, and you can tab between the two windows. The To Do list, as its name implies, can be used to remind you of tasks which, while not tied to a particular time of the day, still have to be done.

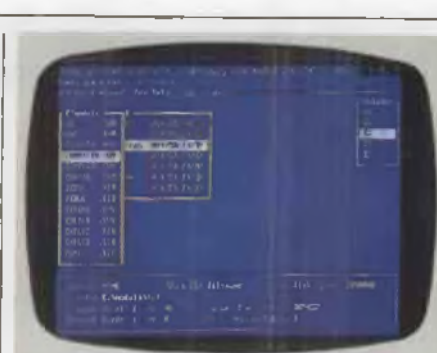
An interesting feature of the calendar, which ties into the Notebase



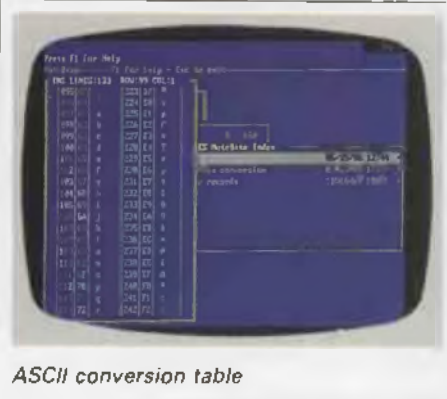
The Homebase main menu



Three base calculator



Comprehensive DOS services



ASCII conversion table



The Homebase calendar



Text editor screen

'core' of Homebase, is the Find option. If you want to display an appointment, but are not sure which day it's booked for, you can start a keyword search on the appointment message. This is a lot quicker than scrolling through several weeks of crowded diary entries.

DOS services

This is a handy front-end for the normal DOS command line. You start by selecting a volume from a small window on the right-hand side of the screen, and the root directory from this drive is then displayed on the left. A third window at the bottom of the screen shows a series of statistics on the drive, including free space.

You can open up to four volume windows and tab between them to select the active directory. You can mark single files by moving the highlight bar, and groups of files by using wild-cards or the space bar to tag them. The stats window keeps a length tally on the selected files, so you can easily check whether they'll fit on another disk.

Moving or copying files is simply a question of selecting source and destination directories which may be on the same drive, and selecting the files. This is a lot easier than using the command line, and is among the best non-WIMP front-ends I've seen.

DOS services also offers the facility to re-sort the files in any directory by a number of criteria, including size and the order they're stored on the disk. Re-sorting is almost instantaneous, and it's surprising how often you can find a use for the facility, once you know it's there.

The editor

There's something vaguely tautological about reviewing a piece of software by using it. All word processor reviews could be like that, and it would have been possible to write this review on the Homebase editor.

You call the editor from the main Homebase menu, or by typing [Alt][Shift]E, and the screen clears, with only a horizontal file menu across its top. Once you've read-in an existing file or created a new one, the edit window is opened and topped with the filename and a line and column count.

The editor uses WordStar command sequences but only produces straight ASCII text, and misses out on any form of dot command. Against this, a couple of handy extras are date and time strings, which can be deposited in your text at the press of a [Ctrl] key.

The editor is not just used for typing letters and memos, but also pops up within the notebase function for editing 'freeform' records, and within DOS Services to directly edit text files from disk.

You can't justify text under the Homebase editor, and some of the other [Ctrl]Q options are also missing. One of the Homebase options states 'Editor NOT in WordStar compatibility mode', which implies there is such a mode. Try as I might, though, I couldn't find one, and no mention is made of it in the manual. Perhaps it's a handle for a future version of Homebase, but as it stands at the moment, functions such as [Ctrl]B, to reformat a paragraph, don't work.

The editor is quite quick, being entirely held in memory, but is only really suitable for memos or short letters, as there's no way of setting margins, or numbering pages, and the only print option is to dump a marked block.

Notebase

The notebase is the core of Homebase. It's a database file which can be created with a pre-set template for each record, or left empty for 'freeform' notes. Notebases can contain all kinds of data. Sample files supplied with Homebase include single record tables of ASCII values and hex/binary/decimal conversion, and templates for a name and address file and a telephone message pad.

A notebase is structured as a set of 'key' fields (of which you may create any number) and associated 'text', which can be added notes or details of whatever's described in the keys. The power of the notebase is in the way you can search it. Searches, which are performed via the 'Find' option, may be on keys or the attached text. Key field searches are very fast.

When you select 'Find', an extra window opens for you to enter the search string. The results of the search are held as a subset. You can add other records to this working set from the whole file, or further refine your search using other criteria. Only one subset can be maintained, and is forgotten as soon as you leave the notebase section.

Whole files or working sets can be scrolled through the main notebase



SCREENTEST

window, which can be of any size up to full screen, and normally display only the contents of the key fields. Selecting a single record displays its associated text.

You can adjust the number and size of fields at any stage, even with data in the records, which is rare in a database of any size.

As well as 'freeform' records you can set up a template, which gives a formal display of the information in a record. A template designer is provided as a separate utility, as is a comprehensive report designer and printer. The report printer can be coaxed into printing labels and can merge the contents of a notebase into a text file for mailshots and circulars.

Quick-term

This is a terminal emulator which can be used to send and receive electronic mail, or to link into information services such as Telecom Gold or One-to-One. It includes an auto-dialler, and can be made to operate in the background to cope with any incoming or outgoing calls.

In background mode you are automatically prompted with each incoming call, which then appears in a window on top of whatever application you're running. The text of the call can be fed through this window as it's received, or can be sent straight to a pre-set file for later viewing. The whole system is very smooth in operation, and saves a lot of interruption.

If you prefer to take more of an active part in your comms work, you can use the terminal emulator to work micro-to-micro or link into other information providers. The Homebase auto-dialler is provided with a datafile of its own, and you can flick through all your contacts and call any of them at the press of a button.

The emulator can use the XModem protocol, so is compatible with a lot of comms software, but only straight ASCII, non-protocol files can be sent or received in the background. The terminal itself is completely configurable.

Cut

This Homebase option may be called up from within any of the other options or from an application, and can lift any section of text which can be defined on a single screen. This is done by moving the cursor, pressing [+], and stretching an inverse video window over the required section. The area is saved to memory and may then be deposited at another point in Homebase, or within another application.

You can do some interesting pasting with Homebase. The manual suggests you 'watch the fun' of pasting a column of numbers, cut from a notebase, into the entry window of the calculator (switched to adding mode). Each number is added up and the total may then be cut and pasted elsewhere, perhaps into a text document.

It doesn't always work quite as smoothly as this description suggests, however. If you cut part of a screen which contains graphics characters, they are pasted back as the corresponding alphanumerics. Paste a section of text from the Homebase editor into WordStar, and you may

... Homebase has a structured database in which you can define a pre-set record, or enter "freeform" notes.'

find you only get the first line. Transferring numbers and text from one part of Homebase to another is safest, and is still a versatile feature.

Configuration

For those who like getting their hands dirty, you can install Homebase to meet your own requirements. The Homebase kernel can be configured by changing a number of switches in the config.sys or autoexec files. The options include resetting the 'hot keys' which call Homebase functions from within an application, dealing with an 8MHz system clock, and a number of system defaults.

One of Homebase's useful features, which can be rather unnerving until you know about it, is the 'screensaver'. This simply cuts the screen display after about 15 minutes of inaction. It's meant to preserve the phosphors on your monitor screen, particularly on monochrome tubes.

Compatibility

Homebase seems to be compatible with most common software. There are a couple of problems with WordStar when you're trying to paste text into an existing document, especially if it's double-spaced, but this is more WordStar's problem than Home-

base's. It's easy to steer round, anyway, by selecting single-spacing before starting to paste.

The only problem I had with compatibility was with a co-resident onscreen clock utility, but this was only because Homebase was trying to display the same thing, and in the same place on the screen. Switching off either clock cured the problem.

Documentation

Homebase comes with a paperback book, which seems to be a current trend in American software manuals. It runs to 200 pages and covers most aspects of Homebase. There are a couple of places where I found the emphasis misplaced (19 pages on installation against 12 on the editor, for instance), but it's generally well-written, is indexed and includes a quick-reference guide. If Homebase wasn't so easy to use, the manual might have been a problem.

Conclusion

Homebase presents itself very well onscreen. The user interface is consistent, using menus at all levels, and enough help is provided to lead you around without being tied to the manual. A couple of options are hidden in rather unexpected places, but nothing that familiarisation doesn't cure.

The main sections of Homebase — the notebase, the terminal emulator and DOS services — are useful and well thought out. It's a pity the Homebase disk takes up a drive on a floppy-based PC, as this removes some of the advantages of co-residency, but it's inevitable considering the size of possible notebases and text files.

It's more than useful to be able to cut and paste text, tables and figures from one application to another, and the calculator provides some well-designed extensions to those in other packages. The calendar is flexible enough for all but the busiest person, and the interrupt-driven alarm can prevent a few missed appointments.

The editor is perhaps the weakest link in Homebase. It's not particularly well-documented and lacks a few features, such as a simple printing option, which would integrate it better into the complete product.

Overall, at £69.96, Homebase represents very good value for money. If you want to run several small databases or have a lot of electronic mail delivered while you work, it may well prove indispensable.

Homebase is available from Basic Computing, 26 Devonshire Street, Keighley, West Yorks BD21 2AU. **END**



PC mice

Simon Williams looks at five PC mice, three mechanical and two optical, and each with its own benefits in construction and reliability.

In the wake of Apple's introduction of the WIMP (windows, icons, mouse, pull-down menus) environment to micros, several suppliers have incorporated similar schemes in their software, on a variety of different computers. As well as the micros specifically designed to run WIMP operating systems (such as the Atari ST and the Commodore Amiga), WIMPs have been 'grafted' onto many others. The most notable of these WIMPed machines is the IBM PC, and there are now many programs offering mouse control.

PC owners are in a different position from ST or Amiga owners, as they have a choice of mice to use with their micros. Five of the most popular models are reviewed here, and vary quite widely in price, method of operation and supporting software.

In its simplest form, a mouse is a hand-held box connected to the PC by a thin lead, usually plugged into the serial interface socket. Inside the mouse is a small, rubber-coated ball which projects through a hole in its bottom surface to touch the desk. As the mouse is moved around, the ball is free to rotate in any direction. Its movement is picked up by rollers, and electronics inside the mouse (or on a board inside the PC) translate these movements into signals which are sent to the micro. Software within the computer then moves a pointer on the screen by an amount proportional to the movement of the mouse.

Some mice use a different system which involves no moving parts except the mouse itself. In these mice (which include those from Mouse Systems and Summagraphics), the moving ball is replaced by two light-emitting diodes. These detectors sense the movement of the mouse as it crosses a special 'pad' which is crosshatched with blue and yellow lines, one set for x axis movement and the other for y axis movement.

Mouse can have one, two or three buttons fitted to them, and these are



used for selecting options from menus and executing other program functions. Most software, with the exception of Computer Aided Design (CAD) packages, require two buttons at most; the mice reviewed here all have two or three buttons.

Each mouse was tested with its own installation and demonstration software, and also with the GEM Collection, a trio of WIMP programs including a file manager (GEM Desktop), a painting program (GEM Paint) and a word processor (GEM Write).



Mighty Mouse

This is the cheapest of the five mice tested, and has its origins in the Far East. It uses a weighted grey ball with contact rollers to provide movement signals.

Mighty Mouse is a completely passive creature, in the sense that there

are no electronics within the mouse box. Instead, signals from the rollers and three buttons are passed down the lead to a nine-pin D plug, which attaches to a half-length PC expansion card. This card is included in the price and has to be fitted inside the PC before you can use the mouse. A flying lead runs from the expansion card to the serial port on the back of the micro. The hardware installation is well-diagrammed in the brief instruction manual.

The software supplied with Mighty Mouse comes on a single disk, and consists of a mouse driver and a demonstration program. The demonstration is more like a series of technical notes, and is written in a peculiar combination of English and another, indefinable, language. It's intelligible, but is really intended for someone who wants to write their own software for the mouse.

Installing Mighty Mouse into an existing application program is quite straightforward, although this was not covered well in the review documentation. Wigmore House, the distributor, will be providing separate instructions when it starts to market the mouse. Basically, Mighty Mouse is software-compatible with the more common PC Mouse, and will work if you install your application for this particular device.

In use, Mighty Mouse proved to be comfortable and easy to use. It's quite a large mouse and fits the hand well, but there's a little 'backlash' in the ball mounting which allows you to move the mouse slightly without moving the pointer on the screen.

The base of the mouse is fitted with four ball bearings as castors to support your hand and prevent pressure on the main ball. These castors make a scraping noise on a smooth desk-top, and it's best to use the mouse on a smooth rubber mat.

Mighty Mouse is ideal for anyone computing on a budget, perhaps with a PC clone. While it lacks the precision for use with CAD packages, it's fine for general work. An added bonus is the fact that the same mouse can be made to work on other micros with an Atari-style joystick port. Although no software is provided, it shouldn't be too hard to get the mouse working with an Atari, a Commodore or an Amstrad.



Logimouse C7

There are two models of Logimouse — a two and a three-button device. Both models use ball and roller mechanisms, but with a high-precision optical system to encode the rotation of the rollers. Therefore, the area of movement of the mouse on the desk is a lot smaller than with other mice, while still responding well to hand movements. The resolution of Logimouse is twice that of all but the Microsoft mouse.

Installation of this mouse in both hardware and software terms is simple. A single lead connects the mouse to the serial port of the PC. Logimouse includes its own processor on a small circuit board inside the case, and derives power for this from the serial port itself. The consumption is low, though, so no unreasonable load is put on the PC.

Software in the form of a mouse

driver is provided on the accompanying disk. The Logitech driver is compatible with the Microsoft/Mouse Systems standard, which is a very good starting point: there can be few programs with which it won't run.

Other software includes TAG, a text and graphics editor. As its name suggests, this program can handle both words and pictures, but at a fairly basic level. It does serve to familiarise a new user with the mouse, though. This mouse's OEM origins show in the provision of C and Modula 2 libraries for the budding programmer.

The manual is clear, although it shows a cosmetically different version of the mouse from the one provided. A *Technical Reference Guide* is also available.

The Logimouse C7 is small for a mechanical beast and is very comfortable to use. It's something of a 'designer' mouse, with stylish slatted buttons; these have a good feel to them and are easy to double-click.

There's no noticeable play in the movement of the ball and it's easy to mistake Logimouse for a true optical device, but without the inconvenience of a pad. The mouse runs quietly and without slip, even on a smooth desk-top.

The Logimouse is a well-designed and well-built mouse, at a competitive price. In its basic form there isn't a lot of user software provided, but its installation is so versatile it will run with practically any commercial package. Extra software to produce pop-up menus and run Lotus 1-2-3 is to be bundled with the Logimouse, but was not available for review.



Microsoft Mouse

The third of the mechanical mice comes from Microsoft, a name well known to PC users as the creator of MS/PC-DOS. This is a two-button mechanical mouse originating from

Japan, and Microsoft supplies two versions: one which plugs directly into the serial port; and another which connects into the PC system bus. The bus mouse uses a half-length expansion card in a similar way to Mighty Mouse. Both bus and serial mice are identical in use, and are supplied with the same software.

As you might expect, this software is very good. As well as the mouse driver, there is a mouse-based text editor, a simple music program and a well-implemented version of Conway's Life.

These are really demonstration programs, but Microsoft also provides Mouse Menu, which is a full-blown utility program to add pop-up menus to your favourite application programs. Ready-made pop-ups for Multiplan, Lotus 1-2-3, VisiCalc and WordStar are provided, but the high-level menu language allows customised pop-ups to be written as well. The program is interrupt-driven, so most applications can be adapted using it. The language is thorough, and even includes the NOTHING statement to make sure certain menu selections are ignored!

As well as the in-house software, Microsoft bundles ZSoft's PC Paintbrush, a four-colour painting program which has all the features you'd expect to find, including cut and paste, zooming, and a range of different fonts and text sizes. If you don't mind the rather spindly icons, PC Paintbrush is well up to standard.

All this software is covered in two well-designed manuals which contain plenty of diagrams and some colour.

The Microsoft Mouse is large, and is shaped to fit the hand (well — mine, anyway); this makes it easy to use. It's alone among the mice examined here in having buttons which wrap around the mouse from the top to the front. While this makes the buttons fall naturally under your fingers, the buttons themselves are rather rattly, and don't feel as positive as those on the other mice looked at here. Although they work satisfactorily, they make the mouse feel a bit cheap. The mouse moves very smoothly on a variety of surfaces and has a higher resolution than either of the optical devices.

Along with the PC Mouse, the Microsoft animal was one of the first on the scene, and as such is likely to be included in the menus of almost all applications programs which offer mouse control. Apart from copying MOUSE.COM (the driver program) onto a work disk, there should be few installation problems.

The Microsoft Mouse is well-endowed with software, and if this is your main requirement, the package offers good value for money. If you're only after a good, solid mouse, there are cheaper mice available which have a better feel.



PC Mouse

This three-button optical mouse from Mouse Systems is made in Mexico, and comes complete with a 9in x 8in aluminium pad marked out with a fine pattern of vertical and horizontal lines. This pattern is read by two LEDs: one operating in the visible spectrum; and the other an infra-red device.

The LEDs and other electronics are powered by a separate supply which is built into a standard mains plug. The output from this supply runs to a jack plug on the back of the serial connector — this connector also takes the lead from the mouse. The jack socket on the review mouse was intermittent, and the plug had to be jiggled until it made contact and the red mouse LED came on.

The PC Mouse is supported on two strips of felt which let it slide across the pad. Although this system works well, the pad is not completely smooth, which can mean that the mouse is difficult to move by small amounts, due to friction. When you have used the mouse for a while, though, the felt should 'bed-in' on the pad.

The three buttons on the top of the mouse are wonderfully light to use, having just the right feel and audible click.

The basic PC Mouse package is supplied with an uninspired version of Klondike patience and a very useful pop-up menu program, similar in principle to Microsoft's. Mouse Systems provides many more ready-made pop-ups, though. These include the obvious WordStar, Lotus 1-2-3 and dBaseIII, but also others such as Multiplan, Symphony and Framework. You can, of course, define your own pop-ups as well, and there is a 'Plain' application which provides menus of generic functions to use on top of any program.

The PC Mouse is also available bundled with PC Paint+, Mouse Systems' own painting program. This is a good program, but costs extra.

Installation of PC Mouse into applications which support mice is very

easy, as this mouse has been around for a while and a lot of companies now support it. If you want an industry-standard mouse, the PC Mouse is light and easy to use, although it's without the resolution of more recent mechanical or opto-mechanical rodents.



SummaMouse

This is another optical mouse, bearing quite a strong physical resemblance to the PC Mouse. In use, though, there are enough differences to separate the two devices quite easily.

The Summagraphics three-button mouse is built in Korea and comes with a separate power supply for its electronics, as does the PC Mouse. The Summagraphics unit is a small black box, with its output lead terminating in a moulded plastic plug. The serial plug is also a moulded unit, with two leads coming from it: one to the mouse, and the other to a socket which matches the power plug. This arrangement is much more secure than Mouse Systems' jack plug.

The Summagraphics pad is a good deal larger than the PC Mouse's, and an area of about 11ins by 9ins must be kept clear on the desk to take it. It's made of flexible rubber, faced with a thin metal layer and printed with crosshatch lines. It appears to be a lot less robust than the rigid Mouse Systems pad, but is very smooth. The mouse slides across the desk with very little hand effort.

The resolution of the SummaMouse is the same as the PC Mouse, but this one has to be calibrated before use. This isn't difficult, and on the applications I tried didn't seem to make a lot of difference. Any optical mouse is subject to alignment limits and should be kept square to the pad in use, or movement of the pointer on the screen will be out of proportion to mouse movement.

The three buttons on the Summa-

Mouse are much firmer than on the PC Mouse and, oddly, are hinged at the front end. Most users' fingers will naturally fall towards the front of the buttons, but will have to be arched back to operate the SummaMouse buttons around their centres.

The SummaMouse supplied for review came complete with Digital Research's GEM Collection. The complete package is a lot more expensive than the other mice reviewed here, and the mouse is also available on its own. In its basic form, it's supplied with a menuing program and an operating manual (the software isn't included in the version bundled with GEM).

The SummaMouse is completely compatible with the PC Mouse driver, and can be installed into any program which offers the Mouse Systems device as an option.

The GEM Collection comes with comprehensive and well-illustrated manuals, but the 16-page pamphlet which makes up the mouse user guide does little more than tell you how to plug it in and clean it. It's a shame Summagraphics couldn't supply more details for those who need to do more than run GEM.

Even with these shortcomings, the Summagraphics Mouse is a well-built device which is very pleasant to use and, apart from its buttons, is rather better designed than its optical rival. Both packages are good value.

Conclusion

The PC user who wants to add a mouse to his/her micro is spoilt for choice. All the devices reviewed here are well-made and should prove reliable in use. Each has its own particular benefits, either in construction, bundled software or versatility.

Of the mechanical mice, the Logitech device is particularly well-made, sports a high resolution, and is compatible with the drivers used by all the major mouse manufacturers. The Microsoft Mouse has a lot of software bundled with it, and has made a name for itself as one of the originals.

The two optical mice are similar in lots of ways, although the SummaMouse is smoother in operation and has a better-designed power supply than the PC Mouse. It's also considerably cheaper.

With more and more WIMP-based software coming onto the market, and more operating systems such as TopView and Windows making an impression, the market for mice on PCs is probably still young. There are rumours of several Far Eastern mice about to come onto the market, so it seems the little fellows are set for a good breeding season. **END**

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AUGUST 1986 PCW 125

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Slow boat to China

China lags behind the West in terms of the micro revolution; surprisingly, the reason for this is not a lack of financial resources, but the Chinese language itself. But progress is being made in this direction, as Bob Couttie reports.

Out beyond the bamboo curtain a sleeping dragon is starting to twitch, and the shudders when it finally awakes could change the personal computer industry worldwide.

Buying power

To put things into perspective, mainland China's population is 20 times that of the UK: that takes massive administration. The Chinese authorities have committed themselves to modernising the nation's entire industrial base, introducing new management systems and improving education — all of which are natural markets for computers and computer software.

On the domestic front, the potential is enormous. In the West, few companies really take the Chinese consumer market seriously; after all, they haven't got much money, have they? Well, last year the Chinese bought so many Japanese TVs and 35mm cameras that the nation's foreign currency holdings were seriously damaged, and, as a consequence, the authorities had to clamp down on consumer imports.

Despite those clamp-downs, the Chinese population is becoming sufficiently consumer-sophisticated for the authorities to want fast-food hamburger joints in the High Streets. If this trend continues, micros shouldn't be too far behind.

The worldwide micro market is dominated by the English-speaking nations for several reasons, not least of which is the fact that non-English-based 'high-level' languages are non-existent, but also because the English-speaking consumer market is the second largest in the world.

Yet in China there are a mere 1200 minis and mainframes and a tiny 125,000 personal computers — hardly enough to buy Jack Tramiel a cigar.

If the Chinese micro market takes off, it could not only make a few fortunes, it could change the whole balance of power in the computing industry. Not because the West will be flooded with 'Seagull' brand compu-

ters and 'Pearl River' software, but because even now Western software companies, such as Lotus, are running out of machines to write for and hardware manufacturers are running out of new markets.

So, what is to stop some bright Sugarclone buying up every QL in sight and floating them down the Yellow River? The same thing that has kept China out of several information revolutions down the millennia: the Chinese language itself.

A computer revolution requires two basic elements: an affordable machine; and a high-level language

'When it comes to software, the effect of the Chinese language and culture is likely to be even more subtle...'

that provides access to its computing power. Even at the assembly code level, instructions are based on the Western alphabet.

Chinese is probably the oldest language still in everyday use and dates from around 2000BC. The written form uses pictograms, picture-words in which, say, the word 'house' is represented by a picture of a house, with the addition of phonograms which define the tone in which the word is spoken. Every word needs a new character.

Written Chinese is so standardised that someone from, say, Lanchow in northern mainland China can write to someone in Singapore, Hong Kong or Gerrard Street, London, and be understood, even though they might not understand each other face to face.

Language problems

But the language has its drawbacks. There is no logical hierarchy in Chinese words, because there is no

alphabet as such. Hence a Chinese telephone directory is ordered by the number of lines in the name of the subscriber. Currently there are about 150,000 Chinese words, and five new ones are added every day.

To add to the confusion, the Republic of China uses a simplified Chinese script while the Hong Kong Chinese prefer the traditional characters.

In languages with an alphabet such as English, French, Greek or Arabic, the tone in which a word is said has little effect, except perhaps for irony. In Chinese, however, a word like 'fu' can mean 'to return', 'to send', 'kingdom', 'father', 'woman' or 'skin', depending on how it is pronounced, and each meaning has a different character.

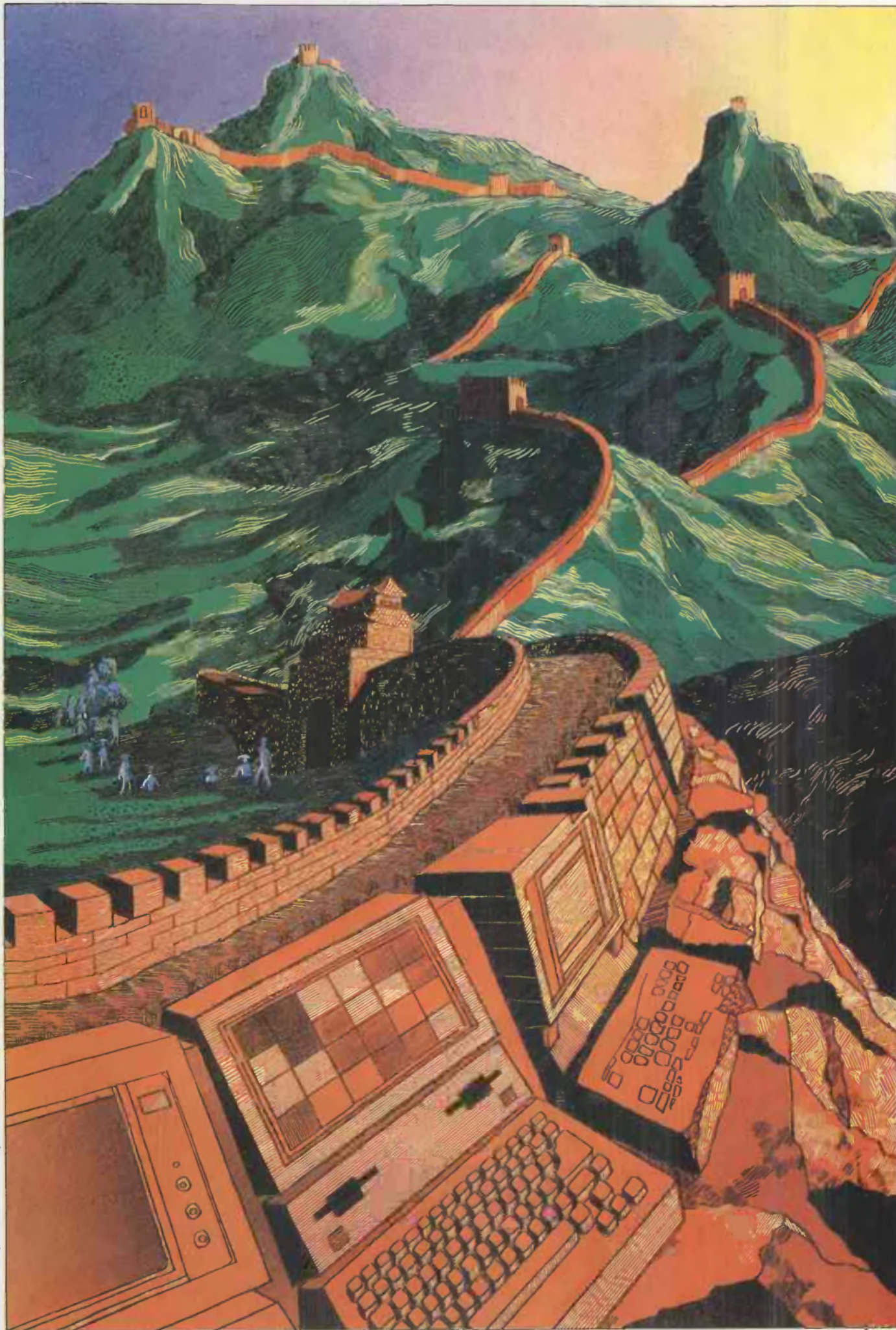
Although the Chinese invented moveable type in about 1045, it was not until Gutenberg applied it to alphabetical languages in the 15th century that mass publication of books and information became possible.

That Western lead in information technology has remained ever since. Of the 125,000 or so PCs in China, only one in 10 is actually in use. The rest are stored in warehouses because, unless you can write and understand English, the machines just take up precious space.

Even typewriter technology has bypassed the Chinese language. The nearest equivalent is a miniature typesetting machine that takes six months' training to operate.

For the Chinese, this presents a formidable problem. If they can't communicate with the microchip, the computing world will pass them by — just as everything else has for the past 1000 years.

The problem is made worse by the fact that there is no accurate way of translating Chinese words into, say, the European or any other alphabet. Hence, when the Chinese authorities switched from the Wade-Giles system of representing Chinese words in European characters to the Pinyin system, 'Peking' became 'Beijing'



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and 'Canton' became 'Guangzhou'. And there are four different systems of translation in use — Pinyin, Wade-Giles, the Chinese National Phonetic Alphabet used in Taiwan, and the Yale system.

This leaves Chinese micro usage 20 years behind the West, in the hands of a few specialists within the huge Chinese organisations who can speak and write in English.

English is the *lingua franca* of international business communications for the Chinese, but it is limited to top managers and those with access to translation services. Concepts like the One Per Desk are pipe dreams. And while a number of PCs are used in business, the lack of a Chinese language front-end isolates the mass of the population.

One solution from a Hong Kong company is to take an IBM PC and adapt the keyboard to print Chinese characters stroke-by-stroke, with each key contributing one stroke. Although it is practical, training still takes around two months, too long for most managers and out of the question for the home user.

Chinese whispers

The future for Chinese data input is probably more along the lines of touch-screen technology, like the Intech CP2054B Chinese character processor, developed in the US for \$280,000 and launched commercially in the Chinese market last year.

This uses an analogue-resistive touch-screen which displays a main menu showing the initial symbols for Chinese sounds in phonetic form, typically using the English alphabet with one of the four translation systems. To get the character for 'an', the Chinese equivalent of 'peace', the user touches the letter 'a' on the screen and a second menu is displayed showing all the sounds beginning with 'a'. The user selects the 'an' sound and a third menu is displayed showing all the Chinese characters in memory with that basic sound, and the user touches the character having the meaning wanted. Although it sounds complicated, training is minimal. The CP2054B is merely a front-end for a 24-pin dot-matrix printer. Messages are built up on the screen and then sent to the printer. Anyone who can read and speak Chinese can use it.

Intech now has a Chinese personal computer on the drawing board and wants to market the touch-screen system to OEMs for incorporation in third-party hardware. Ashton-Tate is developing a Chinese language version of dBase and Lotus is doing the same for 1-2-3. Some modified software was launched earlier this

year. More important is the launch of software that will enable users to write software in a Chinese programming language.

With an easy-to-use (for the Chinese manager) front-end to word/character processing and database application, the door to the Chinese business market is beginning to tweak open a little.

The CP2054B is too expensive for domestic computers, at around \$5000 for a complete system with disk drives, but it should not be too long before competitors come up with similar devices which are somewhat cheaper.

For the Western computer user, there are likely to be new developments in touch-screen mouse technology and other forms of non-keyboard input such as graphics tablets, as manufacturers set up to hit the Chinese market.

'If the Chinese micro market takes off... it could change the whole balance of power in the computing industry.'

Knowledge of Chinese is certain to become a marketable commodity among programmers as software companies gear up, too.

Enough people own domestic TVs in China for the consumer market to be persuaded to buy a non-keyboard computer, perhaps with the keys replaced by a graphics tablet; such a package could be put together even today for less than £100. Smart-card mass storage should be cheap enough to replace tape cassettes and disk-drives. New systems of low-cost, non-disk, non-tape program and data storage are, almost literally, on the cards.

For software companies, a whole new market for expert systems will open up. China simply does not have enough doctors, teachers, veterinarians or agricultural specialists to cover the vast countryside at the community level, so expert databases which can help identify problems and their solutions, or act as teaching aids, are in demand. Combine these with a hand-held unit like the Organiser II and limited inputs through an adapted keyboard, and you'll have a saleable product on your hands.

Many of these products will find slots in the West, too, and will certainly affect the way we use personal

computing power in business and in the home.

Something else will certainly happen. Only a few years ago in the West, the number of people with even a limited ability to program in machine code or high-level languages could be counted in their thousands; today, there are literally millions. Given the availability of a simple, high-level Chinese programming language, an enormous amount of computer talent could be unleashed.

How that would affect the West is impossible to say. But the concepts we use are dependent on the language we have to convey them and the culture in which we operate, and Chinese culture and language is so different that something new is bound to appear.

To take one example, the Chinese find it easier to use the abacus than the calculator, and with touch-screen or touch-sensitive tablets, or even mice, an onscreen electronic abacus is a practical proposition for numerical data input — indeed, Intech has included one on its own system.

Sun Tzu says ...

When it comes to software, the effect of the Chinese language and culture is likely to be even more subtle, even at the level of computer games.

Take, for instance, the various forms of battle games. In the West these are largely based on force versus force, and acquiring enough force to overcome or obliterate the opponent. As in Clausewitz's *On War*, 'The general who fights and wins most battles is a good general.' The Chinese, however, use tactics and strategy based on the writings of Sun Tzu, the oldest and probably the greatest of writers on warfare, in which subtlety and speed are more important than raw force. 'To win one hundred victories in one hundred battles is not the acme of skill. To subdue the enemy without fighting is the acme of skill,' he wrote. Indeed, the general who obliterates the enemy is a bad general.

This could impinge on serious software, too, particularly aids to decision-making — the principles of warfare transfer easily to business practice.

Slow boat to China

When China takes to computers, there will be fundamental and long-term spin-offs to the West, and it is a matter of *when*, not *if*. China's size and special needs make that a certainty. We, in the West, are in for some real surprises that no amount of star-gazing can foretell. For once, the future really is inscrutable. **END**



Intelligent modems

Peter Tootill puts a new breed of intelligent modems through their paces. On display are four multi-speed modems with V22 capability.

In the October 1985 issue of *PCW* we looked at examples of what could be called the first generation of intelligent modems. These were all V21/V23 models which included automatic dialling and automatic answering facilities as standard. Since that time, a new set of intelligent modems with additional, higher data rates (V22 and V22bis), and three and four speeds, have started to appear on the market at similar prices to the older single-standard V22 modems.

V21 modems send and receive data at 300 bits/sec — equivalent to 30 characters a second. V23 modems send data at 75 bits/sec and receive data at 1200, or vice versa. The V22 standard is 1200 bits/sec in each direction, and V22bis is 2400 bits/sec in each direction — the 'bis' just means it's the second level of the standard. The higher data rates are obviously an advantage when you want to move large quantities of data over the phone lines. A file or mes-

sage sent at 1200 bits/sec takes a quarter as long as at 300, which can save on telephone charges.

Despite the incongruous numbering, V22 is a newer standard than V23 and until recently V22 modems were very expensive in the UK (around £700 each), and had few features (no auto-dial, for example). Usually only one speed was provided — perhaps with a fall-back of 600 bits/sec for poor phone lines.

It is interesting to note that Amer-



Photography by Philip Gatward

ican modems conforming to the equivalent US standards are much cheaper than British modems and are very popular indeed. The US 1200/1200 standard is called Bell 212a, and it is basically compatible with V22 — that is, a V22 modem can talk to a Bell 212a modem. American Bell 212a modems usually have Bell 103 capability as well (Bell 103 is the US equivalent of V21, and is not compatible with it). Such modems sell at around £300, or even less! It is, of course, illegal to buy one from the US and use it on UK telephone lines, because such a modem would not have BABT approval. Unfortunately, British V22 modems haven't dropped to US price levels — yet, and I wonder if they ever will.

In this review I shall be looking at four multi-speed modems with V22 capability. The modems in question have certain features in common. They all support V21, V22 and V23. Three of them also provide V22bis and are designed to be Hayes-compatible, which means they will work with a wide range of software such as Symphony, Crosstalk, Sidekick and the sometimes excellent public domain terminal programs that are available for a number of micros. I used a freeware package called 'ProComm' on a Philips P3100 IBM clone for most of this review.

Incidentally, there are degrees of Hayes compatibility (see Smartmodem review, PCW May). However, all three 'Hayes' modems worked satisfactorily with various 'less demanding' Hayes-type terminal programs. In practice, all that many programs require is that the modem recognises the Hayes command to dial a number. Steebek and Pace say that current versions of their modems will work with Smartcom, and Miracle expects to sort out the Smartcom compatibility problem.

I will take each of the modems in turn and look at the individual features, and round up with some of the items that are common to all of them in the conclusion. The main features of each modem are summarised in Table 1, so only significant issues will be discussed in the text.

Miracle WS3000

The WS3000 is available in three versions — the basic V21/V23 model (reviewed in the October 1985 issue), the mid-range V21/V22/V23, and the top of the range (reviewed here) which also has V22bis. If you buy one of the lower-priced models, it can be upgraded by the manufacturer at a later date. The prices range from £295 to £650, excluding VAT.

Outside, the case is black plastic and fairly sturdy. There is no obvious way inside it, so I wasn't able to look at the circuit board, but the PCB on

the model tested in October looked well-designed and built. There are no external controls on the modem apart from a small reset button on the rear, all the modem's features being controlled by software. In addition to the usual connectors on the rear, there is a socket that looks like a BBC printer port. In fact this is a 'control' port, which can indeed be used as a printer port (more on this below). The front carries a comprehensive set of LED indicators. The power supply is inside a bulge in the mains lead.

Setting the modem up presents no problems. In common with normal Hayes practice, the WS3000 chooses its standard according to the baud rate that the computer uses to talk to it. For example, if the computer is working at 300 bits/sec, the modem will switch itself to V21; if it uses 75 bits/sec it will choose V23, and so on. The modem supports a very wide set of modes — 20 in all, including a staggering 11 different V23 modes. The latter includes, in common with all the modems in this review, a speed-buffered option, so that if your computer can't handle the normal V23 split data rates (1200 in one direction, 75 bits/sec in the other), it will talk to it at 1200 bits/sec in both directions.

The modem is a little complex to use if you don't use one of the factory default standards. Also, swapping between V22 and V23 if the terminal runs at 1100 bits/sec both ways requires changing one of the control (or 'S' registers) in addition to setting the terminal's baud rate. With most smart terminal software that has built-in auto-dial routines, you store information about the speed, parity, and so on, of a system along with its telephone number. The program and the modem will automatically set themselves to the appropriate data rate when you select the number to dial from the menu. With this modem, if you use both V23 and V22 systems, you will have to control the setting manually by changing the register; the modem will not automatically detect the baud rate of the system you are calling. Neither is there any 'constant speed interface' option whereby the modem can talk to the line at, say, 300 bits/sec but to the computer at 2400.

The modem can store 64 telephone numbers in its non-volatile memory and these are used by telling the modem to dial, for example, number 23 in its store. There is no keyword dialling so you have to remember which is which, or print yourself a list to stick on the wall by the computer. You can even use the modem's built-in printer port for this purpose. The real use of the printer port, however, is to allow the modem to answer the phone and take mes-

sages without the need for a computer to be attached. The printer port is the only use of the control port that is documented in the manual; it is, in fact, a bi-directional port. Miracle suggests that other uses could include control applications such as monitoring of remote machinery. There is no information in the manual on such uses; it just states that you will have to contact Miracle Technology if you want to use it for other purposes.

The manual is reasonably good; my only real criticism is that it doesn't explain the setting of the modem's speeds too well. The information is there, but it is a little confusing — a simple chapter on setting up and using the various modes would help.

Miracle has been criticised in the past for lack of technical support to customers. The company appears to have taken this to heart, revamped its customer support department and set up a separate technical support telephone line which should mean that users can get advice quickly and easily.

In use the modem performed well, except that I had mixed results at V22; it was sometimes reluctant to pick up the carrier of systems I was calling. Setting S9 to 1 helped, but this is not really recommended (it decreases the time a signal has to be present to be recognised as a carrier; setting it too low can cause the modem to think line noise is a carrier).

Steebek Quattro

At £795 (£914 inc VAT) the Quattro is the most expensive of the modems reviewed here. Its range of features includes constant speed interface to the terminal and error correction (sometimes referred to as ARQ — Automatic Repeat on reQuest).

The Quattro is a little larger than the WS3000 and has a metal case. It also has a set of pushbuttons on the front: these are labelled 'Data', 'Ans', 'test', 'AL', 'RDL' and 'dial'. These are used to give manual control in addition to software control of some of the modem's features. The 'test', 'AL' and 'RDL' buttons are all used for test purposes. The buttons can also be used to dial one of the four numbers in the modem's number store. The modem can also be switched between standards (that is, V21 to V22, and so on) with these buttons.

Inside, the modem is well-made and contains surprisingly few chips, bearing in mind the fact that it doesn't use any of the off-the-shelf chip sets normally used by other manufacturers, such as the AM7910. The power supply is inside the case but the modem remains reasonably cool, even in long periods of use.

The Quattro is a versatile modem which supports a wide range of features and facilities. It has to use the



alternative Hayes set of commands which are preceded by 'AT&'. These are a recent introduction by Hayes and are used in its Smartmodem 2400 which is not yet available in the UK, but is very similar in features and operation to the Quattro.

The Quattro has about 40 control (or 'S') registers compared to the usual 20 or so. There isn't the space to describe them all here, but the average user isn't likely to need more than a handful of them. In addition to the modes mentioned in the table, the modem has various synchronous modes at V22 and V22bis. Again space precludes a detailed description of these here, but they are a more efficient way of moving data than the asynchronous modes normally used on ordinary telephone lines.

Automatic detection of baud rate on both answering and originating calls is also available. This, combined with the constant speed interface (which makes the speed that the computer is set at independent of the data rate on the telephone line) makes the modem very easy to use. You can forget about baud rate settings and let it do the work itself.

Error correction is accomplished by transmitting data in short blocks with a check for corruption on each, using a CRC method. Unfortunately there is, as yet, no international standard in this area, so if you want to make use of it you need a Quattro at both

ends of the phone line. However, it is claimed to be compatible with error correcting modems produced by British Telecom.

A timer is built into the modem and can be used to keep track of the length of calls. A surprising omission is a loudspeaker. I find these are very useful to allow monitoring of the progress of a call. Even though the modem tells you if there is no dial tone, or if the number is engaged, it cannot tell you if a person has answered, and I *still* like to listen to what is going on.

The documentation, although adequate, is not of the same standard as the modem. Descriptions are on the brief side for such a complex piece of equipment. There is a short 'getting started' section which will help the new user, but that could be expanded. Anyone unfamiliar with Hayes-type modems will no doubt have problems understanding the modem. As a comparison the manual for the Hayes 2400, which is a very similar modem, is around 140 pages long; the Quattro's is 68.

Tandata Tm602

The Tandata Tm602 is different to the others in that it isn't Hayes-

compatible, and it doesn't offer a 2400 bits/sec (V22bis) option. It is priced at £465 (£535 inc VAT).

The case of the Tm602 looks and feels less sturdy than the others. It has all the usual connections on the rear, and a not very generous set of LEDs on the front. The reset button is conveniently placed on the front panel.

It is strange that Tandata chose not to go for Hayes compatibility with this modem. The company proclaims that the modem is so easy to drive that Hayes protocols are not necessary. That is all very well, but most smart terminal software is designed to use Hayes protocols and if the modem can't understand them, you won't be able to use any auto-dial features with it. Tandata is right in saying that the modem is easy to use if you command it manually. You can instruct it to dial a number, say 211 0000, by typing any of the following:

D 211 0000 <cr>

Tel 211 0000 <cr>

Ctrl-B CRN 211 0000 Ctrl-C

The last method uses the V25bis protocols which are the CCITT's answer to Hayes, but have yet to receive wide acceptance. You tell the Tm602 the baud rate of the system you are calling by adding, for example, '+v21' after the number. There is no automatic detection of baud rate in either originate or answer modes. Quite complex log-on strings can also be added after the number.

Despite the apparent flexibility of the Tm602, I couldn't persuade ProComm to auto-dial with it, even though I could change the auto-dial prefix to something that I thought would suit the modem. The modem can also have certain of its parameters changed via a simple menu system.

The modem's friendliness is, unfortunately, not carried over into the messages it sends the user. If it doesn't detect a dial tone, for example, it sends the message 'CFINT', the meaning of which is not immediately obvious.

The documentation also lets the modem down badly. The set I received is marked 'provisional issue', and was extremely brief, badly-reproduced and poorly laid out. I think it would be of very little help to a novice user.

Tandata also supplies a range of terminal software that is designed to be used with its (and probably any V25bis) modems. I used the IBM version and wasn't at all impressed: it seemed needlessly fiddly to use. For example, to store a page of data, whether it be an incoming Prestel page or a set of phone numbers to dial-in on the auto-dial directories,

Detail	HS3000	Quattro	Tm602	Series Four
Size (cm)	114x424	128x520	130x517	130x522
Weight	1.75kg	1.4kg	1.175kg	1.24kg
Power supply	External	Internal	External	External
Major working modes	V.21, V.22, V.22bis, Bell 103, 202	V.21, V.22, V.22bis, Bell modes optional	V.21, V.22, V.22	V.21, V.22, V.22bis
Command protocols	Hayes	Hayes, Stenback	Tandata, V.25bis	Hayes
External controls	Reset	data, ans, test, AL, RDL, Dial	Reset	Reset, and see text for detail
Indicators	Per, HS, Q, DTR, RTS, CTS, CD, 19SR, TD, RD, CD, DTR, OH, RD, TD, AA		Per, TD, RD, CD, Line	Per, Q, DTR, RTS, CTS, CD, TD, RD, AA, HS, Carrier, LCO (see text)
RS-232 signals	1-10, 16, 20, 22-24	1-10, 14-18, 20-24	12-18, 11, 20, 22	11-10, 20, 22
Baud rate to terminal	175, 300, 600, 1200, 2400	175, 300, 600, 1200, 2400	300, 1200	300, 1200, 2400 (CHECK)
ditto setting	Auto	Auto	Manual	Auto
Baud rate select orig.	Manual	Manual/auto	Manual	Manual/auto
ditto ans.	Manual/auto	Manual/auto	Manual	Manual/auto
Number store	64	14	n/a	64
Bell tone suppress?	Yes	Yes	No	Yes
Dial tone detect?	No	Yes	Yes	Yes
Busy detect?	No	Yes	No	Yes
No. Unob. Detect?	No	No	No	Yes
Dial Mode	Pulse or tone	Pulse or tone	Pulse or tone	Pulse or tone
Speaker?	Yes	No	No	Yes
Other Features	Printer port,	Const. Speed interface, ARB, call timer, Auto-logon	Const. speed interface, Auto-logon	Lock, printer port, const. speed interface
Options	Data encryption	Bell tones, rack mount		
Documentation	1000	1000	10	Not available yet
Manufacturer	Miracle Technology 151 Peters St. Ipswich IP1 1ED	Stenback Systems, 13 The Paddock, Hambridge Road, Newbury Berks. RG14 5TG	Tandata Marketing Ltd Althorpe Rd. North Malvern, Worcs, WR14 2TL	Pace Micro Technology Juniper View, Allerton Rd, Bradford, BD15 7AG
Telephone no	0473 216141	0483 33009	0484 5168421	0274 488211
BT sold no	1794E1001, 7210101033		081740001	794PC001
Prices	V.22bis £630/£740 inc VAT V.22 £495/£569 inc VAT V.21/22 £295/£339 inc VAT	V.22bis £630/£740 inc VAT V.22 £495/£569 inc VAT V.21/22 £295/£339 inc VAT	£445/£535 inc VAT	Not yet fixed, but expected to be similar to HS3000.

Table 1 Modem specifications

you have to first open the file by pressing F3, enter a file name, and then use F4 to store the page. You have to remember to close the file by pressing F3 again. This is not a review of the software, so I won't go into its features here, but it is a reasonably comprehensive package, supporting both viewdata (in colour if you have the facility) and normal scrolling systems. But as with the Tandata modem, the software documentation is again poor.

Pace Series Four

The Series Four was not finished at the time of the review and so I was not able to do a full review of it. Like the WS3000, it is a three-model range of modems with a basic V21/23 model, and V22 and V22bis models available at higher prices. The prices hadn't been fixed at the time of writing, but were expected to be similar to those of the WS3000 range. In fact the modem is very similar in its operation to the WS3000, although its appearance is very different from the others — it looks as though it would have a very low drag coefficient in a wind tunnel test!

Production models should be available by the time you read this.

The Series Four was to have been called the Kingfisher, but Pace has been unlucky with its choice of names — the company had to change the name of its last modem because someone else had already adopted it. And once again, someone has already reserved Kingfisher for a future product. The modem has a number of unusual features, the most obvious of which is an LCD display on the front that normally shows the time and date. Underneath it are three press buttons which can be used to control some of the modem's functions. You can, for example, dial one of the numbers from the modem's store of 63 numbers, set the time and date and the control (or 'S') register values using them.

As with the WS3000, a printer port on the rear allows incoming data to be printed, so the modem could be used to take incoming messages without a terminal being attached. The built-in clock could be useful in conjunction with appropriate software to date stamp messages, for example. Another unusual feature on the front panel is a row of 10 LEDs that give an indication of the strength of the carrier being received.

As far as I could tell the modem worked well, although it had one or two unfinished areas and the documentation was only a sheaf of typescript. However, the modem promises to be a strong contender in its price range. Some of the extra features may seem a little gimmicky,

but if they don't cost much they are worth having. Others, such as the constant speed interface and auto detection of baud rate when calling out, are worth having, definitely.

There are also a couple of nice little touches on the software side: you can get a complete listing of the control registers with their current settings and a list of the standard 'AT' commands by typing 'ATS?' and 'AT?' respectively. That is even better than a quick-reference grid.

Conclusion

Summing up is difficult. While there are a number of features common to three or more of the modems, there are also a number of differences. The Quattro and the Tm602 are, in their own ways, different to the others, while the WS3000 and the Series Four have a number of similarities.

The major features missing from one or more of the modems are automatically detecting the baud rate of the system you call, and the constant speed interface to the terminal. Automatic speed seeking when making a call is best used with care. If you use it when calling a system that also automatically detects your baud rate, you could end up matching carriers at a totally unsuitable rate! Both the Steebek and the Series Four have these features, while the Tm602 has the constant speed interface.

A few compatible features are the ability to detect dial and engaged tones, and a line-monitoring loudspeaker. The Quattro and the Tm602 omit the speaker, and the ability to detect dial tones is not, in my opinion, sufficient compensation. If I had to choose, I would prefer the speaker. Not only does it allow you to make sure the dial tone is present, it also means you can hear what happens when your call is unsuccessful. For example, it can be that a person answers, or the carrier is present but

too faint for the modem to detect. A speaker allows you to hear what is going on.

All the modems support pulse and tone dialling, but none is clever enough to automatically choose which to use. Other features such as Hayes protocols, printer ports and error correction are very much a matter of deciding what your needs are and choosing the modem to suit. Table 1 gives a comprehensive guide to the modems' features.

Summary

The Steebek is a very versatile modem and has the most comprehensive specification of those reviewed, but its price is significantly higher than the others, especially if you don't need V22bis. 2400 bits/sec over ordinary telephone lines is pushing things a little and you can get significant line noise problems — hence the inclusion of ARQ in the Quattro. However, to justify the extra £300 over the price of the V22 versions of the other modems in the review, you will either have to need to move a lot of data about (and preferably have Quattros at each end of the line to enable you to take advantage of the error correction), or need one of the other of the Quattro's features.

If you only need a V22 modem, then the field is wider. The WS3000 still needs a little work on the V22 mode, but it has a better specification than the Tm602 for a price difference of £30. The Series Four looks a very promising beast, assuming that all the features listed do appear in the production versions.

By the way, if you do want to use V22 or V22bis and find you have problems with noise lines, BT will condition the line between your premises and the exchange to reduce losses for a one-off fee of around £100. **END**



'Are we becoming obsessed with microchip technology? Hang on — I'll ask my computer.'

Data representation

Mike James examines data representation, and stresses its importance in keeping your programming simple.

Nearly every programmer thinks that the difficult part about programming is working out what the program should do — that is, constructing an algorithm. In practice, what to do in a program is a minor problem compared with the difficulty of thinking up a good data representation. As described last month, the way you think about your program lends itself to suitable algorithms; this is only the start of the central role that data plays in program creation. The way you choose to represent data determines how easy it is to invent and implement algorithms to achieve your goal.

Where is the data?

All programs comprise two parts: the part which tells the computer what to do; and the part which tells it what to do it to. Programmers are generally very aware of the part that tells the computer what to do — the algorithm — because it is usually the largest and most visible part of any program.

The part of a program which defines the data the algorithm is to work on is usually well-hidden within the algorithm. If you were asked to point out the lines in a Basic program that defined the data, you would most probably point at a few DIM statements and maybe the odd DATA statement. Most programmers are taught that the only parts of a program that deal with data construction are the few statements in the language that define either the type or the value of a variable. This view of the data creation process is far too narrow; for example, the Basic statement DIM A(10) defines A to be a one-dimensional array of 10 elements (I prefer to ignore A(0) even if it exists!), but in the mind of a programmer a one-dimensional array can be a number of different things. For example, it can be a mathematical vector subject to all the rules of matrix algebra, or it can be a simple list of numbers, or a look-up table. In the mind of the programmer a data type is not just a way of organising variables, such as an array; it also includes a set of natural operations.

This may seem like an empty observation but when you're constructing a program you really do think of an array, for example, as something more than a collection of variables because you're going to use it for something — that is, as a vector, as a list, as a look-up table, and so on.

The fact that much of the act of data definition is in the mind of the programmer accounts for the observation that there are very few statements in programming languages which deal with data. This also accounts for why so little of any program is ostensibly devoted to data definition.

However, once you move away from the supplied types of the language, large chunks of program can be seen to be concerned with data definition. For example, the only advanced data type offered by most versions of Basic is the array, and any array can be defined by a single DIM statement. However, other types of data, queues, stacks, linked lists, trees and graphs can all be constructed using simple arrays and subroutines (see below). In many cases we have to extend our ideas about what parts of a program are concerned with constructing data for the remainder of the program to work on.

Representing the world

The whole point about data inside a program is that it has to represent some part of the external world. Sometimes that part is physical; for example, an oil rig in a program that does stress or vibrational analysis. Sometimes it is an abstract idea, such as a mathematical vector in a program that computes the solution to a set of linear questions. But whatever has to be represented within the program, the program is easier to write if the data type used is as similar to the external world object as possible. In other words, the data type should have as many properties of the real world external object as possible and as few additional properties.

Ideally a representation should

have exactly the same set of properties as the external object and no more. Such an exact representation is often referred to as an *isomorphism* from the Greek meaning 'equal shape'. Although exact isomorphism between the real world and a data representation is impossible, the closer we get to it the better. This is known as the *isomorphism principle* of data representation.

All this talk of isomorphism is a little abstract. To make things clearer, let's consider a simple example. Imagine you were writing a program to construct a timetable that works with the days of the week. There are two obvious ways of representing the days of the week. You could use the familiar three-letter names for each day as strings — that is, 'MON', 'TUE', 'WED' ... 'SUN', or you could use the numbers '1' to '7' to stand for Monday to Sunday. At first sight it looks as though there is very little difference between the two representations, but consider the problem of deciding if one day is earlier in the week than another. What you would like to write in the program would be something like

```
IF DAY1<DAY 2 THEN ...
```

where the '<' sign can be read as 'comes before'. If the numeric representation is chosen, then the above IF statement will work as written, and deciding which of two days is earlier is trivial. This is because the data representation used has the same ordering as the days of the week — that is, Monday comes before Tuesday and 1 is less than 2, and so on. But if you use the string representation, then deciding which of two days is earlier is not at all easy. You cannot use

```
IF DAY1$<DAY2$ THEN ...
```

because the comparison is based on the ASCII alphanumeric order and "THU"<"WED" is true because T comes before W in the alphabet, even though Thursday comes after Wednesday in the week! (I still haven't worked out a satisfactory solution to this very simple problem.)

The days of the week example given above shows that there is an advantage in the data representation



having as many properties of the real world object as possible. It may look as though representing the days of the week by the numbers 1 to 7 is a good isomorphic representation, but it brings with it rather too many properties. For example, what do you make of an expression such as $DAY1 + DAY2$? Numbers can be added together, but days of the week cannot! In this case, the data representation suffers from having additional and unwanted properties.

In simple programming languages there is no way of restricting the operations on a data representation to those that make sense, but this rarely causes trouble in a well-organised program where the object represented by the data is clearly stated.

The opposite problem of not including sufficient properties of the external world object in its representation is much more common and serious.

Data = type + structure

If the name of the game is finding good representations of external world objects, then it is important to know what type of internal data is available to us to construct such representations. The modern view of data is that there are roughly two basic types of data and a large number of organising principles or *structuring methods*. This idea of a structuring method is best explained by pointing out that the familiar act of forming an array is a structuring method. Any type of data can be organised into an array. You can

have numeric arrays, string arrays and even arrays of arrays! Most of the theory of data is concerned with different structuring methods.

Types = scalars and reals

There is very little to say about the simplest types of data to which structuring methods can be applied. There are two types: scalars and reals. The archetypal scalar is the set of integers (whole numbers) 0, 1, 2, 3 ... 'Scalars' have a variety of incidental properties: they can be compared; you can do arithmetic with them; and so on. The key thing about them, however, is that they are countable. If you think that everything is countable, then you have never come across the other fundamental data type — the 'reals'.

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'Real' numbers are the usual sort of number that we do maths with including fractions, numbers like 'pi' and 'e' and the irrational numbers which can only be represented by infinite decimal fractions. The most important property of real numbers is that given any two real numbers, there is always a third that lies between them — no matter how close together they are. For example, between .5 and .49 there is .495; between .5 and .499 there is .4995; and so on. This means that the real numbers are 'un-countable' because you cannot start at a real number, call it the first and then move on to the next and call it the second, because, no matter which number you choose as the second, there is always a real number closer to the first.

Nearly everything's an integer!

The idea that real numbers are un-countable is fascinating, but almost irrelevant to practical programming. Real numbers are best regarded as numbers which you use to do calculations and scalars, or more accurately, the *integers* are what you use to count things with. The use of real numbers is the province of mathematics, and while we often have to worry about the practical details of calculating with the reals, it is the variety of things that can be done with the integers that is the main concern of programming.

We have already seen that the integers 1 to 7 can be used to represent the days of the week. The integers can also be used to represent any countable set of objects, but beware — they can bring with them properties that you don't really want. For example, in the case of the days of the week, the ordering of the integers was useful, but what if you use '1' for red and '2' for yellow? In this case, what do you make of an expression such as red < yellow? The integers contain the idea of 'next larger' or 'successor' — that is, the next larger integer from 1 is 2. In the case of the days of the week it is sensible to say that the next day after Monday is Tuesday, but it is usually not sensible to say that the colour after red is yellow.

The fact that using integers implies an order is rarely a nuisance unless you need to use a different order. For example, the letters of the alphabet are represented in most computers by the integers according to the ASCII code — that is, 'A' is represented by 65, 'B' by 66, and so on — it is this that caused the problem when the days of the week were represented by three-letter strings. If

Inside information: using arrays

Arrays are the most widely used data structure in any programming language, so it might come as something of a surprise to discover that they are only ever used in one of three ways:

- As a representation of a mathematical vector or matrix with natural operations of matrix multiplication and addition.

- As a representation of a list of numbers or other data items. The natural operations include finding an item with a given property (for example, the largest) and moving items around. If the data items are numbers, then the natural operations also include finding the total, the difference between adjacent items, and so on.

- As a look-up table. In this case, each item in the array is a value that is associated in some way with the index of its position in the array. For example, if you fill the elements of an array so that the 'lth' element contains l², you can use this as a look-up table to find the square of any integer: that is, A(l) contains the square of l. The only natural operation on a look-up table is a look-up!

you think that this is not an important problem, the assignment of letters to integers according to the ASCII code contains a trap which nearly every programmer falls into at one stage or another. The letters 'A' to 'Z' are represented by 65 to 90 and the letters 'a' to 'z' are represented by 97 to 122. This implies that "Zebra" < "cat" is true because 'Z' comes before 'c' in the representation. In other words, if you sort using the standard ASCII order, you will find that all the words starting with capital letters come first, followed by all the words starting with lower-case letters, and this is generally not what is required. (The problem of changing the order implied by the ASCII representation is very similar to that of changing the order of the days of the week represented by three-letter strings — once again, I know of no straightforward solution.)

Structuring methods

Given that the only fundamental types of data are the real and the scalar, it should come as no surprise to discover that most of the work in data representation is in inventing and applying structuring methods. There are too many different structuring methods to cover them all in

detail here, so what follows is no more than a thumbnail sketch.

Structuring methods fall into two groups: static and dynamic. A static structuring method creates a data structure that is fixed in size while the program is running — an array is an example of a static data structure. A dynamic structuring method creates a data structure that changes its size and possibly its 'shape' while a program is running. The only dynamic data structure supplied by Basic is the string, which is essentially a sequence of characters that can change its length.

There are only three types of static data structure: the array, the record and the set. The array is well-known to all programmers and it corresponds to lining up a collection of identical data types and assigning to each one a unique index. For example, the Basic array DIM A(10) lines up 10 real variables and calls them A(1), A(2) ... A(10); the Basic array DIM AS\$(10) lines up 10 string variables and calls them AS\$(1), AS\$(2) ... AS\$(10).

A record is similar to an array but you can line up a collection of different types of variable, and instead of a numerical index you use a *qualified name* to select one of the elements. Basic doesn't provide records but Pascal does. For example, in a cross between Basic and Pascal, a record for name and telephone number might be

```

Person
    Name$
    Number%
    
```

where Person.Name\$ is a string and Person.Number% is an integer. It should be clear that the record data type is meant to be used to represent traditional external world record cards. The final static structuring method — the set is also not available in Basic.

A set is a collection of values with no predefined order and so, for example, it is ideal for the representation of colours {red,yellow,blue} or any external world objects that have no natural order. Once again Basic doesn't provide sets, but this is no particular disadvantage as they are used very little in languages that do provide them.

There are a great many dynamic structuring methods and you can, I'm sure, invent as many as you want! There are two ways to implement such dynamic structures in Basic. You can either use the one dynamic data type that Basic supplies, or you can use arrays and *pointers*. For example, a very useful dynamic data type is the *queue*.

A queue is a sequence of items with a front and a back. Items can

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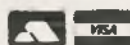
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only be added to the back of the queue and removed from the front. You should be able to see that a queue is a data representation of a queue in the external world. To implement a queue using a string Q\$ is easy. The front of the queue could be the left-hand end of the string and the end of the queue would then be the right-hand end. Adding an item I\$ to the queue is then simply
`Q$=Q$+I$`

Removing an item from the front of the queue is simply
`I$=LEFT$(Q$,1):Q$=RIGHT$(Q$,LEN(Q$)-1)`

To use an array 'Q' to represent a queue is almost as simple. All you need is a pointer 'S' to the start of the queue and a pointer 'E' to the end of the queue. (That is, Q(S) is the first item in the queue and Q(E) is the last item.) Adding an item I to the queue is then achieved by
`E=E+1:Q(E)=I`

and removing an item is achieved by
`I=Q(S):S=S+1`

The only problem with this scheme is that the front and end of the queue slowly move their way up the array as items are added and removed. The solution to this is to make the array 'circular' by adding:

`IF S>N THEN S=1`

and

`IF E>N THEN E=1`

after each update of 'S' and 'E'

respectively.

You can construct other dynamic structures in the same way. The only ones that are in common use are:

The queue — see the description given above. A queue is also called a FIFO (First In First Out) stack.

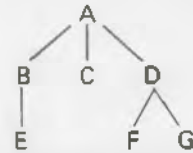
The stack — a list of items, such that items are added to and removed from the start of the list. A stack is like a queue but items leave and join at the front. A stack is also called a LIFO (Last In First Out) stack and various other names.

The deque — a cross between a queue and a stack, in that it is a list of items with a front and a back, but items can both leave and join at the front and the back. This is similar to a deck of cards where cards can be placed on or dealt from the top or bottom.

The linked list — each item in a linked list includes a pointer to the next item. Linked lists are easy to modify, for example, because you only have to change the value stored in the pointer to alter which item is next, rather than move items. Each item in a linked list can have a pointer to the previous item, making what is usually referred to as a *doubly linked list*.

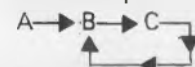
The tree — a linked list in which each item has a number of pointers to a number of next items. Each item can only be pointed to by one pointer. It is called a tree because if you

draw a diagram with the pointers represented as arrows, then it forms the shape of a tree:



There are many different types of tree according to what extra restrictions you place on the structure. For example, if each item is required to have exactly two pointers, then the tree is called a *binary tree*.

The graph — a tree in which each item can be pointed to by more than one pointer. As an item can be pointed at by more than one pointer, it is possible to form 'circular' data structures. For example:



Graphs are sometimes called networks because they can be used to represent complicated relationships between data items.

Facing the problem

One of the most important ideas in constructing data representations is that any of the above structuring methods can be applied to any type of data item, even if the data item is itself a complex data structure. For example, you can have an array of records, a stack of arrays, a tree of strings, and so on. This idea of structuring structures can be taken as far as you like so you can have a tree of arrays of records, or an array of trees of stacks or strings. Fortunately it is rare that structuring methods are applied more than two deep!

Armed with all the ideas of data representation, you should now be able to tackle programming projects in a new way. Instead of worrying about how to solve the main problems, first of all think about the object that the program is concerned with and make a list of the different data representations you could use. For each one, think about what the natural operations are and how you would implement them using the language in which the program is to be written. It is usual to choose the data representation that has as many properties of the real world object as possible, but sometimes it's worth sacrificing some property for ease of implementation.

Finally, once you've decided on a data representation, you should find that the rest of the program is easy! If you don't believe me, try this month's creative challenge.

Next month: How to spot a sub-routine. **END**

Creative challenge 2

You live in a group of islands, and tourists need to know if it is possible to get from one town to another by car without using a ferry. Given the basic information that there is a road between town X and town Y for all the roads in the islands, construct a program that will answer 'Yes' if it is possible to drive between two towns, possibly via a number of other towns.

For example, if there is a road between town A and B, B and C, E and F, then the program should answer 'Yes' to the question 'Is it possible to drive between town A and C?' but 'No' to 'Is it possible to drive between town A and F.'

Notice that your program does not have to give any details of the route between the towns in question; it just has to decide whether or not they are connected by a road.

The answer will be given next month.

Answer to creative challenge 1

If you think of the row of asterisks that have to be printed as a *sequence* of asterisks, then the natural way of solving the problem is to use a loop as in:

```

FOR J=1 TO D(I)
  PRINT "*";
NEXT J
PRINT
  
```

which will print the number of asterisks indicated by D(I). However, if you think about the row of asterisks as a static chunk of characters, then you might think of using the MID\$ function to generate such a chunk in one operation as in:

```
PRINT MID$(A$,1,D(I))
```

assuming, of course, that A\$ contains a string of at least 40 — that is, the maximum number of asterisks ever needed.

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Means to an end

David Levy's AI series continues with an explanation of how computers solve problems and make decisions, with particular reference to heuristics.

A problem exists whenever someone does not know how to achieve a particular outcome or state of affairs. The problem-solver will have some information about the problem, even if it's no more than knowing the nature of the problem, and during the problem-solving process, the solver repeatedly uses some or all of the available information to discover more information, and more, and more until a solution is reached.

There are many kinds of information which can help to solve problems. There may be information which guides the solver towards the method or approach which should be tried first; there may be information which enables the solver to eliminate completely some of the possible solutions; or there may be information which indicates that the solver should concentrate more efforts along certain avenues. Such information, or rules of thumb, are called 'heuristics'.

People use heuristics all the time in decision-making and problem-solving, often without realising that they are doing so. If you see a grey sky before you leave home in the morning, you will probably take your raincoat or umbrella because you know that if the sky is grey, then probably it will rain. Computer programs also employ heuristics to make decisions and to solve problems.

One of the earliest heuristic-based problem-solving programs was GPS (General Problem Solving) developed by Newell, Shaw and Simon in the late 1950s. GPS would work towards a solution by reducing the goal to a set of sub-goals, in such a way that if all the sub-goals were achieved, then the original goal would also be achieved. If a particular sub-goal proved too difficult, it was split into sub-sub-goals, and so on.

In order to achieve each of the goals or sub-goals, GPS would employ various heuristics in one or both of two different ways: (i) means-end analysis; and (ii) planning. Let's first see how means-end analysis works.

Means-end analysis

If a situation exists which is not the

desired one (the goal), it will be possible to detect differences between the two. For example, if I am in London and wish to be in Edinburgh, then I know that the principal difference between my current situation and my goal is one of *distance*.

Knowing that *distance* is what separates my current situation from my goal leads me to ask the question: 'What can change this distance?', and I might come up with answers such as: a car, a train, a plane, a bicycle, and so on. The means (the method of transport) has actually been suggested by the end (the reduction or elimination of distance between myself and Edinburgh). In order to achieve this type

'People use heuristics all the time in decision-making and problem-solving, often without realising that they are doing so.'

of suggestion, the computer program needs to know what type of operation can bring about changes in a particular aspect of the problem. In this case the particular aspect of the problem is distance, and the type of operation that can bring about a change of distance is the use of a mode of transport.

The problem of distance could be more complicated. I might be at home in London and want to be in the Caledonian Hotel in Edinburgh. One of the modes of transport suggested by means-end analysis is 'plane', but there are no regular flights from north-west London to the centre of Edinburgh, so I need to get to Heathrow airport to catch the plane in London and then I need to get from Turnhouse airport to the centre of Edinburgh. My original goal has now been split into three sub-goals: (1) get from home to Heathrow airport; (2) get from Heathrow to Turnhouse airport; and (3) get from

Turnhouse to the Caledonian Hotel. The first sub-goal might suggest taxi, car, underground train or bus. The second sub-goal has already been solved (since the sub-goal of getting from Heathrow to Turnhouse was prompted by the idea of travelling by plane). The third sub-goal might suggest taxi, car or bus. We can now see that the suggestion of travelling from London to Edinburgh by plane has given rise to 12 possible solutions:

- (1) Taxi to Heathrow, then plane, then taxi to the hotel;
- (2) Taxi to Heathrow, then plane, then bus to the hotel;
- (3) Taxi to Heathrow, then plane, then car to the hotel,

and so on. The program might be satisfied to find any solution (in which case it would be delighted to have 12 to choose from); or it might want to find an optimal or near-optimal solution, in which case it would evaluate each of these 12 possibilities with some kind of scoring function before deciding which one to adopt, perhaps based on time and/or cost.

The approach of trying to reduce the difference between the problem situation and the goal is one of the methods that can be applied in means-end analysis. An alternative method is to transform the problem situation into a different problem, in the hope that the new problem might be easier to solve than the original one.

Planning

The method of planning used by GPS was designed to construct a possible solution in general terms, prior to working out the details. The planning method works by first omitting some of the details of the original problem. This leads to a simpler problem, and when the simpler problem has been solved, the program can use the solution to the simpler problem as its model for finding a plan that solves the original problem.

This whole process is very much akin to the splitting up of goals into sub-goals, but with the important difference that here, there is no *guarantee* that a solution to the simplified



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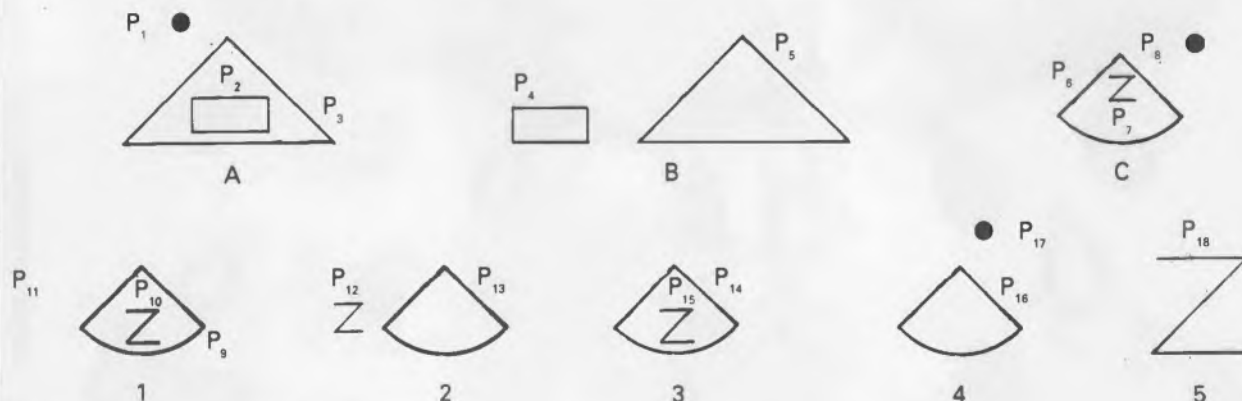


Fig 1 A geometric-analogy problem

problem will lead to a solution to the more complex problem. In contrast, the 'goal into sub-goals' approach does guarantee that achieving the sub-goals means achieving the original goal.

Geometric-analogy problems

In the early 1960s, Thomas Evans wrote a program called *Analogy* to solve problems of the form:

Shape A is to shape B as shape C is to shape ?

where the solver is offered a multiple choice of solution shapes. Problems of this type are often found in intelligence tests, so it's easy to argue that a computer program which achieves a high degree of speed and accuracy in such tests must clearly be intelligent. Fig 1 shows an example.

The first step taken by *Analogy* was to decompose each of the problem figures into sub-figures, so that (for example) figure A would be decomposed into a dot, a rectangle and a triangle.

Next, the sub-figures generated from the decomposition would be given to a routine which determined a specified set of properties of these sub-figures and the relationships between them. For example, one relationship in figure A might be that the rectangle lies inside the triangle, and this could be represented by an expression such as [rectangle INSIDE triangle].

The program now examines each appropriate pair of objects and determines what transformations exist that would convert one of the objects within the pair into the other one. For example, if a pair of objects consisted of

the transformation 'turn upside down' would convert the triangle on the left to the triangle on the right. This part of the program is, in fact, a pattern recognition routine which is able to determine the similarity between objects. When the similarity information has been computed for every appropriate pair of objects, both within a problem figure and between different figures, this information, together with the decomposition and relational information, is used to calculate the solution to the problem. We can see how the program 'thinks' by following part of its solution process on the above problem:

- (1) Figure A is decomposed into three parts, called P1, P2 and P3.
- (2) P2 is inside P3; P1 is above P2; P1 is above P3.
- (3) Figure B is decomposed into two parts, called P4 and P5.
- (4) P4 is to the left of P5.
- (5) Figure C is decomposed into three parts, called P6, P7 and P8.
- (6) P7 is inside P6; P8 is above P6; P8 is above P7.
- (7) P2 and P4 are the same shape and size and are orientated in the same way; P3 and P5 are the same shape and size and are orientated in the same way.

And so on.

The solving routine now matches the decomposed parts of figure A and figure B in all possible ways that are compatible with the similarity information, and it concludes that P2 is the same as P4, P3 is the same as P5, and P1 (the dot) is removed when going from figure A to figure B. On the basis of this matching, the program generates a statement which shows how figure A is transformed into figure B, such as:

REMOVE P1, TAKE P2 out of P3, MOVE P2 to the left of P3

The next stage is to match figure C with each of the five possible answers (figures 1, 2, 3, 4 and 5). Matchings are immediately rejected

if they do not correspond to the ones between figures A and B on the basis of parts added, removed and matched. (In this example, figures 1 and 5 are rejected, while figures 2, 3 and 4 are examined further.) The program then tests each of the remaining candidate solutions as follows.

Each step in the transformation process that converts figure A into figure B is applied to figure C, if appropriate, and the result is matched with the candidate solution. The purpose here is to find a step, or steps, which convert figure A into figure B and which also convert figure C into one, and only one, of figures 2, 3 and 4. In this particular example, all three steps are applicable to just one of the three remaining candidate solutions. If we remove P8 (the dot), we are left with the sector and the Z, which is true of both figure 2 and figure 3, but not figure 4. If we then take the Z out of the sector, we are still left with the sector and the Z, but they are related in a way which eliminates figure 3. The one remaining candidate solution is figure 2, and this possibility still remains after we carry out the third step of the convert process: move the Z to the left of the sector. The program now knows that figure 2 is the solution.

Symbolic integration

One of the most famous problem-solving programs of the 1960s was *SAINT* (Symbolic Automatic INTEGRator), written by James Slagle at the MIT (Massachusetts Institute of Technology). Despite being blind, Slagle has long been one of the world's leading experts in the field of heuristic programming and tree-searching, and, incidentally, is quite a strong chess player. His program was able to solve symbolic integration problems at the level of a good university student: running on an IBM 700 some 25 years ago, it took an average of two minutes to solve 52 out of



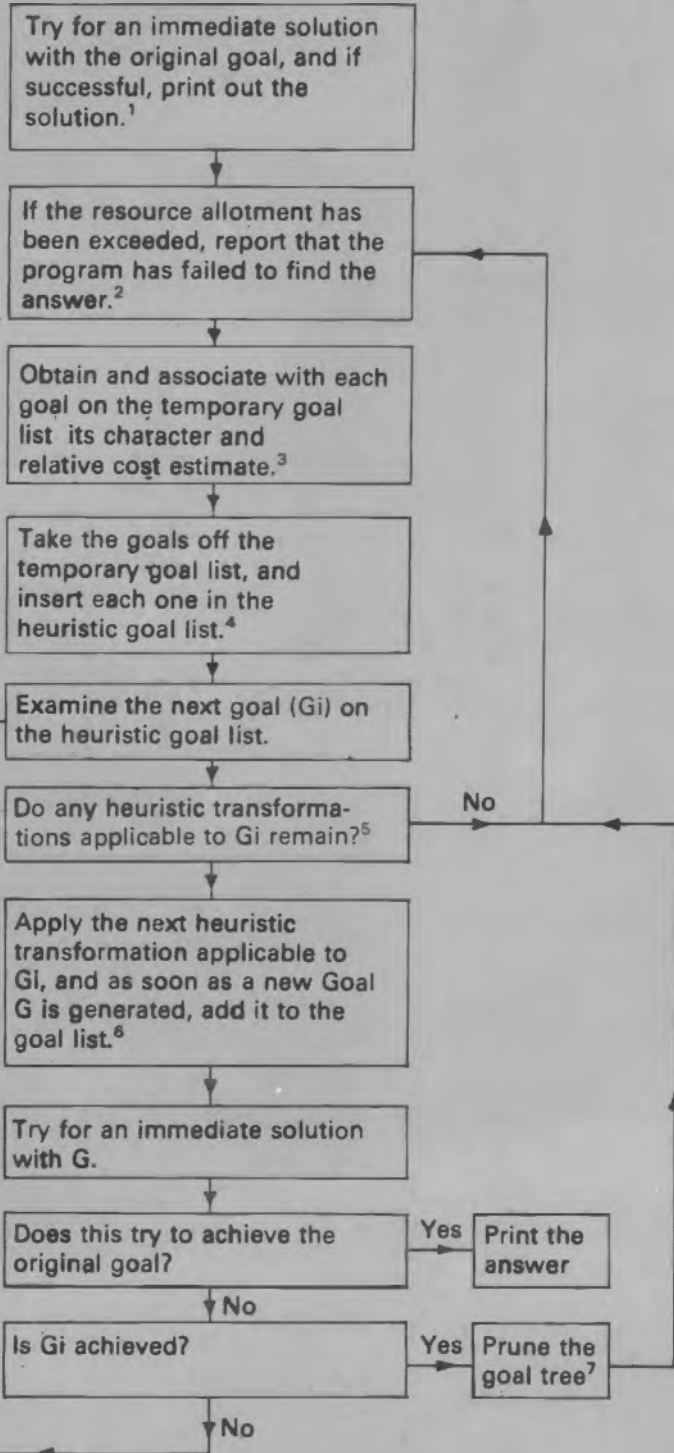


Fig 2 The program flow of SAINT

the 54 problems in the MIT calculus examination for first-year students. SAINT illustrates some of the concepts in problem-solving that have been mentioned earlier in this article, and I would strongly recommend the more serious reader to study Slagle's own paper (see 'Bibliography').

The program flow of SAINT is explained in Fig 2.

Problem-solving trees

The simplest way to represent any problem-solving process in a computer program is with a tree structure (such as that shown in Fig 3).

The root of this tree (the node at the top) represents the problem. The branches (P1, P2, P3...) which stem from this problem represent the various possibilities that the program can explore from the initial

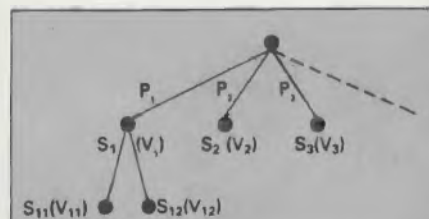


Fig 3 A simple problem-solving tree

problem situation. The nodes at the ends of these branches (S1, S2, S3, ...) represent the situations that arise when these various possibilities are tried. Each of these situations has a value (V1, V2, V3, ...), assigned by an evaluation function, which represents how near or far is the solution from the goal (the solution to the problem).

When the program starts out in its search for a solution to the problem, there are various aims that it may have in mind. The simplest aim is to find a solution to the problem — any solution. Or the program may wish to find the shortest solution — the one involving the smallest number of steps or actions. Or the aim may be to find the 'cheapest' solution or to find a solution as quickly as possible. By using a tree structure and by making some simple assumptions, any one of these aims may be satisfied (provided that a solution does exist).

In order to find a solution as quickly as possible, the program explores the tree by repeatedly examining the most likely-looking possibility. It starts by generating all the possibilities from the root of the tree, and then evaluating the resulting situations. It then chooses the situation with the best value (let's assume that this is situation S1, with value V1), and generates all the possibilities from that situation (which we denote by S11, S12, S13, ...), evaluating the resulting situations (the values are denoted by V11, V12, V13, ...).

The next stage is to choose the unexplored situation on the tree which has the best value — this might be one of the newly generated situations (S11, S12, ...) or it might be a situation which was already on the tree (S2, S3, ...). The program then explores all the possibilities from this new 'best' node, and so on. The process terminates when a newly created situation is found to have a value which indicates a solution to the original problem.

A simple example of this method can be seen in my attempts to get from my home to the centre of Edinburgh. The root of the tree would be 'at home'. The first possibilities that I explore might be: go to Euston station, go to Paddington station, go to King's Cross station, go to Heathrow airport, go to Gatwick airport, go to Dover harbour, and so on. The situations that arise after taking each of these steps would be: at Euston, at Paddington, at King's Cross, and so on, and my program would then need to evaluate each of these new situations. It would hopefully give the best scores to being at King's Cross, Heathrow and Gatwick, since each of these places is connected directly to Edinburgh by rail or air; whereas being at Paddington, Euston

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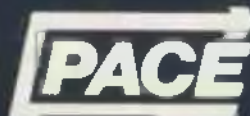
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or Dover would get worse values, since there are no direct connections to Edinburgh from any of these places.

The program would now consider my possibilities from (say) King's Cross, and would discover that one of them (taking a train to Edinburgh) has a better value than all the others (taking a train to Newcastle, taking a train to Cambridge, and so on). The new 'best' node would represent

the situation 'being at Waverly station in Edinburgh', and the program would then explore such possibilities as: walk towards the Caledonian hotel, take a bus in the direction of the Caledonian hotel, take a taxi to the Caledonian hotel, as well as a number of other less useful options (such as take a train back to King's Cross!). As soon as the program discovered, by evaluating its new situation, that I had arrived at the hotel, it

would know that it had found a solution to the original problem.

This method works well when the aim is to find a solution relatively quickly, but it's often the case that one wishes to find the best solution. (The word 'best' can mean cheapest or quickest, or it can satisfy some other criteria.)

If the program is required to find the shortest solution — that is, the one with the fewest steps, it will evaluate situations in such a way as to provide, instead of a merit value, an estimate of how many more steps from this particular situation will be required before a solution is found. The program can then determine which situation should be explored next, on the basis of the values:

number of steps so far + estimated number of future steps

This method is more likely to provide an efficient solution to the problem, but it can be improved upon still further. The steps in the solution process may not all have the same cost associated with them. My journey to the Caledonian Hotel in Edinburgh can be split into three steps: travel to an airport or railway station in London; travel to an airport or station in Edinburgh; and travel from the airport or station in Edinburgh to the hotel. Associated with each of the possibilities at each step there may be a different cost, either in terms of money, or time, or some other commodity. In order to minimise the total cost of the solution, the program modifies its strategy so that it always explores the situation for which (cost of getting to this situation + estimated cost of finding a solution from this situation) is a minimum. The cost of getting to a situation should already be known when the program creates that situation on its tree, and the estimated cost of reaching a solution from that point can be provided by the evaluation function.

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Notes on Fig 2

(1) The program's goal is to perform the integration of the original expression. Whenever a new goal is generated, the program tries to achieve it at once using straightforward methods, and if it is successful, it then tries to achieve the original goal.

(2) The 'resource allotment' is the amount of workspace available. The program keeps track of how much memory it has at its disposal for further attempts at solution, and if memory is exhausted before a solution is found, SAINT reports that it cannot solve the problem.

(3) Any new goal which is not a 'standard form' and not amenable to an 'algorithm-like transformation' is added to a temporary goal list. If the integrand of a newly generated goal is of a 'standard form', that goal can immediately be achieved by substitution. For example, one of the 26 standard forms used by SAINT is:

$$c^x dv = c^x / \ln c$$

and so if $2^x dx$ were to appear as a new goal on the list, this goal would be achieved by substituting 2 for c and x for v , leading to the solution of $2^x / \ln 2$ for this particular goal. If an integrand is not of a standard form, it is tested to see whether it can be transformed into a goal which is more easily achievable.

(4) The heuristic goal list is a list of goals which require heuristic transformations, and is sorted in order of increasing effort requirement. When a goal is taken off the temporary goal list the program obtains its 'character', which is an ordered list of features of characteristics. These features might be useful in measuring or estimating the cost of attempting to achieve this particular goal.

SAINT employs 11 features, including the function type (algebraic function, function of sines and cosines, and so on), and the 'depth' of the function. The depth of an integrand is the maximum level of function composition which occurs in the expression, for example:

x is of depth 0
 x^2 is of depth 1
 e^x is of depth 2
 xe^x is of depth 3

This gives a crude measure of the difficulty of the problem and allows goals to be added to the heuristic goal list according to their relative cost estimate (cheapest first). If no goals remain on the heuristic goal list, report that the program has failed to find the answer.

(5) A transformation of a goal is called heuristic if it isn't certain whether or not it's an appropriate next step. SAINT employed 10 types of plausible transformations.

(6) The original goal is made the first member of the goal list, and then new goals or sub-goals are added from time to time.

(7) There are two types of relationships between goals that affect the significance of the goals. It may be the case that two or more goals *all* need to be achieved in order to achieve some higher goal — this is an 'AND' relationship. Or it may be sufficient to achieve *any one* of a set of goals — this is an OR relationship. From these two basic relationships it's possible to build up more complex relationships, for example: the problem is solved if goal 1 AND (goal 2 OR goal 3) are achieved. Whenever a goal has been achieved, the program removes certain closely related goals from the lists. These are goals which have also been achieved as a direct result of this new achievement, or they are goals which no longer need to be achieved (OR goals).

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If you use a micro and are considering subscribing to an electronic mail service such as Telecom Gold or Easylink, the chances are you will have been told that all you need is a modem and a phone line.

Strictly speaking, of course, that's true, but, by and large, you'll find that to make things work, you may need some hard- and software no-one has told you about, together with a good helping of expertise.

There's a daisy-chain of things that have to work together perfectly for electronic mail and bulletin boards to work successfully: starting with word processing software, it progresses via terminal software, an RS232C board (on most micros still an add-on!), a modem cable, a modem and, last but not least, a BT socket properly wired for modem use. Apart from this, you may also need a good, clean telephone line — not always easy to come by. Many BT areas still have old electro-mechanical exchanges, whose rotary relays induce tons of noise, making packet switching networking (PSS) less than a delight. Don't forget: Britain is one of the very few countries where local calls are charged on a time-related basis, so you pay for every unsuccessful datacall!

WP software

What word processing package should you use? I've had some experience with less-than-compatible software recently, and must caution the buyer that many word processors create files that won't transmit. The reason is that British Telecom's Packet Switching Network (as well as services you can dial direct) only accepts discrete packets of data — typically, a maximum of 255 characters is what you can expect to go through in one go, provided that the mailbox or PSS node is set up properly.

To achieve proper handshaking on BT's PSS, set your terminal protocol for 'XON/XOFF' and use 'SP' as your terminal identifier, while Mercury (and other services such as Tymnet in the US and Dabas in Holland) will want both a [CTRL]R and a [CTRL]X entered before the user name. Don't

do this and you'll lose data, either way!

Consequently, some word processing software is out since it creates 'endless' lines — that is, the word-wrap you see on your screen is for display purposes only and does not consist of actual carriage return characters in your file. This includes Xywrite (Xyquest), Multimate (Multimate Corp) and Tandy's Deskmate (and without doubt many others I've not used), unless they're used with terminal software that 'wraps' as packets go out. The only such package I've found is MCI Mail Access, which is sold by MCI Digital Information Services Corp in Washington, DC to its subscribers — Access lets you set the required line length prior to sending, runs on the IBM PC and compatibles, and costs \$49.95.

If you're lucky enough to be able to dial directly into your electronic mail system, this may wrap for you — Telecom Gold does, provided your mailbox is set up properly with the PARAM.INI command file, which tells the system what type of terminal you use.

(I should, at this stage, explain something that had me confused for a long time: the computer industry considers the visual display unit and the monitor software a 'terminal'. This means that when you set up your system for electronic mail, you have to decide which part of it you want to designate 'terminal' — this can be your screen, but also your RAM memory or printer. After all, when downloading data to be printed, it doesn't matter if you don't get it all on your screen if your printer can handle 165 characters per line!)

But if you have to use a PSS, it is a good idea to examine a textfile created by your favourite word processor for line breaks — on MS-DOS and CP/M systems, just use the TYPE command at the A-prompt — and if there are no visible CRs or CR/LF pairs, your chosen package may be less than ideal for electronic mail.

Apart from some cheap-and-cheerful text editors, WordStar produces files ideal for email, although you do have to watch out for dot

commands and control codes. Control codes are generally high-order characters, and these aren't accepted by packet switching services: they often even throw you off the node or lock up your modem. Some terminal software (Crosstalk and Smartcom are good examples) allows you to strip out the high-order characters, to ensure nothing goes wrong.

Word processing commands are another matter. Multimate creates a large block of file identification and formatting data right at the start of the textfile, which throw PSS all over the place, while WordStar's dot commands try and tell Telecom Gold things it doesn't understand — Gold also uses dot commands in both 'MAIL' and 'EDITOR' modes. Xywrite files run fine on either system, but they arrive minus some codes.

If you must use any of these software packages and you don't have a sophisticated 'comms' package, there is one solution, though it isn't very elegant: convert all troublesome characters and codes to something acceptable, and convert them back at the other end. A simple Basic program will suffice — the listing shown here (Fig 1) comes from MCI Mail, which has had the same problem as me. Originally, this program was intended for Xywrite/MCI conversion, but I've altered it so you can specify yourself what characters are to be replaced. It's not copyrighted and is in the public domain.

Obviously, the character replace functions available in some terminal packages are best — I've seen them featured in Crosstalk (Microstuf), Smartcom (now that Hayes is on the UK market) and Ascom (Dynamic Microprocessor Associates), but I'm sure there are others. Ideally, they should enable you to replace any character with any other, so you can replace all periods, for instance, with a little-used character such as '^', always making sure your recipient does the same thing. It would be even nicer if Telecom Gold were to provide a different command character — MCI Mail, for instance, has adopted the oblique stroke, which is certainly less often used by word processing software. Why not pro-


```

40 PRINT " "
50 PRINT "WOULD YOU LIKE TO:"
60 PRINT "          1 "CHR$(15);" CONVERT TO EMAIL FORMAT"
70 PRINT "          2 "CHR$(15);" CONVERT FROM EMAIL FORMAT"
80 PRINT "          3 "CHR$(15);" END"
85 PRINT " "
90 INPUT "PLEASE ENTER 1-3":L
95 IF L = 3, THEN SYSTEM
100 IF L < 1, THEN GOTO 50
110 IF L > 3, THEN GOTO 50
120 PRINT " "
130 INPUT "What is the name of the file to be CONVERTED":FFILES
133 PRINT " "
135 ON ERROR GOTO 170
140 OPEN FFILES$ FOR INPUT AS #3
150 GOTO 190
170 PRINT " "
171 PRINT CHR$(15);" FILE DOES NOT EXIST, PLEASE CHECK"
172 PRINT CHR$(7)
173 PRINT " "
180 RESUME 130
190 INPUT "What will the name of the CONVERTED FILE be ":OFILES
200 OPEN "B:TTEMP.TXT" FOR OUTPUT AS #2
210 IF EOF(3) THEN GOTO 500
220 LINE INPUT #3,B$
230 N = LEN(B$)
240 C$ = ""
250 IF L = 2, THEN GOTO 370
260 FOR I = 1 TO N
265 REM ENTER CHARACTER STRINGS TO BE CONVERTED BY ASCII NUMBER
270 IF MID$(B$,I,1) = CHR$(174), THEN GOTO 310
280 IF MID$(B$,I,1) = CHR$(175), THEN GOTO 330
290 C$ = C$ + MID$(B$,I,1)
300 GOTO 350
310 C$ = C$ + "<<"
320 GOTO 350
330 C$ = C$ + ">>"
350 NEXT
360 IF L = 1, THEN GOTO 480
370 FOR I = 1 TO N-1
380 IF MID$(B$,I,2) = ">>", THEN GOTO 440
390 IF MID$(B$,I,2) = "<<", THEN GOTO 420
400 C$ = C$ + MID$(B$,I,1)
410 GOTO 460
420 C$ = C$ + CHR$(174)
430 GOTO 450
440 C$ = C$ + CHR$(175)
450 I = I + 1
460 NEXT
470 IF MID$(B$,I,N) <> ">", THEN C$ = C$ + MID$(B$,I,N)
480 PRINT #2,C$
490 GOTO 210
500 CLOSE #2,3
501 ON ERROR GOTO 540
510 NAME "B:TTEMP.TXT" AS OFILE$
511 PRINT CHR$(12)
530 GOTO 50
540 PRINT " "
544 PRINT CHR$(7)
545 PRINT CHR$(15);" ERROR - OUTPUT FILE ALREADY EXISTS"
546 PRINT " "
550 INPUT "DO YOU WISH TO OVER-WRITE (Y OR N)":D$
560 IF MID$(D$,1,1) = "Y", THEN GOTO 590
570 IF MID$(D$,1,1) = "N", THEN GOTO 590
580 INPUT "WHAT WILL BE THE NAME OF THE CONVERTED FILE ":OFILES
581 RESUME 510
590 KILL OFILE$
600 GOTO 510
610 END

```

Fig 1 Conversion program

vide a routine to let you set your own?

Modems

Once you've sorted all this out, and are satisfied with your hard- and software set-up, it's time to have another look at modems. British Telecom is hoping to have a V22bis (2400-baud full duplex) PSS node available by Spring 1987, and good

news that is too. The majority of users still access both PSS and Telecom Gold on 300-baud, but the availability of 1200-baud modems is likely to bring about some rapid changes, so I've begun to take a serious look at modems which can handle both 1200 and 2400 bits per second, with a leased line/telephone voice line (PSTN) choice.

A lot can go wrong on 300 baud

without your noticing it — it's a safe speed. It is a scroll speed you can comfortably read at, and whether or not you're echoing to disk or RAM, your hardware will not normally require a lot of fast handshaking — your computer telling the PSS multiplexer to 'hold it' because it can't keep up, or vice versa.

Not so on 1200 and 2400 baud — at this clip, even some slow screen monitors on older 8-bit hardware cause problems, and unless processor handshaking is very well implemented, with any and all internal maintenance, bank or sector switching or screen refreshment resulting in your micro sending a quick 'XOFF' to the multiplexer buffer, while having enough buffer itself to capture what arrives between your XOFF and the multiplexer's subsequent halting of the datastream, you've got a problem.

Modems have a lot of converting to do, and this takes time. Though this can generally be measured in milliseconds, at 1200 baud and up, this can result in all sorts of unpleasantness.

One of the simple but effective error-checking protocols calls for a check on the presence of a CR/LF pair coming back from the host system or multiplexer buffer while transmitting (equally needing something like WordStar to originate files with CRs). Once a CR/LF has been transmitted, the software holds its own output until the host has echoed the carriage return before sending the next line.

Ok, it's not Xmodem but it works well and provides a reasonable amount of making sure your text gets there in one piece. Unless, of course, your system doesn't handshake properly. It will lose bits of data time and again, and chances are that somewhere in those bits is a CR/LF pair. Since your system has sent a pair, it will now wait until it receives the echo, but since this 'got lost' in the abortive handshake, the host waits for the next line and the terminal for the echo — you're hung. Though this is extremely irritating for the user, it's actually a cheap check on errors — it doesn't slow transmission down terribly and still signals you if something's gone badly wrong, though it will pass up the odd missing character.

Don't fool yourself, though — if you have a lot of data going across, a high-speed modem will eventually save you money. I've tested two British dual-speed modems, the Racal V12422S and British Telecom's Datel 4242X. Both are essentially 2400-baud modems with both leased line and (PSTN) telephone line facilities, and feature 1200 baud as 'fallback' speed. The Racal will also let you use 300 baud, though not switching automatically from 2400/1200 to 300. The

snag is, of course, that both modems cost around £900.

The Racal V12422S is the most sophisticated modem I have ever used. It can (not *must*) be fully software-controlled and all its functions and internal switches can be soft-set. It has a nice, large program memory, which can even contain log-on sequences, and can be password protected — ideal for running bulletin boards and the like, since it can be set remotely as well as locally.

The V12422S works perfectly, though I do have some points of criticism: the casing is somewhat flimsy, and the memory has a bug in it — some numbers, once stored, can't be erased, though this will not inhibit its functioning. Here again, this didn't just happen to me — the shops that stock it have the same problem. Racal's operation in Florida, which is where the company manufactures most of its boards, is losing money and has had to lay off personnel.

Does one need all this sophistication? My answer would be: not really! Now that we have Crosstalk, Smartcom and a host of other terminal software packages, modem settings, numbers and log-on sequences can be stored on disk, where they don't require half a computer inside the modem. I'm also not sure that I like the soft-setting of function switches: it's too easy for these settings to be corrupted by power surges and the like, apart from the fact that having all the 'sensitive' data on disk provides extra security.

My alternative would be British Telecom's Datel 4242X. It doesn't feature 300 baud, but it does include all the other facilities mentioned above, except for the memory and the soft switches. There's a bunch of ordinary DIP switches inside the sturdy aluminium casing, and it has press buttons on its vertical face (rather than touch switches on a sloping face, as with the Racal — they're all too easy to depress accidentally). It also has a built-in power unit, which solves the problem of *where-to-stick-it*, and it features a built-in error-correction protocol although this only works between 4242Xs. Racal, too, has built error correction in; this time with the Microcom Networking Protocol, which is software-dependent.

Somehow, the BT modem has a better 'feel' to it. It just auto-dials and leaves the rest to your software, but then, if you can afford to pay £900 for a modem, you're probably also able to spend a few bob on your terminal package. I should mention that BT also rents it out, if you're not looking to buy — after you've paid the bulk of the purchase price, the rental

comes down to a token amount.

Also: your local BT engineer will set the system up for you, closely followed by two more BT chaps with a Tektronix modem tester. This generally means that you have a chance to test hard- and software, modem and electronic mail system together, and that is definitely a service most shops don't provide!

Both modems will auto-dial and auto-answer, and all essential functions are DTE-controlled. They return error-codes for 'engaged' and 'busy' tones, and can be set for touch tone, which BT calls MFT for multi-frequency-tone dialling. Not that that's much use, because it'll only give a speed advantage when dialling other numbers in the same exchange (least of all, until BT has installed its System X in all exchanges in the UK, which will be a while yet). Well, so far, for Guy Kewney (who's on my exchange) and myself it means that we can dial our local police station, and each other, faster than we can dial 999!

(Should you have problems with your telephone lines or BT equipment, BT now offers special teams for help and guidance. Modem and PSS users can ring Freefone Special Services, where advice is given, and if need be you'll get a special telephone number to ring a specialist team direct. Then there is the Noise Action Group, a specialist team whose services you can request when you have line problems and your local BT area can't help. Just ask for EM1.1.)

Comms software

It all depends, of course, but there are a few very helpful software packages and hardware items that can help make comms easier. My personal experience is that the modem is possibly the most important link in the chain. Apart from anything else, many modems do not reach their advertised speeds, and the faster modems give a significant reduction in access time and, therefore, reduce bills. Besides, a leased line is cheaper than you think (although both BT and Mercury quote horrifying waiting times) and a 2400 baud dial-up is just around the corner.

By and large, WordStar is a 'safe' package to generate files for electronic mail purposes. If you take care to print your files to disk before sending, dot commands won't be a problem either! In combination with Microstuff's Crosstalk, WordStar is unbeatable, since Crosstalk will let you set up your micro to answer the phone, and has clear and concise instructions for its character replace functions.

It is otherwise a sophisticated and

versatile 'communicator', relatively easy to set up and compatible with just about any modem and data service. I say 'relatively easy' advisedly, since the plethora of functions and possibilities make it impossible to simply load and tap away. At least Crosstalk provides a help file at just about any level, especially useful if you don't know where in the manual you are (and believe me, that happens...)

My favourite multi-function package is Tandy's Deskmate, which is now available for the IBM PC. It had to be converted since Tandy uses more function keys than IBM does, and I hope that the new UK version is better debugged than mine (from Fort Worth, and written for the PC/AT — it still refers to function key 12 — of 10!). I've not tested this PC version, but all versions (PC, PC/AT, Tandy's 1000/2000/1200HD) are similar: containing a text editor, spreadsheet, filer, scheduler with alarm, communications software and message area. It's a snip at £90.85 (including VAT).

In effect, you can use Deskmate to create your own mini-Telecom Gold, and if you're using a larger PC with, say, half a megabyte of memory and a hard disk, you're not even very mini any more, though this runs best with the special hard-disk version of Deskmate, which I haven't yet seen. One thing it doesn't do is create 'wrapped' lines, so you can't use it if your host system doesn't wrap for you. (That is, unless you can get PSS to do this for you — it is supposed to be capable of wrapping automatically, but I have been unable to activate the setting.)

Value for money?

Telecommuting, in whatever form, is fun, and can be quite a powerful tool. But we've been fooled (by BT) into thinking it is cheap, too, and that is the understatement of the century!

Only with good software and modems, decent telephone lines and well-supported data services can you use electronic mail to its full advantage, and then you'd better spend a lot of time understanding how it works. The French PTT may be putting free terminals into subscribers' homes, but there's one thing you can't give away: user dedication, of which we seem to have a lot these days. It can't be a coincidence that BT has recently bought IT's Dialcom, which is the US Corporation that owns the rights to Telecom Gold. Worldwide, Telecom Gold vies with CompuServe for the first place in electronic mail provision, while it is now the world's largest Dialcom licensee.

END

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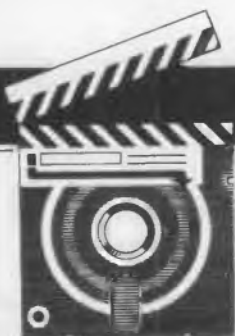


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SDS Modula-2

SDS Modula-2 is a complete, practical system for the creation of commercial-quality applications, and is claimed to provide a 'true programming environment'. Nick Walker tests its capabilities.

Ask any programmer which factors influence their choice of programming language, and the chances are that at least one of the following will be included in the reply: how much the language costs; whether learning the language will further a career; how easy it is to learn; how popular it is; and other factors quite unrelated to the language's basic structure. Rarely is the most dominant factor how suitable the language is for express-

ing the problem to be solved.

Niklaus Wirth, the Swiss guru of structured programming, has long been an advocate of finding efficient and understandable notations for the expression of computer programs. To this end he created Pascal, a language for use within educational establishments which is excellent for the succinct programming of algorithms. So successful was Pascal that it broke out of its academic birth-

place and made inroads into industry, despite a number of deficiencies when used for the creation of commercial applications.

Currently in vogue for the creation of large 'real' applications is C, a language which owes its structure to Pascal but also gives the kind of low-level hardware access that Pascal lacks. However, C source code is often incomprehensible even to experienced C programmers.

Modula-2 is Wirth's latest creation, in which he has attempted to create a language that updates the failings of Pascal and adds the features needed to create large (real) applications. Enough has been said about the advantages of Modula-2 (see PCW July), so I'll just briefly re-cap here on what I see as the major benefits of using Modula-2.

Modula-2

Modula-2, as its name implies, allows the creation of individual modules which can be separately compiled. The programmer of a module has strict control over the elements of that module which can be accessed from other modules. This is ideal for multi-programmer environments, and allows single programmers to exercise discipline over the individual components of their programs. Modula-2 is a 'superset' of Pascal: it retains Pascal's structure but corrects the operational problems that have plagued Pascal programmers over the years. There are signs that a standard will be defined for Modula-2 by the BSI, despite Wirth's supposed lack of interest in such standards. Modula-2 incorporates facilities for real-time and multi-tasking applications —

ASCII — provides ISO-standard names for ASCII control characters
Utility — provides constants which show how bytes are mapped onto 16- and 32-bit words
ByteStr — supplies routines to perform standard operations on byte strings very quickly
DOSCALL — accesses MS-DOS functions
Files — standard stream I/O modules for SDS Modula-2. Provides stream-orientated access to PC's disk files, keyboard and display
Geometry — provides abstract data-types and procedures which help to specify and solve geometric problems, especially those related to graphics
InOut — provides a device — and system-independent means to read and write numbers and strings
MathLib0 — a library of floating point functions
MS-DOS — implements disk file streams
NumConv — converts CARDINALs, INTEGERs and LONGINTs to STRINGs, and vice versa
Program — supports overlays and overlay calls
RealConv — converts real numbers to strings and vice versa
Screen — supports the PC display directly
ShellVars — gives access to both the environment variables created by the MS-DOS SET command and to command line arguments
Sound — gives access to the PC's sound capability
Storage — exports routines for allocating and disposing of memory from the heap
String — exports procedures for performing various operations on STRINGs
TermDrv — implements a TTY-like access stream to the PC device screen and keyboard
Terminal — provides access to the PC keyboard and screen in a stand-alone module

Fig 1 The standard library modules included with SDS Modula-2

both increasingly important areas of computing.

The success of Modula-2 now lies in the hands of the compiler manufacturers and the standards groups such as the BSI. In the current micro world this means ultimately producing a good compiler for the IBM PC and its many clones. SDS Modula-2 was the first IBM PC Modula-2 compiler to reach this office, and SDS-XP is an extended version which includes tools to assist in program development. It is SDS-XP that I shall review here.

Although it isn't stated in the manual, the minimum configuration needed to run SDS Modula-2 is a 256k RAM IBM PC with two floppy disk drives. However, as Modula 2 generates a lot of files, a hard disk is really needed to get the most out of it. For serious program development I'd recommend a full-blown 640k RAM system, at least 20Mbytes of hard disk and preferably a go-faster processor.

To quote the current marketing jargon, SDS is claimed to be a 'complete programming environment'. Installation is simple — it's just a matter of copying the files across to a hard disk or floppies (happily, the SDS is not copy-protected).

Running SDS results in a 'desk-top' screen, mostly shading with a menu-bar running across the top. A simple text-only windowing system operates upon this desk-top, and is driven mainly by the Tab and function keys.

Function key F3 activates the pull-down menus which are labelled, from left to right: Desk, File, Tools, Edit and Controls. The cursor keys move you across the menu bar and through the items of any one menu, and Return performs the operation selected.

The Desk menu contains four 'desk accessories' which are deemed useful for programmers: a calculator, an ASCII table, a clock and a Help function. The File menu gives you all the necessary file manipulation; Tools controls the compiler and linker functions; Edit is the 'cut and paste' menu relevant to editing source code; and Controls gives window manipulation.

I found the desk-top a little awkward to use at times, as there seemed to be no consistency between which functions were accessed from the menu bar and which functions were accessed from the function keys. Having said that, this desk-top is far easier to use than the heavyweight compilers that are driven from the MS-DOS prompt.

Before going on to examine the compiler in detail, I should mention the first window you'll come into contact with. This is known as the 'Library shelf', and its function is to aid you in organising your Modula-2 modules into separate, distinct libraries.

Integer Operations:

```
BEGIN
  x:=13, y:=2, i:=0, z:=0
  Write ('S')
  REPEAT
    z:=y          (* Assignment *)
    z:=x+y        (* Addition *)
    z:=x-y        (* Subtraction *)
    z:=x*y        (* Multiplication *)
    z:=x/y        (* Division *)
    z:=x MOD y     (* Modulus *)
  UNTIL i=1000
  Write ('E')
END
```

Floating-point operations:

```
BEGIN
  x:=13.75, y:=0.75, i:=0, z:=0
  Write ('S')
  REPEAT
    z:=y          (* Assignment *)
    z:=x+y        (* Addition *)
    z:=x-y        (* Subtraction *)
    z:=x*y        (* Multiplication *)
    z:=x/y        (* Division *)
    z:=Sin(y)     (* Sine *)
    z:=Cos(y)     (* Cosine *)
    z:=Arctan(y)  (* Arctan *)
    z:=ln(y)      (* Natural logarithm *)
  UNTIL i = 1000
  Write ('E')
END
```

Screen operations (Text)

```
BEGIN
  i:=0
  Write ('S')
  REPEAT
    Write(i)
    Write ('1234567890qwertyuiop')
  UNTIL i=1000
  Write ('E')
END
```

Screen operations (Graphics)

```
BEGIN
  i:=0
  Write ('S')
  REPEAT
    FOR x=0 TO 100 DO
      FOR y=0 TO 100 DO
        PlotPixel(x,y)
      END
    END
    ClearScreen()
  UNTIL i=1000
END
```

Disk access speed.

```
BEGIN
  i:=0
  Write ('S')
  Create(Outfile)      (* Create new file *)
  Open(Outfile)        (* Open file for output *)
  REPEAT
    Write("1234567890", Outfile) (* Write Records *)
  UNTIL i=1000
  Close(Outfile)       (* Close file *)
END
```

Fig 2 Pseudo-code Benchmarks

ies. By carefully selecting which libraries are on the shelf at any time, you can significantly speed up development time and discipline yourself into only using modules of a certain group.

The editor/compiler

The editor and compiler of SDS Modula-2 are so intrinsically combined that it would be impossible to consider them individually. Experi-



enced programmers used to a traditional high-powered text editor will be in for a real shock upon entering the SDS editor. This is a syntax-directed editor, which means that it knows all the valid language constructions of Modula-2 and will create an outline of any one of them with a single keystroke. All that's then needed is for the variable elements to be filled in. This is the *only* way to enter programs using this editor: trying to enter straight text will result in nothing more than a series of infuriating little beeps.

Creating a new module will result in a skeletal outline containing the opening module statement and the 'BEGIN' and 'END' which delimit a module. Tab and Shift Tab are the keys which are most often used to move you around within a module, with the cursor keys giving longer-range movements. After the correct place has been found, a statement, or definition, is generated by the 'Alt' key in conjunction with a single alpha character. For example, if you type 'Alt F' while in the body of a module, you would generate the following characters on the screen:

```
FOR < id > = < expr > TO < expr >  
DO  
END;
```

You then use the Tab keys to step through the statement, replacing anything enclosed in angled brackets with the necessary information. All the statements generated in this way use a form of meta-language which will be familiar to most programmers of high-level structured languages. The designers of this editor have tried to keep the alpha character used to generate a statement relevant: 'Alt V' for a variable declaration; 'Alt W' for a While statement; and so on. For statements which have more than one form, 'Alt X' will transform them into other forms. For example, 'Alt X' applied to a FOR statement (as shown above) will be:

```
FOR < id > = < expr > TO  
< expr > BY < expr > DO  
END;
```

The only statements, which fall foul of this method of generation are comments which can only be generated on a line of their own. This prevents you from putting little meaningful comments on the same line as code and 'commenting-out' machine code — both good programming practices.

Overall I had mixed feelings about this editor. The advantages are undeniable — you'll never forget a semi-colon or misspell a keyword, and in terms of keystrokes it considerably reduces the amount of typing. However, initially it can be very frustrating and difficult to use. If you are

a two-fingered typist like me, I recommend that you stick with it — after a week's use, it starts to pay off. Happily there is a facility for the import of straight ASCII, so you can use a standard text editor. A similar facility exports text from the SDS editor to a standard ASCII file, which, incidentally, seems to be the only way of obtaining a printout.

The only 'normal' editing features which have been retained are the 'search and replace' and 'cut and paste' facilities, both of which are

'Whatever the merits of the SDS editor from the user's point of view, there's a definite advantage for the compiler writers.'

accessed from the Edit pull-down menu. One particularly nice aspect of these commands is the grouping function which operates automatically on blocks of text, all at the same level of indentation.

Whatever the merits of the SDS editor from the user's point of view, there's a definite advantage for the compiler writers. The most time-consuming, and usually the most complex, aspect of compiler-writing is the parsing. This is the process of recognising and turning the strings of characters that make up the source code into symbols, keywords, variables, numbers, and so on. As the SDS editor generates statements which are guaranteed to be syntactically correct, it's possible to do this part of the compiling process as the editor is in use. This technique is called incremental compiling and is particularly suited to interactive programming environments such as micros.

In normal use this incremental compiling is concealed; the only exception being when importing ASCII files where it's obvious that more than just file loading is taking place.

Another problem is that the editor will log the last 20 errors of a file which has been imported in this manner, so importing a file with many errors can turn out to be a

tedious business.

The peculiar keystroke combination 'Ctrl/', when typed in the editor, sets off the rest of the compiling process and, as a lot of the compiling has already been done, it really flies. My own experiment with a standard IBM PC suggests that around 40 lines of Modula-2 is turned into object code every five seconds. This is somewhat slower than the 100 lines claimed by SDS, but then the company doesn't state which machine was used. Even so, it compares favourably with the competition.

A number of compiler options are available before running the final compilation, including stack-check, range-check, arithmetic-check, 8087/80287 maths chip support, and background compiling (not yet working). The background compile function, when it comes into operation, is a tribute to the multi-tasking commands within Modula-2, as the SDS compiler is itself written in Modula-2.

Twenty-seven libraries of useful modules are included with the SDS system, including all the Wirth-defined modules used to give a set of standard I/O commands. More usefully, there is a good collection of 'link-and-run' modules of calls to the MS-DOS operating system and to the IBM's sound and graphics capabilities. The full list of modules is shown in Fig 1.

One final, small-but-significant, feature of the compiler is that it has the ability to accept machine code as part of a module. This is very useful, as with micros there's always going to be the occasional time when it's necessary to go down to assembler level and twiddle the bits from there.

The linker

SDS Modula-2 may combine the functions of an editor and a compiler, but it does keep the linker as a stand-alone function. The linker's function is to combine all the object code from separate modules into one large runnable file (.EXE file). A sign of the suitability of the SDS system for the creation of large applications is given by the ability of this linker to produce overlays (.OVY files). Overlays are necessary when the total object code exceeds the 640k maximum of an IBM PC.

I am reliably informed that the linker is normally the biggest bottleneck in the turnaround of a Modula-2 program. This is true of the SDS Modula-2, but not drastically so when compared with the linker of other languages on the PC. The linker looks sequentially through the libraries on the shelf so ensuring that only those libraries' references are on the shelf and that they are sens-

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ibly ordered, resulting in faster linking.

Keeping a program up-to-date in a multi-programmer environment has always been a problem, as it's difficult to keep track of which modules have been changed since the last compilation. The SDS linker goes some way to avoiding this by checking the creation date of all imported modules. Any inconsistency results in a 'version error', and although the linker continues to run, no object code is produced. However, it's still very much up to the user to keep a list of modules that need to be compiled.

One wonderful program included with the extended SDS-XP will solve these problems by automatically re-compiling modules that have changed, providing you keep the system's date and time correct. This program, more than any other aspect of the SDS system, allows Interactive Technology to call SDS a true programming environment. It's also fascinating to watch it in action.

The run-time debugger

A specially-designed run-time debugger is available for SDS Modula-2 at extra cost. This debugger is particularly interesting because it's obvious that it, too, was written in Modula-2. By making the features of the debugger separate modules, it's possible to only import those features you require. It also gives the user the unique ability to write his/her own debugger commands in Modula-2.

The debugger creates two processes: one to create and catch breakpoints; and a second to act as a command-line processor when a breakpoint occurs. All the usual debugger features are available from this command, including single-step execution, disassembler, global and stack data display, heap display, and module procedure tables.

In use

It has long been a desire of mine to create a set of Benchmarks which are not language-specific and which more accurately reflect the kind of operations a micro might spend its life performing. PCW's own Benchmarks, while setting a standard that has been maintained for years, are growing long in the tooth; many machines are not now offering Basic in ROM, and qualities which these Benchmarks test can hardly be said to be relevant to the day-to-day operation of modern micros.

Having no Benchmarks available for Modula-2, I took this as an opportunity to make a start on the creation of my own Benchmarks. I should stress that they are very much in

embryonic form, and any input which readers would like to submit on how they could be improved would be gratefully received. There are two basic rules: keep the Benchmarks as short as possible; and ensure they are capable of running on practically any micro.

It may be argued that having to state both the language and the machine used to run these Benchmarks will complicate the process of Benchmarking — I can only agree. However, I feel that in many inst-

'Modula-2 scores strongly on ease of use, the inclusion of run-time libraries, and it conforms to a definite standard.'

ances, the current PCW Benchmarks are qualified by the version of Basic which is being used to run them. Hopefully, with these new tests, it will not only be possible to compare machines, but also different languages on the same machine and the same version of a language running on different machines.

At the moment there are five Benchmarks, testing integer arithmetic, real arithmetic, screen access times for text, screen access time for graphics, and disk access time. The relevant heavily C-influenced pseudocode is shown in Fig 2. The Benchmarks are not intended to perform a full test on any of these functions — they just give an indication of performance. At a later stage I intend to add an array creation test and an access time test.

The results for SDS Modula-2 running on a standard IBM PC are

Integer arithmetic:	2.1secs
Real arithmetic:	20.9secs
Screen (text):	45.3secs
Screen (graphics):	127.8secs

Fig 3 SDS Modula-2 Benchmark results

shown in Fig 3. Not only did I not have time to create an array test, but neither did I have time to properly test any other language. However, from my brief experiments, SDS Modula-2 looks about average when compared to rivals such as Turbo Pascal and Living C; it's certainly not outstanding.

Documentation

A 240-page manual is supplied with the SDS-XP system which attempts to be a tutorial for the absolute beginner and the seasoned Pascal programmer, and a reference manual. On the whole it succeeds very well, with the possible exception that the reference manual may not go far enough. It's certainly a change from the heavy user manual/reference manual approach which is so drily written that it takes half a day to create a 'Hello World' program. With SDS-XP I had an EXE 'Hello World' within 15 minutes, and that would have been faster if it hadn't been for the peculiar editor.

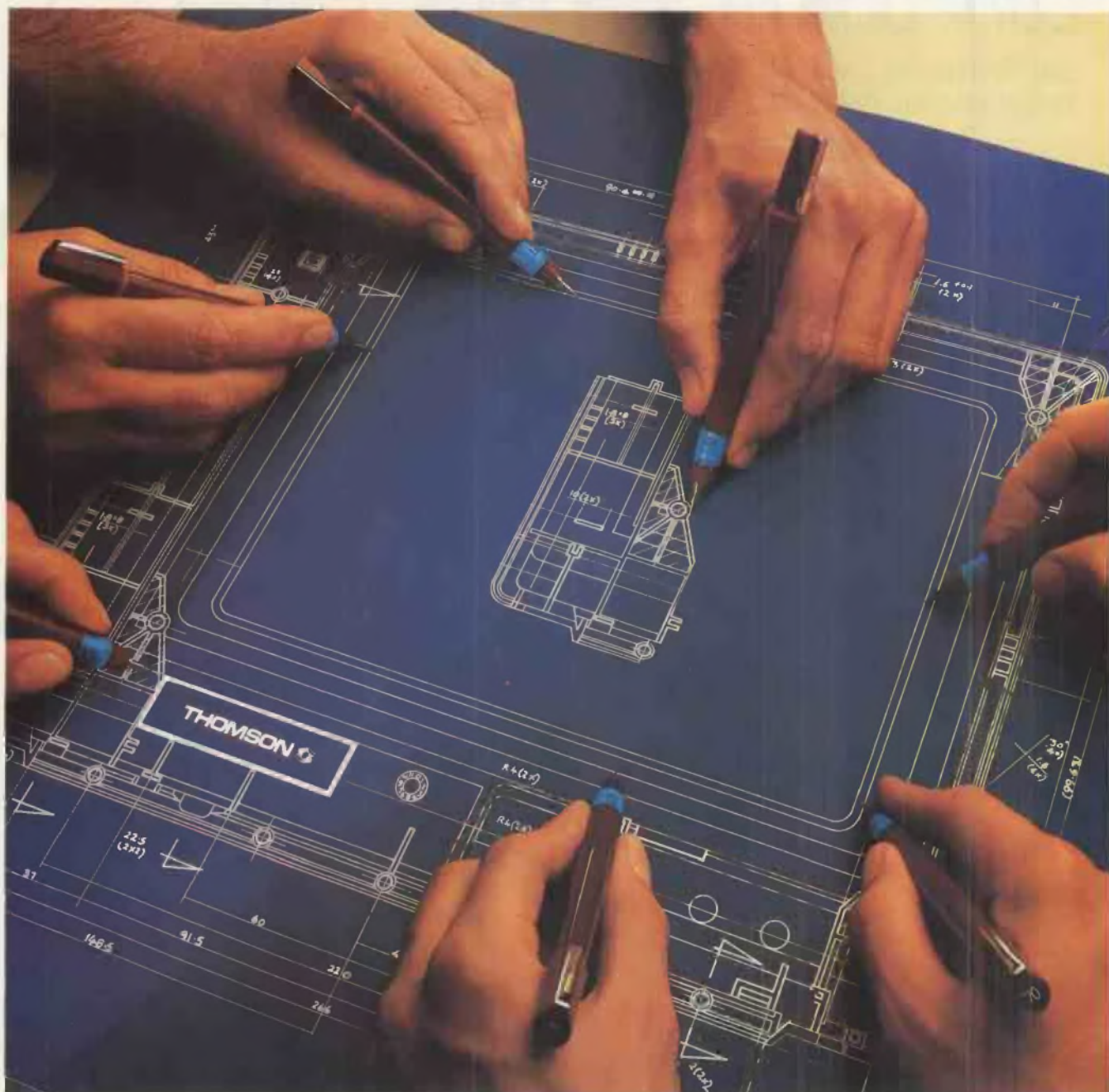
Prices

SDS Modula-2, SDS-XP and the run-time debugger have been written by a US firm called Interface Technologies. In this country they are available from Real-Time Associates for the following prices: SDS alone, £120; SDS-XP, £250; and the run-time debugger, £80. It's possible to upgrade from SDS to SDS-XP for £150.

Real-Time Associates is far from being just a distributor of SDS Modula-2: the company is deeply involved with creating and promoting Modula-2 in the UK. Real-Time Associates offers Modula-2 systems for a number of mini and mainframe machines, provides training for potential Modula-2 programmers, and is involved in the BSI standard. Consequently IBM PC owners should get a far better level of support than with most imported US software; in fact, the prices quoted above include 60 days' free telephone support.

Conclusion

SDS Modula-2 is a complete and practical system for the creation of commercial-quality applications. It scores strongly on ease of use, the inclusion of run-time libraries, and, unlike a lot of its competitors, it conforms to a definite standard. To some, the quirky editor may seem a liability, but to the committed two-fingered typist it could become invaluable. Combining these features with a competitive price makes SDS Modula-2 an extremely good buy for anyone wanting to start serious programming. **END**



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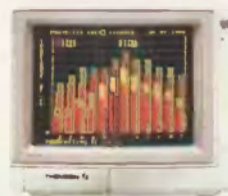
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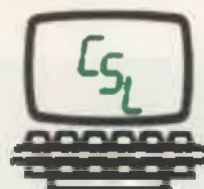
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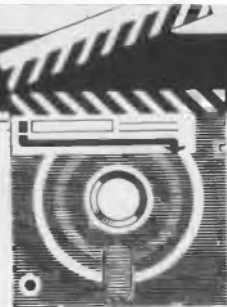
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SCREENTEST

Rbase 5000

Rbase 5000 from Microsoft is an attempt to steal the data management crown from the dBase family. But is the package complete enough to succeed? Kathy Lang finds out.

In the market for database management systems providing a full range of capabilities on micros, the dBase range from Ashton-Tate has led the market for as long as there have been micros powerful enough to support sizeable databases. Even on the IBM PC, where the widest choice of such packages is to be found, dBase II, III and III Plus between them are said to have about 15 per cent of the total packages software market in the UK, outselling their nearest rivals five times over. Small wonder, then, that many other suppliers look hungrily at dBase's position, and the most ambitious set out to take the dBase family head-on. The latest supplier to do this is already one of the giants of the micro software world, though with a stronger track record in languages than in packages: Microsoft, which has acquired the Rbase database management system from US software house Microrim, and which is now aggressively marketing the latest version, Rbase 5000, in the UK.

The basic set of information handled by Rbase 5000 is a table; each table is stored in a file, and indeed an Rbase table corresponds to a file in other packages, with each row in the table being a record and each column a field. A set of tables (nominally 40, but in practice 37) comprises a database. Connections between tables are made during processing, rather than being permanently established when the database is set up initially. Instructions can be given to Rbase 5000 in a number of ways: through commands entered at the keyboard (with prompting if desired); via sets of stored commands; or through complete applications including menus and tailored Help screens. Once set up, command files

or complete applications can be compiled, to speed processing and to protect code from change by inexperienced users. Applications can be set up directly using an editor — Rbase 5000 has its own, but you can use any suitable program — or with plenty of help by using Rbase 5000's Express facility. However, the limitations in Express suggest that, while it would be useful as a learning tool, most system developers will need to use the command system direct.

Thus far, you can see that Rbase 5000 has the basic features to enable it to compete with dBaseIII Plus and with other powerful database systems such as Dataflex, at least in the single-user market. Now to explore these features in more detail.

Constraints

The main limitations and features of Rbase 5000 are shown in Fig 1. None of the constraints should cause problems except, in some applications, the limit of six digits on computational accuracy with real numbers. An important point to note, though, is that while any single table may have up to 400 fields, the same limit applies to the total number of fields in a whole database. An important omission is the absence of an Array data type: few data management systems have this, but it's very useful for system developers. As with dBase, you can simulate lists to some extent by using memory variables with appropriate names. No limit on the number of memory variables is specified.

File creation & indexing

File definition in Rbase 5000 is entirely separate from the specification of screen layout through user-designed forms. The essential requirement is

to define the contents of each table in a database, by specifying the name, type and length of each field. This can be accomplished either through the Express application, which gives some prompting and allows screen editing of entries, or by entering keyboard commands directly. That process is more tedious and less easily modified than using Express, so for this purpose I suspect everyone will use Express. Unfortunately, you cannot specify in Express which fields are to be used as keys, so even the most inexperienced user must learn something of the command language right away.

There is no restriction on the number of indexes, but each must consist of one complete field — no subfields or linked fields are allowed. Indexes are used only to speed retrieval of records, not for ordering purposes; to see records in a particular order, they must be sorted each time that requirement arises. And from my Benchmarks, it appears that the speed of sorting is unrelated to whether or not a field is indexed. Indexes are, however, kept up-to-date automatically, and you don't need to specify the indexes when a file is opened.

The relationships among tables in a database are not defined when the database is created; rather, they are *ad hoc* in the sense that you can request reports on data from several files, and set up screen forms which enter data into several forms, but you cannot define relationships as being intrinsic to the database itself.

Data entry & updating

A variety of methods of data entry are provided in Rbase 5000. The most basic is to use the LOAD command, which allows you to enter

data one field at a time; field names are provided as prompts on request. Editing is available only within the entry line. You would therefore be most unlikely to use this mode except for occasional additions to tables with very few fields. The usual method is to set up a screen form, using 'paint-a-screen' methods, to enter data, usually into a single form (though a form can enter data into several tables if necessary). A screen form can have calculated fields as well as those entered from the keyboard.

Larger sets of records can be added to tables by using the APPEND command to tack one table onto the end of another; in addition, the usual range of relational operations such as JOIN and INTERSECT are provided to merge two tables in a controlled way.

Data editing can be accomplished through screen forms, again applying to one table or several, or using a one-record-per-screen-line browse. In either case, data is selected for editing by attaching a 'WHERE' clause to the EDIT command when using the direct command mode rather than editing through a tailored application. This approach requires a little more forethought — or more typing, or both — than the more conventional approach of entering a key field value in a model record on the screen. It can also be more flexible than the usual method, since it means that any subset of records can be selected for editing, and sorted in any order, according to decisions made when the editing takes place.

Rbase 5000 can validate data against a set of rules. These rules are flexible enough to provide for most requirements: for example, you could specify that a field value must already exist in another table (say, to validate customer numbers on invoices), or that it must not exist in the current table (to ensure unique customer codes). The rules are set up with direct commands rather than through Express, and the process is rather tedious (though it does help to use a proper editor to enter them into a command file). When data is being entered interactively, Rbase 5000 will not allow the user to enter an invalid value, and will display the message specified in the rule when an error occurs. For batch updating, an exception file is created of amendments that do not conform to the rules.

Groups of records, or a complete table, can be updated automatically; amendments allowed include calculations on existing fields and/or constants, so you can carry out operations such as increasing the price of all products in a particular group by 10 per cent.

The way these features have been implemented provides evidence of

the uneven development of the package — more on this under 'In use'.

Screen display

Rbase 5000 provides two main types of screen display: the list format used in editing and viewing when no customised screen is invoked; and user-built screen forms. The list format allows selection of columns and control over their widths. There are two types of screen form. When entering Rbase 5000 commands one by one from the keyboard, you are restricted to forms that access only one table, and are restricted to one screen. When using a full tailored application, or executing a single set of commands from a file, you can include forms that span several screens, and incorporate fields from more than one table. Finally, any report can be displayed on the screen as an alternative to printing.

Reports

Reporting facilities in Rbase 5000 are powerful and not too difficult to use; reports are set up using a paint-a-screen approach, with scrolling to allow the definition of wide reports. Calculated fields, headers and footers, subtotals, control over page widths and the ability to transmit control codes to the printer are all provided. Reports can include fields from more than one table, and selection and sorting of records from the main or driving table is allowed. Fields may be longer than the columns defined to display them, and Rbase 5000 will wordwrap such fields when necessary. It would also be possible to construct simple standard letters using the reporting features.

Selection & sorting

Rbase 5000 provides a SELECT command that allows you to display chosen sets of records, either complete or specified fields only, one line per record on the screen. Many other commands allow you to select records by attaching a WHERE clause. A range of conditions is provided, using the usual relational operators such as greater than, not equal, and so on, plus wild-codes for single characters and strings to match text fields. Multiple conditions may be combined with AND and OR, but you cannot use brackets to alter the order of evaluation, so care would be needed with complex conditions. Selective retrieval is faster for indexed fields, provided that the last condition in the WHERE clause is testing an indexed field for equality with a constant, and that if the clause has more than one condition, these are combined with AND.

Selected sets of records, or a complete table, may be sorted by up to 10 fields before display. However,

Maximum file size	OSL
Maximum no fields	400
Maximum digits	16
Special disk format?	
Link to ASCII files?	YV
Fixed rec structure?	Y
Amend rec structure?	Y
Link data files?	Y
No sort fields	10
Maximum key length (chars, fields)	1500, 1
Data validation	G
Unique keys	Op
Store calculated data	IN, BA
Store selection criteria	P
>1 criterion/field?	Y
Browsing methods	AF
Reference manual+	**
Reference card+	****
Hot-line?	D
Max record size (chars)	1530
Max field size	1500
Max prime key length	1500
File size fixed?	N
Data types	N, I, C, D, T, £
Fixed record length stored?	Y
No data files open	37
No keys	UL
Subsidiary indexes kept up-to-date?	UTD
Screen formatting	P, D
Report formatting	P, I
Totals & statistics	Y
Combining criteria	A, O, N
Wild-code selection?	SW
Interaction methods	C, FT
Interaction methods	C, FT
Tutorial guide+	**
Online Help+	***

For a full explanation of abbreviations, see 'Database dossier', page 188, January 1985 issue

Fig 1 Features and constraints

since this ordering is achieved by sorting, it is not maintained when field values change. To view or edit files in a particular order always incurs a time penalty. Where files are always kept in order, the cost is a very small addition to the time spent on saving each record. For packages such as Rbase 5000, the overhead is the time to sort the whole file, incurred each time the file is to be edited or viewed in order. And it may well be that the total overhead time may be less when using the Rbase 5000 approach (though that is very application-dependent). But my own view is that the small amount of extra time per record taken with the first approach is barely noticeable, whereas the time taken to sort a whole file, even in Rbase 5000 where the sorting is relatively efficient, is very noticeable indeed. You will have to judge for yourself whether this factor is worth serious consideration, since its importance varies a great deal between applications.



SCREENTEST

Rbase 5000 at the command level and an editor. Express has limitations — the most severe being a maximum of 40 fields in the database and one selection condition in any WHERE clause — which I sus-

pect will make it more interesting as a training vehicle than as a serious development tool. In most cases, then, you will need to develop your own command files, either as a supplement to Express or as complete files or applications. Command files can be created with RBEDIT, Rbase 5000's own editor, which provides screen editing features, or by using any editor which can produce ASCII text files.

In addition to the commands that can be entered from the keyboard, Rbase 5000 provides a good range of programming features such as con-

Calculation

You can include calculated fields on input forms and in reports. Rbase 5000 does not support a wide range of functions; for example, you can carry out a substring operation on a memory variable, but not directly on a field in a table, and there are no equivalents of functions such as finding the starting position of a character, nor any statistical functions on individual fields. You can, however, calculate sums, averages, counts, and so on, of sets of records or complete tables. You can also total fields included in a SELECT command.

Multiple files

Rbase 5000 allows you to have up to 40 tables in a database; three of these are used for housekeeping purposes, leaving a maximum of 37 data files. Linkage between records in screens and reports is achieved by matching appropriate fields dynamically, when the record linkage is required. Opinions vary about the merits of leaving such relationships entirely dynamic — flexible, say the proponents; anarchic and leading to corrupt data, say the critics. There is much to be said for the compromise approach, used in packages like dBasell Plus, of allowing you to specify permanent links if you wish, or to go for purely temporary links if that's more appropriate. However, Rbase 5000's generosity in permitting so many open data files will render such nice points irrelevant to many. (In practice, the overall limit of 400 fields in a database is likely to be reached long before the table limit.)

Housekeeping & security

A range of housekeeping facilities is provided, including the ability to set up and change directories within Rbase 5000. You cannot, though, format a floppy disk from within the package. Security is handled by providing three levels of password that may be attached to any database: these allow the user to alter the database structure, to amend data but not structure, or to view data only.

Tailoring

Rbase 5000 provides a wide range of tailoring facilities, ranging from simply storing sets of commands in a file, to producing complete applications compiled for fast execution. Applications, which comprise command files for processing, menu files for directing control among sets of commands, and screen files to contain messages and help, can be built through Express or directly using

BM1	Time to add one new record	Inst
BM2	Time to select record by primary key	Inst
BM3	Time to select record by secondary key	5secs+
BM4	Time to access 20 records from 1000 sequentially on three-character field (same field as in BM2 key)	13secs+
BM5	Time to access record using wild-code	23secs+
BM6	Time to index 1000 records on three-character field	56secs
BM7	Time to sort 1000 records on five-character field	25secs
BM8	Time to calculate on one field per record and store result in record	34secs
BM9	Time to total three fields over 1000 records	39secs
BM10	Time to add one new field to each of 1000 records	4mins 5secs

Time to import a file of 1000 records: 7mins 8secs

Notes: NT = Not tested. NP = Not Possible. + = including scrolling. Where two times are given, first is access to first record, second is access to each subsequent record

Fig 2 Benchmark times recorded on an IBM PC/XT/H

Package	Cost (£)	Summary
Dataflex	995/1295	Powerful, flexible database management system available on a wide range of single-user and networked systems. Excellent for system developers, good for novices prepared to apply themselves. Clumsy manual, excellent reference summary and examples
dBaselll	550	More advanced version of popular dBasell package. Allows max 10 files open at once, which can be interrelated as you wish on a DIY basis. Flexible indexing. Command-based: can store sets of commands to get close to programming. Only on IBM PC and clones
Paradox	550	Table-based system for IBM PC, many similarities to 1-2-3. Tables can be related. Good querying and reporting, powerful command language. Keeps data in memory if possible: speed on larger tables should be checked. Easy to use at basic, menu-driven level
Power-base	395	Powerful database management system with linking of many files, batch updating, up-to-date indexes, reporting adequate (no letter-writer), excellent links with other packages, for example, 1-2-3. No system development tools. Easy to use, documentation excellent
Rbase 5000	595	Powerful IBM PC package for system developers, command-based with compiler but no run-time system. Good data-handling and reporting from multiple (up to 40) files. Currently only single-user. User image and documentation rather confusing

Fig 3 Comparison of similar data management packages

Summary

Supplier:	Microsoft
Telephone:	(0734) 500741
Cost:	£595
Systems:	PC
Features:	Database consists of tables (up to 37 in practice), related to each other when processed. Powerful data handling including data validation, selection and sorting onscreen, good reporting, programming-like language to create processing files and menus
Drawbacks:	Retrieval of single records via commands clumsy. Sorted order not maintained through edits. Max 400 fields per database
Ease of use:	Command language rather confused and inconsistent, not really suitable for novices. Documentation has some faults

ditional statements and loops, and the ability to define memory variables limited only by the available memory. There does not seem to be any way to save the values of memory variables independently of command files. Nor does there appear to be any facility for executing DOS commands from within the program (as distinct from running Rbase 5000 through a BAT file that can execute several programs in turn). This would provide a real limit on the usefulness of Rbase 5000 in building complex applications. The absence of a run-time system makes Rbase 5000 expensive for packaged applications.

User image

Instructions to Rbase 5000 can be given directly from the keyboard, using commands which are entered directly, or, if you prefer, in response to prompts. Commands can be stored in files, and command files can be used alongside menus and prompt screens in complete applications. Clearly such applications can be used by novices without computing experience, but I suspect that, even with prompting, Rbase 5000 would otherwise be quite hard going for novices. And while commands and options can be abbreviated, the command system is still relatively verbose.

Such criticisms, however, pale into insignificance beside the Topsy problem. Remember Topsy? 'I never had no mother. I reckon I just grewed.' Well, that's Rbase 5000's user image in a nutshell: there are all sorts of inconsistencies, and plenty of evidence of the uneven development of the package. Some areas are highly consistent; others are quite a muddle. For example, you may want to update a group of fields automatically. If you want to assign a constant or a memory variable to a field in all or a selected group of records, you use the CHANGE command. To assign an expression, perhaps consisting of incrementing a field by 10 per cent, you use the ASSIGN command. And if you just want to change the value of one field to that of another in the same record, you

have to pretend that the assignment clause is an expression, entering a statement such as 'field1Rbase 5000field2+0'!

Documentation

The curiosities of some parts of Rbase 5000's user image are certainly not made any easier by the documentation. This consists of three manuals: a *User Guide*, a *Reference Manual* and a *Reference Summary*. The *User Guide* comprises a tutorial section, followed by a series of chapters on the fundamentals of the package. It includes a good explanation of the fundamentals of database design, but makes little attempt to relate this material to the structure of Rbase 5000 itself. (Indeed, I suspect that the conceptual and practical sections of the manual were written by different people.) The lack of any attempt to discuss the overall Rbase 5000 approach to data storage and handling makes the package very difficult to get to grips with. The problem is exacerbated by the way the tutorial section zips about between use of direct individual commands and of the Express module without

explanation.

These confusions are partly the result of bad documentation, but in part also stem from the confusions in user image design.

The *Reference Manual* is sub-titled a command dictionary, which is a more accurate description since much of the nitty-gritty detail needed is not described there but in the *User Guide*. The reference summary is at just the right level — brief descriptions, followed by syntax definitions using train diagrams, which I personally prefer to BNF or so-called 'plain English' specifications.

Conclusion

Rbase 5000 is a powerful and sophisticated package, with most of the tools needed to build complex applications, though its facilities may well prove too difficult for novices to use. The ability to compile complete systems will be a powerful recommendation for many developers. Against the functional advantages must be set the haphazard user image, often unhelpful documentation, and absence of some useful features such as the ability to run DOS commands from within the package.

On price, Rbase 5000 is competitive for single systems; indeed, in the short-term it's cheap, since Microsoft is offering two copies for the price of one and reducing the price by £100 to £495 until the end of August. But there are no plans for a run-time system, so system developers have to pay for a full version for each user. A version to provide shared use on networks is expected in the near future.

Rbase 5000 is a strong contender in the market for database management systems on micros, but it may not be quite the world-beater its suppliers are hoping for. **END**



Take your pick

The Pick operating system combines power and friendliness in data handling and retrieval. Long neglected by users, Roger MacNicol feels it is now getting the recognition it so rightly deserves.

The established wisdom at the moment is to choose your software first, and then choose a computer that can run it. One of the most important types of software for commercial use has proved to be databases — potentially freeing people from drudgery, and enabling managers to access needed information faster and more efficiently. The range of database software for desk-top computers is enormous, and the almost monthly reviews of new database products show the speed at which this choice is increasing. But each of these programs will be limited to a greater or lesser extent by the fact that they must run under an operating system which generally has to be 'a Jack of all trades but Master of none'. Just consider the major categories of software available under MS-DOS: word processing, databases, graphics, communications and number-crunching. So why not try a different approach? If the software and the operating system are so mingled together that they lose their distinct identities, the system can then be optimised to get the maximum power out of the chosen hardware. This is the strength of the Pick operating system.

Development

Pick has been around for many years, but only really took off in this country in 1979 when a number of Pick look-alikes began to emerge. It has already found widespread use with the police, the health service and local authorities because of its unparalleled combination of power and friendliness in data handling and information retrieval. If Unix is the software developer's dream, then Pick can be seen as the businessman's dream.

Pick provides a powerful relational database, with an easy-to-use query language that enables the user to interrogate the database in a very natural syntax; it also provides a version of Basic called Pick/Basic which is extensively enhanced and is highly integrated with Pick's sole file structure. Pick was designed from the outset to be a virtual memory system;

Pick sees the RAM and the hard disk as one single unbroken expanse of memory, and it is inherently a multi-user, single-tasking environment. Pick also provides comprehensive security at both the user and file levels.

The Pick operating system began life in 1966 at TRW Systems, where it was developed for the US Army Cheyenne helicopter program, under the name GIMS (Generalised Information Management System). It was accepted by the US Army in 1969 and implemented on an IBM 360 series mainframe. At the end of that project one of the original team from TRW Systems, Richard Pick, was allowed to continue development of a commercial version, which first saw light of day in 1973 on a Microdata 8-bit mini under the name REALITY. The nature of the Pick system has remained essentially unchanged since this implementation.

Design

Pick's design centres around a four-level hierarchical structure made up of successive one-to-many relationships: a system dictionary which defines the way that the system is partitioned between different users (each partition is known as an 'account'); each account then has a master dictionary which defines which files it is allowed to access; each file then has a data dictionary which defines both the physical location and the logical design of the file; finally, each file may have several data levels which hold the required information (see Fig 1). An important consequence of this design is that all data is stored at the same logical level in the system.

All the memory used for data (both RAM and hard disk) is divided up into 512 byte 'frames'. A new file is started by assigning a number of 'groups' of frames to hold the data, (known as the file's 'modulo'). The number of frames in each group must also be specified at the time of the file's creation (known as the file's 'separation').

When we wish to store an item in the file, its key is mathematically

manipulated to decide uniquely which group to store it in (hashing). The resultant file structure is known as a keyed random access file.

Each item in the file can be further sub-divided into three one-to-many relationships: attributes, values and sub-values. Fields in the item are known as attributes. The successive attributes in the item are simply concatenated together, separated by the high-bit byte \$FE. Each attribute may be broken down into many values separated by the byte \$FD, and in turn each value may be broken down into many sub-values, separated by the byte \$FC. In practice sub-values are rarely used, and at a recent keynote address at the Spectrum Trade Show in Las Vegas, Richard Pick said he knew of no case where the data structure made the use of sub-values mandatory. This variable length data structure is consequently very efficient on storage space with no wasted space and an overhead of only one byte per delimiter. The only limit in the current release of Pick is that the total size of each item must not exceed 32k.

When an item is saved, it is always added at the end of the group, and if it is replacing a previous version of that item, the rest of the group is moved up. When a group is full, the operating system will assign another frame from the overflow table and link it to the group. When a group shrinks, the spare frames will be released again to the overflow pool.

The advantage of this structure is that the time taken to retrieve a record is largely independent of the size of the file, since you can always go straight to the group that holds the required record. This makes Pick ideal for large applications such as library catalogues.

Now we have a picture of the physical file structure, let's go on to look at the logical file structure that makes Pick into a relational database. The dictionary of a file is similar to the data levels in structure in that it is simply made up of a number of items containing attributes, and in some cases multi-valued attributes. There are two kinds of entries in the

file dictionary: there will be an entry pointing to the memory location of each data level, specifying which frame the file starts on, together with its modulo and separation; and there are data-defining items.

The data-defining items can be further divided into two types: attribute definitions, giving a name to the contents of an attribute, and derived data, where the contents of the attribute have been manipulated. Either of these may have synonyms defined in the dictionary to cover alternative spellings and abbreviations.

Pick's enquiry language, known as Access, uses these data-defining terms and synonyms to select, sort and list the data when requested.

Access: Access allows the user to interrogate the database in a very powerful and flexible way. As you might expect, all the words available to the user are dictionary-defined. The account's master dictionary defines the verbs such as SORT, SELECT and LIST; the connectives such as WITH, AND and NOT; and the names of the files in that account. The file's dictionary is used to define the logical correspondence between the name of an attribute and its physical location in the item (for example, SURNAME may be de-

fined as the contents of attribute 3).

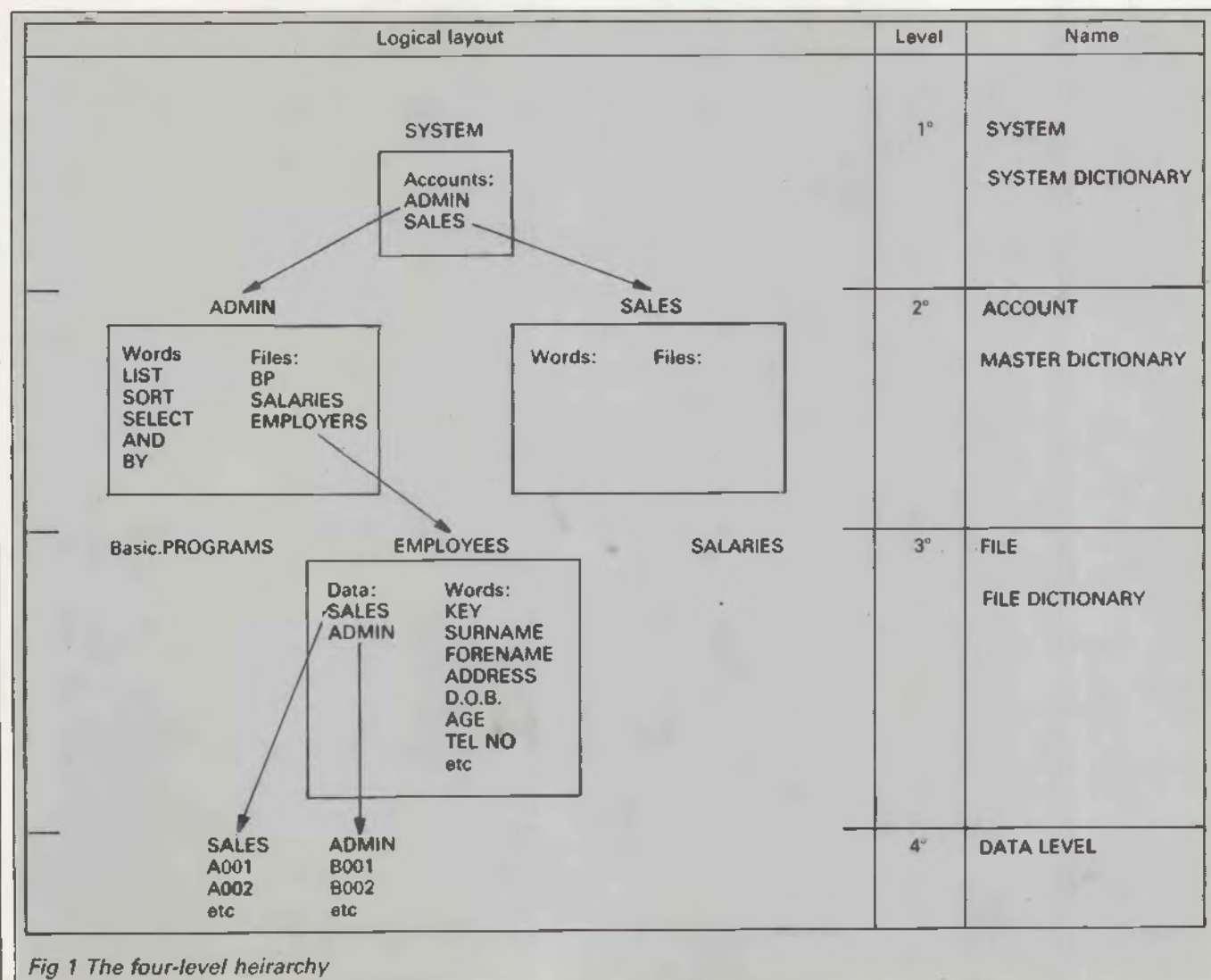
The advantage of this is that you can tailor the language exactly to your own requirements and colloquialisms. If you want to say 'Give me ...' rather than 'Sort ...', you would simply specify GIVE to be a synonym of SORT, and ME to be an ignored word.

Access sentences are built up of verb — filename — selection criteria — sorting criteria — attributes to print — general format control. After the verb and filename, the syntax of the sentence is completely free. Any dictionary data definition may be used for sorting, even when the data represented has been derived. The results of a SORT or SELECT may be stored in order to give serial access to a file or to part of a file. More complex sequences of actions may be built up in command files called 'procs'. Procs may also be used to pass the results of sorts and selections through to Basic programs. The proc language is built up of unreadable one-letter codes, and is far from friendly.

Let's see how Access works out in practice, taking for our example an 'Employee' file, with one item for each employee. Because each item in a file is stored and retrieved by its

key, the key must be unique. Since we cannot guarantee that every employee will have a different name, we could choose a simple alpha-numeric key which could be assigned sequentially. We might then decide we needed to store an employee's surname, forenames, address, telephone number, national insurance number, date of birth, date of joining the company and an internal pay code. Multivalues can be used to store successive lines of the address, or list different phone extensions to try. Fig 2 shows how the logical file structure might then be arranged. If the file was called EMPLOYEES, a typical Access sentence might be: SORT EMPLOYEES BY SURNAME WITH D.O.B. BEFORE "1 JAN 1926" SURNAME FORENAME D.O.B., which would produce a sorted list of all employees over the age of 60 giving their names, addresses and dates of birth. The Access sentence: SELECT EMPLOYEES WITH PAY.CODE "SA" would produce an unsorted list of all the company's Systems Analysts in the pseudo-random sequence defined by the hashing algorithm. The verb SSELECT would produce sorted selections.

Dictionary definitions allow the data to be processed in a variety of



ways. This processing may be specified at either or both of two stages, resulting in the data being held in three distinct forms. The first form is the raw data on the disk. When this data is read, it passes through the first processing stage, called a 'correlative', to produce the internal form. This internal form is used for sorting and selecting items. The second stage of processing occurs when the data is output to the screen or printer, and is called a 'conversion'.

Pick encourages the user to store data in a raw form. Numbers are stored as integers, and the date is stored as the number of days before or since 31 December 1967. This means that sorts, which use the internal form of the data and are based on the ASCII sequence, will always produce the correct result. Conversion codes are then used to control the position of the decimal point in numbers, and the desired format of the data. Although any of the processing commands may be used at either stage, conversions ought only to be used when they are bidirectional without loss of information, because the same code is used as an input conversion to change

your sorting or selecting criteria to its internal form.

The richness and power of Access derive largely from the use of correlatives, of which the three most common types are 'F', 'A' and 'Tfile'.

'F' correlatives are specified in Reverse Polish Notation, and can be used for both mathematical and text manipulation. We could specify a dictionary item for AGE based on the stored date of birth. If the DOB was held in attribute 6 of the item, a simple correlative for AGE would be "F;6;(DY);D;(DY);-;6;(DJ);D;(DJ);+.". We could then SORT or SELECT the EMPLOYEE file by AGE, or print the AGE in a listing, just as we could with the raw data — the date of birth.

Tfile correlatives extend the use of the dictionary from merely providing meaning for a single file, to a 'window' onto the whole database from the point of view of its primary file. We could use the PAY CODE to look up the current salary of an employee from a table. This means that if the salary is changed, it only has to be changed in one place — the table, and not in the record of every employee on that grade. A dictionary definition pointing to the same attri-

bute as PAY CODE, called SALARY, could be specified to look up the salary from the SALARIES file, with the correlative "TSALARIES;V;;1".

Access provides simple verbs for adding up attributes which are listed. If SALARY were specified as an attribute to be added up, and the EMPLOYEES file were sorted by DEPARTMENT, the listing would then give us the total annual wage cost to the company of each department.

'A' correlatives differ from 'F' correlatives by allowing the user to refer to data by its dictionary name. If we had stored the net cost of an object under the name NET.COST, a dictionary definition for the total cost with VAT could be specified by the correlative $AN(COST)*115/100$. This could be made more generalised by storing the VAT rate in a look-up table. 'A' correlatives tend to be the most readable of the different types.

With Access the user can specify complex processing of the data, and refer to it by a single word in a sentence. This gives Pick one of the easiest and friendliest ways of getting information out of the database of any system.

However, Pick's major weakness comes in getting the information into

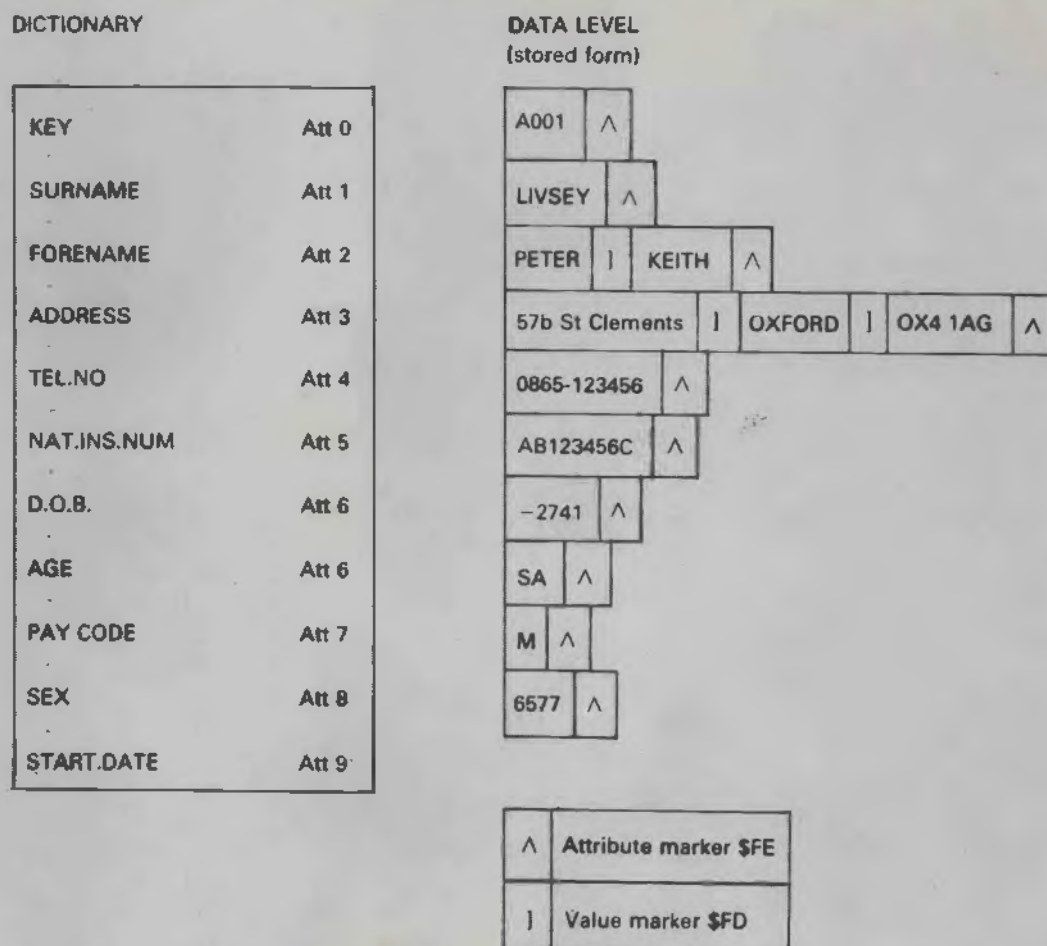


Fig 2 The dictionary for the EMPLOYEES file and a sample item

the database. To do this you can use the crude line editor provided with Pick which is fine for programming, but of little use to the businessman. Or resort either to programming in Pick/Basic or using one of the many excellent application generators available. Most Pick machines come with an application generator built in, either an in-house one like All on Microdata kit or a bundled commercial package, of which the three most popular in this country are probably Creator, System Builder and Wizard.

Pick/Basic: Unlike most operating systems where a variety of languages are available to the user, Pick only supports Pick/Basic. In keeping with the overall philosophy, this is a dialect of Basic which has been extensively enhanced so that it completely reflects the data structure provided by Pick. As well as the usual real arrays, dynamic arrays are supported. A dynamic array can hold a complete item, together with its attribute, value, and sub-value markers, and is represented by chevron brackets: VAR(2,3) would mean the third value of the second attribute of VAR. Basic statements are provided for inserting elements into the middle of a dynamic array pushing all the other elements up, for deleting elements from the middle of a dynamic array, and for sorting the elements of a dynamic array.

Unlike most other Basic dialects, Pick does not distinguish between string and numerical variables, so items can be simply built up by concatenating the data together with the right markers, before being written away to the file.

As a dialect, Pick was years ahead of the work done by Sinclair and Acorn in incorporating many of the facilities for structured programming usually associated with Pascal. It provides the CASE statement to replace multiple IF statements. It also provides a choice of LOOP UNTIL and LOOP WHILE, as well as providing UNTIL and WHILE extensions to FOR NEXT loops. This choice allows the programmer always to choose the most natural way of expressing the structure of the program.

Pick look-alikes

You may wish to ask: 'If Pick is so good, and has been around for this long, why isn't it better known and more popular?' The answer is probably not, as *The Guardian* argued last year, 'that Pick is not sexy enough', but is partly historical, and partly reflects the nature of the business market. The first problem that beset Pick was that Microdata was taken over by McDonnell Douglas. This led to Richard Pick leaving Microdata to form his own company, then called Pick & Associates. This new company implemented Pick on the Honeywell Level 6 (under the

name of Ultimate), which led to a royalties lawsuit which dragged on for several years.

The second problem was that Richard Pick has always tried to keep the development of Pick under his personal control. All true Pick implementations have been done by Pick and his team, and a Pick source licence will cost the hardware manufacturer around 20 times the cost of a Unix source licence. Pick Systems also turns down many requests from hardware manufacturers to implement Pick on their kit.

Revelation: With the decreasing cost of computing power, Pick has become available on successively smaller machines. Pick Systems has released true Pick for the IBM/XT and AT, and Cosmos Inc has released Revelation for both generic MS-DOS machines (including the Apricot and the Nimbus) and for PC-DOS machines. When Revelation was released in 1984, reviewers clearly found it difficult to categorise (see *PCW*, April 1984). Technically it is an overlay operating system, which means that it sits alongside MS-DOS, and uses MS-DOS for reading and writing to the disk. If you review it as an operating system you turn people off; yet it doesn't fit well into the category of database software because it provides so much more.

Revelation has several distinct advantages over Pick on the PC. Pick needs a partition of the hard disk all to itself, so when you are running it any files and programs you may have on the DOS partition are not available to you. But since Revelation sits alongside DOS, you can easily swap information between DOS and Revelation applications. Utilities are provided to upload your old dBase and Lotus 1-2-3 files into Revelation.

Revelation will run happily under Microsoft's Windows, which means that you can run an application under Revelation and a word-processing package under DOS simultaneously in different windows on the screen, and swap information between them.

The most exciting advantage of Revelation is the improvement of its presentation over Pick. The explosion of desk-top computing has resulted in many improvements in the ease of use of applications by non-technical people. Revelation succeeds in bringing together minicomputer power, in the sense of being able to express and manipulate more complicated data structures, with the friendliness that people have come to expect from desk-top applications.

Two good examples of this are Revelation's handling of procs and correlatives. In Pick, each of these uses a different set of unreadable one-letter codes. In Revelation, correlatives have been replaced by writing an unlimited amount of Basic code

into the dictionary definition, which makes them potentially much more powerful. It also enables some standardisation between the dictionary and applications. Procs have been replaced by a PERFORM statement in Basic, which allows any MS-DOS or Revelation command to be called.

When it comes to getting data into Revelation, Cosmos has improved on Pick by providing a full-screen editor, and a simple application generator called R/Design. For people who want a more powerful generator, or who wish to run the same application on Revelation that they have running on their Pick machines, Creator and System Builder are available at £295 and £495 respectively.

Revelation probably provides the most powerful and flexible environment for handling data yet available under MS-DOS and PC-DOS, but you will need at least 512k RAM and a hard disk. An 8087 co-processor will speed Revelation up by around 20 per cent. Revelation currently costs £750, but it has recently been accepted onto IBM's approved list, so the price is likely to rise.

Uni-Verse: Over the last few years Unix has, like Pick, become available on successively smaller machines. Several commentators have perceived them to be competitors and written comparative reviews, but each has very different strengths. Unix provides a much better environment for communications and number-intensive applications; it also provides a wide variety of languages, but it cannot begin to compete with Pick on the suitability of its data structures for the businessman, or on its friendliness. Pick is a much more mature system. This debate may now become irrelevant with the release of uni-Verse from VMark which provides the full Pick environment on any Unix system V machine.

Uni-Verse comes in four flavours (*sic*) to enable existing Pick applications to be easily transferred: true Pick, Prime Information, Microdata's Reality and Ideal for standard uni-Verse. A uni-Verse account corresponds to a Unix directory, and each account must have its flavour defined at the time of its creation. Users of uni-Verse are encouraged to use Ideal-flavoured accounts which provide several enhancements to standard Pick. Like Revelation and Prime Information, uni-Verse is an overlay operating system, which means that all of Unix is still available to the user, and Unix processes can be called from within uni-Verse.

The release of Revelation and uni-Verse considerably extends the range of hardware that can support the Pick environment. It also means that the user can have the same application running on his desk-top micros and minicomputers, and swap information between them. **END**



BIBLIOFILE

Nuclear war rears its ugly head in this month's book selection, with an insight into computer-controlled offence and defence. David Taylor is in control.



Look, no soldiers

Title: The Automated Battlefield
Author: Frank Barnaby
Publisher: Sidgwick & Jackson
Price: £12.95 (hardback)

Not for the faint-hearted, this. I wonder that Frank Barnaby isn't a martyr to nightmares, since he's preoccupied (as in a couple of previous glum books) with the prospects, such as they are, for world peace and stability. The short answer is that they're not at all good, because of the terrifying lick at which ever-deadlier weaponry is turned out. Yet they just might get better. Mr Barnaby has a plan.

Computers, he points out, are now forcing the pace of armaments development at mind-boggling speed — automating this, revolutionising that. It's ingenious and marvellous,

up to a point. But it's also a bizarre, chilling future he predicts, as computerised, 'hands-off' warfare looms.

Frank Barnaby is by training a nuclear physicist, who for 16 years worked at Aldermaston on research into nuclear weapons. He was not encouraged by what was going on, so he switched his attentions to 'peace-mongering' — as director of a Scandinavian Peace Research Institute, then as a lecturer pottering about the world as a kind of travelling academic evangelist for world disarmament.

What particularly exercises him is that computerised systems on 'conventional' weapons are now making them so accurate and so destructive that the gap is closing between 'contained' and full-scale nuclear war, thus upsetting the strategic apple-cart.

What's more, as battlefields get more and more lethal, no soldiers

will be able to survive and the use of robotics and unmanned weapons will increase, ultimately to the point where commanders may direct operations from remote command posts, watching on their VDUs as automatic ironmongery slogs it out to armageddon.

It's a surreal prospect, but one for which Mr Barnaby already sees advance signs. Missiles (like the Exocet) look after themselves once launched. Already, many reconnaissance and target-acquisition operations are handled automatically. And as military computers become rapidly more 'intelligent', there's less and less point in trying to outsmart them with manned intervention of any sort.

So far, so dispiriting; but at last comes Mr Barnaby's master plan. Supposing a 'defence zone' were to be set up on the East-West (German) border, saturated with sophisticated sensors and fancy radar, backed up

by satellites. Supposing it were mined, too, and spiked with short-range missiles, so that nothing could get by undetected, nothing could outwit the computerised HQ, ever-ready to deploy just as much or as little as was needed to contain any threat...

'Non-provocative defence', Mr Barnaby calls it, since the 'defence zone' would have no relevance for attack. We wouldn't need today's 'conventional' forces — soldiers and their artillery; still less would we need a nuclear arsenal.

It's a pity Mr Barnaby can't be co-opted onto the SALT team. God only knows which way war-mongering will develop in the short-term (never mind the long-term), but Mr Barnaby can sound pretty convincing when he says weapons (and especially small weapons) are changing so fast that they are poised to make nonsense of NATO strategy soon.

Nor can there be much doubt that the current European defence structure in any case looks less and less credible: obliged to 'go nuclear' at an absurdly early stage.

Mr Barnaby makes an exciting case for his computerised 'defence zone', but then President Reagan makes his vision of SDI sound like the answer to everyone's prayers as well.

If there's a crumb of comfort to be seized at, whether in the local context of European defence or the global one of the nuclear arms race, it is perhaps that the unstoppable march of military computers seems to favour defensive rather than offensive strategies.

To that extent, Mr Barnaby's stimulating crusade is a bit encouraging. In today's climate of world tension, it's perhaps not much, but I dare say it's the best we can hope for.

Sweet dreams.

MacNutter

Title: MacThink!
Increasing Intelligence and Creativity with the Macintosh Computer
Author: Vera F Birkenbihl
Publisher: Sigma
Price: £9.95 (paperback)

As you were. No need to worry about a thing, not now the Mac is everywhere. Why, it can do most *anything*. If you need the world or your life fixed, just reach for the handy mouse and away we go. All MacUsers tend to go a bit starry-eyed at the wonder of it all. Vera Birkenbihl goes bananas.

'Suppose you were writing a piece about zebras,' teases one typical chapter.

Righty-ho, Vera. I'm supposing.

'Suppose you wanted to explain the difference between the face a

zebra will make when it's seeking contact and the face communicating the "request" to have its skin cleaned.'

Between you and me, there's not a lot of call for that kind of piece, but let's humour Vera for a bit.

'I hope you agree that it would be silly to try to describe these faces with a lot of words.'

Certainly. Wouldn't attempt it, myself.

'Of course, you might think of using a photograph! But suppose that you have only a fuzzy one or none at all?'

I'd be up the creek, Vera, and no mistake.

'If you were able to work MacPaint, you could easily include a drawing.'

See what I mean? Your problems solved. Clickety-click and you've got zebras pulling faces all tickety-boo.

Dear God, this is a peculiar book. Vera has us walking little elephants round a drum-type kinematikon or zoetrope. We get a crash course in Arabic. We're told that if we were to pour a glass of water from a plane, high up over North America, and we could magically change each water molecule into a grain of sand, the whole of North America would be 27 metres deep in sand. Let's take a break and draw a kangaroo.

Vera Birkenbihl runs Brain Friendly Procedures in West Germany. With the help of a Mac, she says, 'you can conquer the domain formerly possessed by very few specially gifted people.' And the main message of her book: 'MACing something rather than "making" it... the key to shifting into higher gear (mentally), thus MACnifying your inherent capabilities and increasing your intellectual potential.'

Of course, Vera. Of course.

Now then. Very quietly, on a count of three, let's all creep softly away as Vera goes for her lie down.

'Great!' exclaimed Pete...

Title: The NECEN Voyage
Author: William S Davis
Publisher: Addison-Wesley
Price: £9.60 (paperback)

Calling all kids! If you've made a start on the first draft of your Christmas list, give this high priority. Brill. It's a ripping sci-fi yarn, action-packed adventure for computer-mad youngsters — daft as you please, but intended to teach as well as entertain. It's wonderful stuff.

A sinister, blackmailing hacker snatches control of NECEN — America's North East Central Computer — and causes mischievous havoc. Hole-in-the-wall cash dispensers eat bank cards and make rude remarks to cus-

tomers. Traffic lights are on the blink. Communications are cut. Then Mr President gets the message:

'I have NECEN. If you want it back, please transmit the sum of one billion dollars... You have 24 hours to pay me.'

Respectfully, THE HARLEQUIN.'

What's to be done? Well, it's obvious, isn't it? Grab Professor Corbin and his team, shrink them down to the size of a computer bit (using lasers, how else?) and send them in to try and wrest control of the giant NECEN computer from the inside. Piece of cake, really.

En route, as you'll have guessed, we get lots of little lessons on what's what as the Prof navigates a whirling disk drive or rides an analog signal, conquers strange chips and cracks unknown code.

Will he succeed in time? I'm not going to spoil it for you, but you shouldn't need three guesses.

Utterly preposterous, then, childish and fantastic as the best of Superman. I couldn't put it down.

Outlook: mostly dull

Title: The Computer Handbook
A Businessman's Guide to Choosing and Using a Computer System
Author: Charles Jones
Publisher: Macmillan
Price: £11.95 (paperback)

This is a very worthy 'reference and advisory source for businessmen and managers' and every bit as dreary as it sounds. I've had a basin full of books which treat newcomers to computing as if they were half-witted as well as behind the times. You know the kind of thing... *In order to open a door, it is necessary first to turn the handle.*

For instance, how's this for fatuous advice: 'In order to make any judgement about what is possible, it is necessary to know what is available.'

Or this piercing thought? 'In the same way in which it is possible to drive a car without an understanding of how it works, so too is it possible to operate a computer without an understanding of how it works.'

Or this: 'The installation of a computer involves more than just unpacking the equipment and connecting it up.'

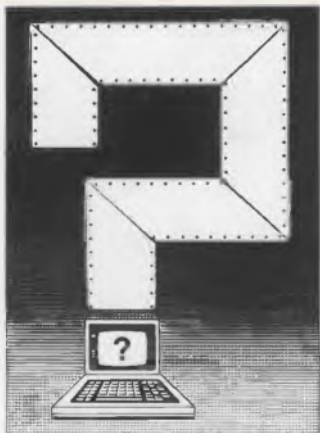
I don't doubt Mr Jones knows his corporate onions, but he's no stylist. Yes, there's common sense in this book, but there isn't half some padding, too. Why do publishers go on putting out fat books full of blindingly obvious statements, wrapped up to look like insight?

'Computer technology is just starting to mature,' sums up Mr Jones. 'The path of future developments is far from clear.' It is to be hoped he's not planning a sequel.

END

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.



QL icons

The March issue of *PCW* contained some favourable comments about the Sinclair QL ('The QL revisited'). It seems to form the basis of a powerful PC at a bargain price, with or without disks. Is there any way of realising the potential of such a system in the way that Gem provides a user interface for the Atari 520ST? **Roy Bradley, Ponteland, Newcastle upon Tyne**

As I write, Amstrad boss Alan Sugar is trying to discover the true market position of the QL, and the future of the machine — at least in its Sinclair guise — is in some doubt. However, it seems likely that QL-compatible systems will pop up, and you are quite right in stating that it's the basis of a powerful, expandable system. The multi-tasking operating system, QDOS, is faster and more flexible than the ST's TOS, so it will be easy to 'bolt on' an alternative user interface: Eidersoft ((0708) 851099) offers an attractive ROM-based icon package called ICE, which costs £24.95; WD Software ((0534) 81392) sells JOSS, a simpler, pointer-based file-handling interface, for £15. Both utilities are multi-tasking, unlike Gem.

Sharp RS232 card

Where can I buy an RS232 interface card for a Sharp MZ80A expansion unit? I have tried Sharp Electronics,

Kuma, Sharpsoft and several Sharp dealers. **WS Thomas, Birkenhead, Merseyside**

Peterson Electronics Ltd, of Academy Street, Forfar, Tayside DD8 2HA, specialises in Sharp interfaces. The company sells the unit you need for £99 plus VAT. The price includes appropriate software, including a modified Basic interpreter.

Homepak hopes

In the March issue of *PCW* you tested a program called B/Graph and mentioned another program by B/Graph's publishers, reviewed in November 1985 — Homepak. Will Homepak run on an Amstrad 6128? Could you also give me the name and UK address of the program's publishers? **Peter Shafe, Alicante, Spain**

Homepak is an American package which only runs on machines with the 6502 processor and a substantial US following — the Apple II, the Atari 800 series and the Commodore 64. It is published in Europe by Software Express International ((021) 384 5080) and distributed by Ariolasoft, of Suite 105/106, Asphalte House, Palace Street, London SW1 5HS ((01) 834 8507).

The closest equivalent to this package for the Amstrad is probably Mini Office 2, from Database Publications; the Gemini range of business software is probably also worth a look. Both are regularly listed by *PCW* advertisers.

Anyone for chess?

Are there any books which could help me understand chess game programming? **JR Oaten, Ashford, Kent**

Yes! The classic book on chess programming, from which the majority of home computer chess programs derived their inspiration (and, in many cases, their

code as well) is *Sargon* — a computer chess program, by Dan and Kathe Spracklen. Published by Hayden, in 8080 and Z80 code versions, the book is a complete documented listing of a fairly powerful machine code chess program. It comes heavily recommended as long as you can read Z80 code, or use a Z80-based micro.

You can get a good grounding in the technicalities of computer game-playing from *Computer Gamesmanship* by David Levy. The book costs £7.95 and is published by Century.

Pergamon Press publishes lots of interesting books on computer chess, including a series entitled *Advances in Computer Chess*, edited by MRB Clarke, the definitively-titled *Chess Computer Book* by TD Harding, and a cheaper, more light-hearted tome by Alex G Bell, *The machine plays chess?*. All of these titles should be available from proper bookshops.

Parlez-vous français?

I'd like to be able to access French viewdata services using a ZX Spectrum and a modem. Is the software to do this available? If not, where could I get information in order to write the program myself? I can program adequately in Z80 assembler. **Nicholas McKenna, Runcorn, Cheshire**

Teletel, the French viewdata system, uses the same data rate as Prestel — 1200/75 baud — but the format of information (as well as the language) is different. Spectrum emulation software is not on the market, as far as I, and the French phone service, can discover, but you should have no trouble getting hold of the appropriate specification. Write to Phillipe Perron at Intelmatique, 98 Rue de Sevres, 75007 Paris, France.

The French PTT's British office is at 50 Pall Mall, London SW1Y 5JQ, tel: (01) 839 2531. A standard French Minitel terminal should work first time — even from the UK.

BBC Micro users can obtain Teletel emulation software from Aldoda International on (01) 794 0991. The company's Telecom Gold address is 72:DTB10179.

In France you can contact Teletel by dialling 16 from any phone. In Britain you must dial 01033 (for France), then 3613 9155 for Teletel 1, 3614 9166 for Teletel 2 or 3615 9177 for the third viewdata 'channel'. The interactive telephone directory is on 01033 3619 9111. You don't need to register before using the service, and there are plans to set up a (cheap rate) Teletel node in London. Until that arrives, however, pick the time at which you phone carefully — to minimise the cost of the call.

Standard Prestel systems do operate on the continent, in Austria, Belgium, Italy, the Netherlands and Switzerland. You should be able to communicate with those systems using UK Prestel software, but you'll have to register as a user with the appropriate telephone company first.

Oric match

I wish to buy a printer which is compatible with my Oric computer, but two stockists have told me that there is nothing available. Is this correct? If not, which dot-matrix printers are suitable? **PH Sheldon, Brentwood, Essex**

The stockists are wrong. A four-colour plotter, the MCP-40, was the 'official' Oric printer, but just about any printer with a Centronics interface (the most popular variety) will work happily with the machine. You'll need an appropriate cable, with an Amphenol plug at the printer and an IDC connector at the Oric; you may find that a BBC Micro or Dragon lead will work. If the printer supplier can't sort

you out, Tyepro Ltd (tel: (0223) 322394) will be able to make the lead up for you.

Genial genies

I own a Genie II computer. Are there any clubs for Genie owners and users? *Matts Sehlberg, Ornskoldsvik, Sweden*

The Genie II is a version of the venerable Tandy TRS-80, manufactured by EACA in Hong Kong. The Genie II runs just about all TRS-80 software, and the National TRS-80 User Group has many Genie owners among its membership. This non-profit making group publishes a newsletter and holds regular lectures and meetings in the UK — overseas members are also welcome. Details are available from the secretary, Brian Pain, at 24 Oxford Street, Stony Stratford, Milton Keynes MK11 1JU.

Shop talk?

I have been considering buying an Atari 520ST, but my local computer shop has advised against this, saying that the Basic is very poor, being full of faults, and that, in particular, the file-handling routines do not function properly. As a result of this, the shop does not stock the machine.

I did wonder whether the shop was simply trying to get me to buy something which it did carry, but I have noticed that, although reviews of the machine have been favourable, none of them make any mention of the machine's Basic. Is it really so poor as to be unusable for any serious purpose?

John Randall, University of Salford

Atari ST Basic is certainly bug-ridden, and — I am told — was never intended for commercial release by the original author. It is certainly possible to write Basic programs on the ST, but there are lots of faults: file-handling is shaky and double-precision variables don't seem to work at all, presumably because the interpreter was written in C and Atari has yet to build a double-precision library into its C compiler.

As far as I am aware, Atari and Digital Research have no plans to fix the bugs — the Basic was bought 'off the peg' — but Hisoft, tel: (0582)

696421) is working on a compatible Basic compiler which should clear up the problems. Several alternative Basic interpreters have also been announced, but I've not had the chance to experiment with any of them.

Muppets & modems

There are three fairly common file-transfer or modem programs currently available to run on a range of hardware — MODEM7, XMODEM and KERMIT. Are any of these compatible with each other — in particular, can they communicate with each other through a modem? *CW Rose, South Molton, Devon*

KERMIT is the odd one out in your list — it is intended to handle micro to mainframe links, and is incompatible with other packages. MODEM7 and XMODEM, along with other popular packages like CP/M Modem and Christensen Modem are — broadly speaking — compatible, being based on the same code. Christensen was the original author.

The PCW network news columnist Peter Tootill tells me that there are two mutually incompatible versions of XMODEM, called XMODEM Checksum and XMODEM CRC; the difference lies in the way that transmission errors are detected. XMODEM CRC is the new, more reliable version.

Feedback

Global aid: Ross Giddings has written in with good news for Tony Billing (PCW May). Globe computer owners can obtain service from Forbes Amroe of Links Crescent, Weston-Super-Mare, Avon (tel: (0934) 416990). The 'Amroe' in the name refers to Mike Roe, an engineer who worked with the makers of the machine. Fat Joyce: Despite Amstad's claims to the contrary (PCW April), it is quite possible to install your own memory upgrade in a PCW8256 'Joyce' word processor. Several readers have written in to explain the process, and I can confirm that it's a fairly easy job, having upgraded a machine myself. The extra memory

increases the size of the RAM disk — drive M — from 112k to 368k. Thus you can copy a disk, on a single drive system, without having to swap the source and destination disks repeatedly. You can also fit a spelling-checker, and a substantial dictionary, onto the expanded RAM disk; this makes dictionary searches very fast, and frees all of the 'real' disk drive for your documents. The extra space is also available to 'intelligent' CP/M-Plus software, which can use bank-switching to gain access to the extra RAM.

Eight 41256-15 dynamic RAM chips must be plugged into empty sockets on the Joyce's main circuit board. Happy Memories, of Newchurch, Kingston, Herefordshire, charges £2.50 plus VAT per RAM chip, including postage: a total of £23 for eight.

The power and data connectors for a second disk drive are also present in a Joyce — neatly tied out of your way — so you can plug in another if you can get hold of the required 720k bare drive. This month I'll concentrate on the RAM upgrade, which offers a more noticeable performance improvement at a lower cost.

You must take the machine apart in order to upgrade the memory. There are no security seals inside the machine, but your warranty will be invalidated if you have to take the machine in for service and Amstrad engineers can tell that you've been inside the machine. On most Joyces no soldering is required, and the modification is easy to reverse if need be. However, you shouldn't take the machine apart unless you are confident about your abilities — PCW cannot take responsibility if you run into problems.

Before you do anything else, unplug the machine and leave it to stand for an hour or so. The display circuit uses some high voltages which take a long time to be discharged. Six cross-point screws support the back of the machine: two at the top, two between the bottom of the display and the base, and two either side of the expansion connector on the back face of the machine. There's no need to remove the base.

Tip the machine forward so that the display rests upon a cushion, and undo all six screws. Lift the back vertically off the machine. The main circuit board,

which includes the 'expansion' connector, is in a slot between the disk drive and the monitor. Don't touch any of the other circuitry. Undo the catch at the bottom of one edge of the board and slide it upwards, so that you can work on it easily.

Along the lower edge of the board is a column of eight chips with a column of sockets alongside. The existing chips comprise the standard 256k of memory; your upgrade fits into the adjacent sockets. Chips are supplied with their legs slightly splayed, so you may need to bend them inwards slightly — by rocking them against a hard surface — before they'll plug in easily. All 16 chips must point in the same direction — you can tell one end of a chip from another by the presence of a small notch or dot, carved into one end of the plastic chip body. The notches should point away from the nearest edge of the board.

Once you've installed the extra memory, you must indicate its presence to the machine. There are two types of PCW8256. New models have a bank of four tiny switches near the centre of the circuit board which are labelled A to D, and set to ON/OFF/OFF/ON respectively, on a 256k machine. To select 512k, reverse the first two switches so that the pattern is OFF/OFF/OFF/ON.

The first Joyces have no switches. Instead, there are four links labelled A to D, and two unmarked links. To select 412k you must connect A to the top unmarked link, and B to the bottom unmarked link. If your machine falls into this category you may wish to add the switches, using an upgrade kit. A suitable kit is available for £49.95 from the source of these instructions — Micro-Bridge, of 75 Goodramgate, York YO1 2LS. If you can get your machine to York, Micro-Bridge will fit the upgrade at no extra charge.

Re-assembly of the machine is straightforward. Make one final check on your work: squint across the rows of chips to make sure that all the legs are correctly plugged in. Then put the circuit board back in the slots, replace the back and screw it on tightly. The longest screws go at the top, and the shortest by the expansion connector. When you connect the power and load CP/M, the screen will show that 366k is available to drive M. **END**

Parles-tu franglais?

The European Commission is eager to promote the development of online information, so maybe it's time to brush up on your languages. Peter Tootill reports.

'Cheap and easy access to all sources of information is considered to be one of the keys to future economic development.' So runs the opening sentence of a document produced by ECHO (the European Commission Host Organisation). The document goes on to reveal that the European Commission is actively seeking to promote the development of the online information market. To this end it produces a regular free newsletter called *I'm Information Market* as well as running a few databases of its own.

I'm is a short (about 12 pages) magazine which provides information on developments in the field of online databases. Articles are published in several languages, although most of it is in English.

The available databases are:

● **DIANA-GUIDE**, which provides de-

tailed information about databases and hosts available in Europe.

● **EABS**, which contains information relating to the published results of scientific and technical research sponsored by the EEC.

● **ENREP**, a directory of environmental research projects in the EEC countries.

● **ENDOC**, which is related to ENREP and is a directory of over 500 environmental information centres — that is, places which are involved in environmental research.

● **EURODICAUTOM**, an online guide to scientific and technical terminology in eight languages.

● **DUNDIS**, a directory of United Nations databases.

● **TED** (Tenders Electronic Daily), an online list of all invitations to tender for public works and supply multi-million pound contracts.

● **PABLI**, which is similar to TED, but is mainly for developing countries.

● **THESAURI**, a database for people involved in producing thesauri.

● **EUREKA DATA**, a catalogue of research projects on European integration carried out at European universities. It also carries details of over 5000 professors and university researchers in around 60 countries.

● **CCL-TRAIN**, a training database designed to assist people to learn the command language used in searching databases. It uses the Common Command Language (CCL) which is used on many database systems. A training manual is also available.

With the exception of TED, the above are all free of charge, but you do need a password. For more info, contact: Euronet DIANE-ECHO, 177 Rue d'Esch, L-1471, Luxembourg, tel: (010) 352 48 8041, telex 2181.

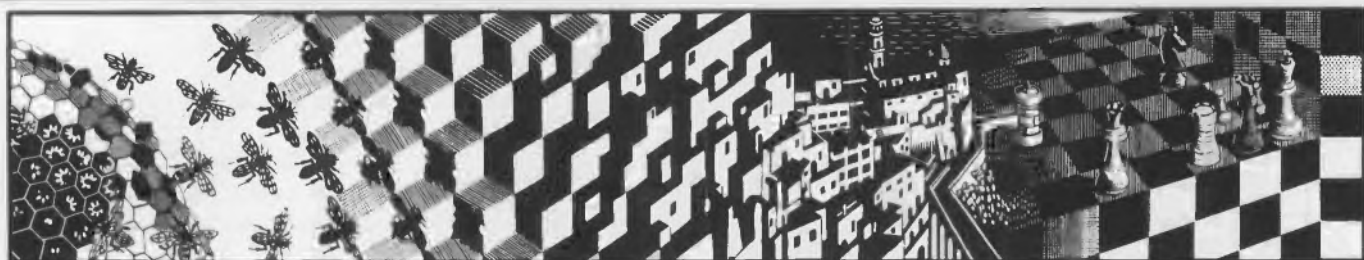
UK public online systems

Number	Name	Location	M-F times	W/E Times	Rates	Notes
(0001)885 634	DUBBS-Dublin	Dublin	9pm-8am	24	3	Bell 13.30-16.30 Wed
(01)200 3439	Airtel - TBBS	London	24	24	3/1275	Pilots area
(01)200 7577	TBBS London NW	London	24	24	3	TBBS, Tandy Users Group
(01)248 5747	Prestel	London	24	24	3	No graphics on this number
(01)262 1629	TBBS Capital	London	24	24	3	
(01)346 7150	Marctel	London	24	24	3/1275	FBBS system.
(01)348 9400	TBBS London	London	24	24	3	
(01)399 2136	M6-Net	London	n/a	Sun. 5pm-10pm	3	One of longest running BBS
(01)429 3047	OSI	London	24 Ring back	24 Ring back	3	
(01)450 9764	TechnoLine	London	24	24	1275v	Commercial
(01)452 1500	Techno-line 2	London	evenings	24	1275v	Commercial
(01)455 5380	NNBBS London	London	24	24	3/1275	
(01)542 3772	WBBS Wimbledon	London	N/A	Sat 7pm-mon 8am	3/1275	
(01)542 4977	TBBS Ravoreed	London	24	24	3-24	
(01)638 2034	CyberZone	London	24	24	3	
(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	Assyium	London	24	24	3	Writers and comms areas
(01)883 5290	NBBS London	London	9pm-8am	24	3/1275	
(01)888 8894	Gnome at home	London	24	24	1275v	
(01)927 5820	Daltel	London	24	24	1275v	
(01)941 4285	Netrotel	London	24	24	1275v	
(01)954 9847	Dark Crystal	London	24	24	3/1275	

(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	Bam-Bom on ring back
(0206)862 354	Pete's Place	Colchester	24	24	3	
(021)430 3761	CBA8BS	Birmingham	24 (not Thurs)	24	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	Cambridge	24	24	1275v	
(0224)641 585	ABERDEEN ITeC	Aberdeen	24	24	1275v	
(0224)781 919	Aberdeen Commodore	Aberdeen	24	24	3	Commodore 64 based
(0247)455 162	SBBS II (Irish Man)	Ireland	9pm-11pm r/b + 11pm-9am		3/1275	rates are daily
(0258)54 494	TBBS Blandford	Dorset	24	24	3	Blandford Computers
(0268)22 177	BITEC	Basildon	24	24	1275v	
(0268)25 122	BITEC	Basildon	24	24	3	
(0268)710 637	RICBBS	Basildon	5pm-10pm	24	?	
(0295)720 812	Bloxhae	Bloxhae	10pm-1am	10pm-1am	3	
(0376)518 818	REACT	Essex	24	24	3	
(0384)635 336	West Midlands	Stourport	6pm-8am	6pm-8am	3	TBBS
(0392)53 116	CBBS South West	Exeter	24	24	3/1275	
(0394)276 306	BABBS-I Felixstow	Felixstow	24	24	3	
(0395)272 611	CFC	Exmouth	24	24	3	John Burden
(0401)50 745	MBBS Leconfield	Leconfield	24	24	3	Martin Taylor
(0429)234 346	On-Line System	Hartlepool	24	24	1275v	Hartlepool Computer Services
(0443)733 343	N6BBS Mid Glamorgan	Ferndale	6pm-1am	6pm-1am	3	was on 755298
(0482).....	Hamnet	Hull	6pm-8am	24	3	Radio Hams
(0482)859 169	Forum-80	Hull	7pm-11pm	1pm-11pm	3	Night-Bam Bell 103(UK's first BBS)
(0483)573 337	Fido Comulink 1	Guildford	24	24	3/1275	Multi-user (see C/link 2)
(0483)573 338	Fido Comulink 2	Guildford	24	24	3-24	Bell tones on this number
(04862)25 174	PBBS-'Adult' BBS	Mitcham	24	24	3/1275	
(0492)49 194	Cyertel	Colwyn Bay	24	24	1275	
(0506)38 526	Livingstone BBS	Livingstone	24	24	3	
(051)428 8924	Liverpool Mailbox	Liverpool	24	24	3/12	Britain's first 24 hr system
(051)737 1882	Matrix	Liverpool	24	24	3/1275	Subscribers only (was Manchester)
(0524)60 399	CNOL	Lancaster	24	24	3	Clinical BBS for medics
(0534)39 389	Jersey Fido	Jersey	24	24	3	
(0592)860 313	JNBBS Aastrad BBS	Fife	9.30pm-8am	9.30pm-8am	3	Sponsored by John Menzies
(0767)50311	CBBS Gamlingay	Nr Sandy	24	24	3	
(0707)52 242	RS6B	London	24	24	1275v	
(0604)20 441	Norview	Northants	24	24	1275v	
(061)494 6938	Fido TeePee link	Manchester	10pm-9am	10pm-9am	3/12/24	New number in Feb86
(0625)33 703	Telemac 15	Macclesfield	24	24	3/1275	
(0698)884 804	SABBS	Larkhall	24	24	3	Atari based system
(0702)54 6373	C.View Rochford	Kent	24	24	1275v	
(0702)552 941	Maotel	Southend	24	24	3	Commercial system
(0705)524 805	Gosport Apricot BBS	Gosport	24	24	3/1275	3
(0705)736 025	BBS09	Portsmouth	7pm-10pm Wed	10am-10pm Sun		7 bits even parity
(0752)364 059	Haunting Thunder	Plymouth	2am-6am???	???	3/1275	Fido
(0762)333 872	PBBS&I Portadown	N.Ireland	10pm-1am R/B	10pm-1am R/B	3	
(0782)265 078	Stoke ITeC	Stoke	24	24	1275v	
(0784)65 794	Staines BBS	Staines	24	24	3/1275	7 bits even parity
(0792)203 953	FBBS Swansea	Swansea	24	24	3	
(0874)711 147	Communitree	Brecon	24	24	3	
(0883)844 164	LABBS	Surrey	24	24	3/1275	The Prisoner - 2 lines
(0895)420 164	CBBS(London NW)	West Drayton	24	24	3	
(0895)52 685	London West Tech	Uxbridge	24	24	3/1275	TBBS
(0903)212 552	Lasermail Fido	Northing	24	24	3/1275	Subscribers (12/24 coming?)
(0908)668 398	Key-board	N.Keynes	8pm-8am except Tue and Thurs		12h	Micron - Spectrum system
(0923)676 644	SBBS - Watford	Watford	9pm-11pm plus	+11pm-6am	3/1275	Times are daily
(0936)77 025	NBBS Cheshire	Sandbach	24	24	3/1275	

! Notes on rates:

3 = 300 (V.21) 1275 = 1200/75 (V.23) v = Viewdata format
 12 = 1200/1200 (V.22) 24 = 2400/2400 (V.22bis) h = half duplex
 3-12 = V.21,V.23,V.22 3-24 = V.21,V.23,V.22,V.22bis



Stephen Applebaum is bored with himself, so he's developed an alter ego with which to have another stab at life. Is his second life better than the first? Find out in this month's games review.



The second time around

Title: Alter Ego
Computer: Commodore 64/128; IBM PC; Macintosh; Apple II
Supplier: Activision
Format: Disk
Price: £24.99

'If only I knew then what I know now' is a much-used phrase, designed to massage our consciences back to equilibrium after one of life's inevitable mistakes. Sounds great. But how many of us would really like to go back and relive the tribulations of our callow years, forearmed with knowledge culled from experiences had in later life? Not many, I bet. After all, childhood and adulthood are both periods of discovery, during which we're free to take risks and make mistakes. In so doing we increase our mental and emotional strengths, leaving us more able to cope with similar circumstances in the future. Such experiences, however trying, are essential for character development, and only after having gone through them can you say 'If only I knew then what I know now' — next time, you'll know better.

Of course, there are those who yearn for a second crack of the whip, a penchant which inevitably leads to dissatisfaction with their present lives. For these people, Peter J Favaro, PhD — a distinguished psychologist, no less — has created Alter Ego.

'Most of us fantasise about doing things differently, living alternate lifestyles, walking in someone else's shoes,' opines Mr Favaro. 'I created

Alter Ego so that we can all do so in a risk-free and fun way.'

In American society, where failure isn't tolerated, an alternate lifestyle is probably something that a lot of people crave — perhaps Favaro should be looking at the reasons *why* people want to change their lives, instead of supplying a palliative for unfulfilment.

In order to give his image an air of realism, Favaro interviewed hundreds of men and women about their most memorable experiences. From these discussions, he collated a collection of common experiences. Not surprisingly, some people talked about their experiences with the opposite sex, some quite explicit examples of which have been included in the program — an action that has resulted in Alter Ego having had a parental guidance warning slapped on its packaging.

To get an idea of your alter ego's personality, the program opens with a personality profile. This is a list of statements to which you must respond with either 'true' or 'false'. Your answers are used by the computer as the basis of your alter ego's character when it first enters the world.

Like Shakespeare's *Seven Ages of Man*, Alter Ego is split into seven life stages: birth and infancy; childhood; adolescence; young adulthood; adulthood; middle adulthood and old age. Unlike *The Bard's*, these phases are diffused across three disks.

Each of life's phases is depicted as a kind of family tree, where the names of successive generations have been replaced with icons repre-

senting 'life experiences'. Your very first experience is birth; or, in the case of Alter Ego, your escape from your mother's womb. Here you can either come out fighting or complaisantly glide out into the big wide world.

To develop your alter ego you must move up the 'tree', selecting different experiences as you go. These are divided into life experience categories which include: social; intellectual; emotional; physical; familial and vocational. Much like the personality profile filled in at the start of the game, life experiences are situations where you have to select an action in response to an event. Your reaction has a direct effect on your character, which can be monitored by selecting an icon that reveals your alter ego's condition.

You can check on your character's status at any time throughout its life, or wait until the end of one of the seven stages, when it is displayed automatically.

As well as life experiences, there are also 'life choices'. The number of these increase as you get older, and include such things as getting married, having a relationship outside the family sphere, getting a job, going to work, and so on. Whereas life experiences can occur only once, life choices can be returned to time and time again, and play an important part in your development.

When your character reaches old age, you'll find that it can't do as much as it could when it was young. For instance, I optimistically put mine in a soft-ball squad, which resulted in it having a heart attack during a

game. If you play *Alter Ego* sensibly, however, your character will die without any regrets, the reward for which is an icon depicting the sun setting over a calm sea.

Playing *Alter Ego* from birth to death can take upwards of three hours. To prevent boredom setting

in, therefore, Activision has included a save routine which allows you to save the game to disk at the end of a life stage.

After playing *Alter Ego* all the way through two or three times, I feel that other than its undoubted ability to break the ice at parties, it has very

little going for it.

Although I played the male version, there's a game specially designed for females as well. I can't see *Alter Ego* appealing to anyone other than as a frivolous bit of fun to be tossed away and forgotten after a single, three-hour session.



Time and time again

Title: *Time Bandit*
Computer: Atari 520/1040ST
Supplier: Microdeal
Format: Disk
Price: £24.95

Good arcade games are few and far between these days, which is why none have graced these hallowed pages in months. The problem is that nearly everything I receive in the way of arcade games is a derivative of something that appeared on the scene two or three years ago. For instance, just before writing this month's 'Screenplay', a new copy of *Space Invaders* staggered onto my desk. There, on my desk, was an anachronism, an echo of the past. I frantically rummaged for a newspaper. Was it April the First again, already?

Having reconciled myself to never having to review another arcade game, my cynicism took a battering with the arrival of Microdeal's *Time Bandit*. Not only is this game unique in its structure, it also contains some of the best graphics ever to grace a computer screen in the PCW office.

In some respects, *Time Bandit* is reminiscent of Activision's arcade classic, *Gauntlet*. Microdeal's offering isn't quite on a par with the latter graphically, but it comes pretty damn close.

Time Bandit is a zap-'em maze game with a difference. As well as the usual shoot-outs, there are complex puzzles and riddles that must be solved to complete the game. To play *Time Bandit*, you need sharp wits as well as keenly-honed reflexes. Adventure addicts aren't left out either, as there are some intriguing problems that can only be surmounted by finding and using specific objects.

In *Time Bandit*, you take the part of a treasure hunter who travels through time in search of gold, gems, money and adventure. For the

most part, this is accomplished by wandering around a series of extremely well-drawn mazes, or time zones, filching valuables as you go.

Time Bandit's main screen is a map representing the topography of an alien landscape. Liberally scattered about the map are small symbols representing a factory, a sphinx, a Pac-Man and even the *Starship Enterprise* — to which the game's authors have payed homage — to name but a few. These curious items are Timegates. When you move your character over any one of these, you are flung headlong into a curious and extremely dangerous world.

By walking through a Timegate, you immerse yourself in the new world until finding the key, or keys, which will effect your release. Immediately after you enter a time zone, you are set upon by the blood-thirsty Evil Guardians, creatures who protect their land's wealth.

Points, in *Time Bandit*, are called Cubits. These are earned by finding the keys, unlocking the doors that lead to the way out, gathering treasure and, of course, shooting the Evil Guardians. The number of Cubits awarded to you for shooting an alien depends on your Manner, or bravery, rating. I don't know to what extreme this goes, but I was termed 'psychotic' after despatching a host of the evil hordes. The more dangerous you are, the more likely you are to gain the 1000 Cubits necessary to procure yourself an extra life.

Each time zone has its own dangers, whether they're green men with clubs, lions, snakes, spiders, strange bug-eyed creatures, or any one of a multitude of other beasts. What each world does have in common with its neighbours, though, is layout.

Every land, and there are quite a few, consists of 16 levels: four major phases (1 to 4), each with four sub-levels (A to D). The object is to reach the sixteenth level in each world and steal all the Great Artefacts therein.

What happens next is a mystery.

Time Bandit is mostly a fast-action shoot-'em-up. However, the inclusion of some adventure sequences makes it something of an oddity.

Just as in a normal adventure, you have to complete *Time Bandit*'s phases by typing in your commands. Most of the puzzles are quite difficult, and many apply to things which happen later in the game. These sequences, therefore, provide a well-earned break for both you and your joystick, as well as useful hints for overcoming contingencies.

Earlier, I stated that *Time Bandit* features a Pac-Man Timegate. Somewhat cheekily, Bill Dunlevy and Harry Lafnear, *Time Bandit*'s authors, have included a thinly-disguised copy of this arcade classic as one of the worlds that must be conquered. Although it doesn't use the original Pac-Man character, it plays in the same way but with small, animated men.

Originality and great artwork go hand in hand in *Time Bandit*. From the weird alien landscapes to the multifarious hordes, the amount of detail is incredible: ghosts rise from graves, then turn into *Ghostbuster* symbols when shot; bouncing balls poke out their tongues in wide-eyed surprise; bombs say either 'dud' or 'pow' when hit; and small, green men scamper about, manically cleaving the air with their clubs. Only lions, which walk sideways like hippy crabs, let the side down.

One of *Time Bandit*'s most exciting features is that it can be experienced by two players simultaneously. Both players have the same objective, and can either help or hinder the other. The first one to die returns as a shadow. In this state he can shoot anything that moves, including the other player, and steal treasure. He cannot gain points for any of this, however.

Overall, *Time Bandit* is a marvelous treat for the eyes and ears, and is a blessing for anyone bored with the normal kind of maze game.

SCREENPLAY



Forever Amber

Title: Nine Princes in Amber
Computer: Commodore 64/128; Atari 520/1040ST
Supplier: Telarium
Format: Disk
Price: £19.95; £44.95

Back in the early 1970s, Roger Zelazny wrote a pentalogy of science fiction novels, set in a parallel world called Amber. All five books were successful, by science fiction standards, and have since earned Zelazny cult status among readers of the sci-fi milieu.

Zelazny first introduced his alternate world to the public in *Nine Princes in Amber*, a novel that has recently been turned into a computer adventure by US-based Telarium, a company renowned for bastardising the works of famous, and not-so-famous, authors from various literary fields.

Telarium's version of *Nine Princes in Amber* follows Zelazny's plot quite closely, but deviates where possible to take advantage of the freedom that a computer offers. Although it isn't necessary to have read the book before playing the game, I'd advise you to do so — the story is quite complex, and it is easy to get lost in the welter of characters which come and go throughout the adventure.

Like Zelazny's original, the game's plot twists and turns with the gut-wrenching ferocity of a switchback ride, where you never quite know which way you're going to turn next.

If you've never played a Telarium adventure, they're generally text-based with a smattering of colourful pictures. Unfortunately, and this is one of the major drawbacks to many American adventures, they tend to access the disk after almost every move. On the plus side, this

means that the adventure can be made quite large, the descriptions comprehensive and the pictures numerous. But it also means that they're painfully slow. It's lucky the game is interesting, or you'd find yourself nodding off as the program searches the disk for the next picture or phrase.

Nine Princes in Amber starts with you waking up in a hospital bed, to find your legs in plaster and your memory shot. Drowsy and confused, you glimpse an orderly, who is holding a hypodermic needle, standing by your bedside. Without hesitation you grab the needle, then render the man unconscious with a blow to the throat. Hindered by the plaster casts, you tear a metal strut from the bed and break them. To your amazement, your legs are unscathed.

Up until now you had no idea of who you are, why you are in the hospital, or who brought you there. A chart on the wall answers some of these questions. You discover that your name is John Corey and you are 35 years old. You were taken to the hospital by your sister, following a car accident in which you received two broken legs. At the bottom of the chart is your sister's name and address.

You don the orderly's clothes, leave the hospital and catch a taxi to your sister's house. From here on, the plot unravels slowly, revealing your past and present predicament to you piecemeal.

It transpires that your name is actually Corwin, and you are ninth in line to the throne of Amber; and that your car crash was no accident, but a means of getting you out of the way. While you have been unconscious in the Shadow World (Earth), your brothers and sisters have split Amber up into factions, the most powerful of which is led by Eric. Now you

must return to Amber and wrest the crown from your squabbling kin.

You first reacquaint yourself with your brothers through a pack of Tarot cards, found in your sister's mansion. Upon these cards are printed likenesses of your brothers, clothed in their royal garments; on one card is a portrait of yourself, clothed in black and silver.

Aided by Random, another inhabitant of Amber who has escaped to the Shadow World, you head off on a fantastic journey that takes you from the dirt and grime of New York to the lush landscapes and imminent danger of your world, against which Earth is a mere phantasmagoria by comparison.

Telarium has done a good job of converting *Nine Princes in Amber*, although as always happens when a book is turned into another medium, much of its original impact has been lost in the conversion. One of the game's major failings is its slow speed, which becomes increasingly more annoying as the game progresses. The pictures used to supplement the text are, on the whole, well-drawn and pleasing to the eye. However, the amount of time that it takes to retrieve each picture breaks up the flow of the game, and makes me feel that it might have been better to forego some of them for the sake of additional text.

If you can spare the time, *Nine Princes in Amber* (the game) is well worth a look. It isn't too difficult, so if you're thinking about buying your first adventure but aren't sure where to start, you could do far worse than try this one. Those of you who want to get to know Zelazny's work, however, should buy the book, because Telarium's effort pales next to its pulp counterpart.

END

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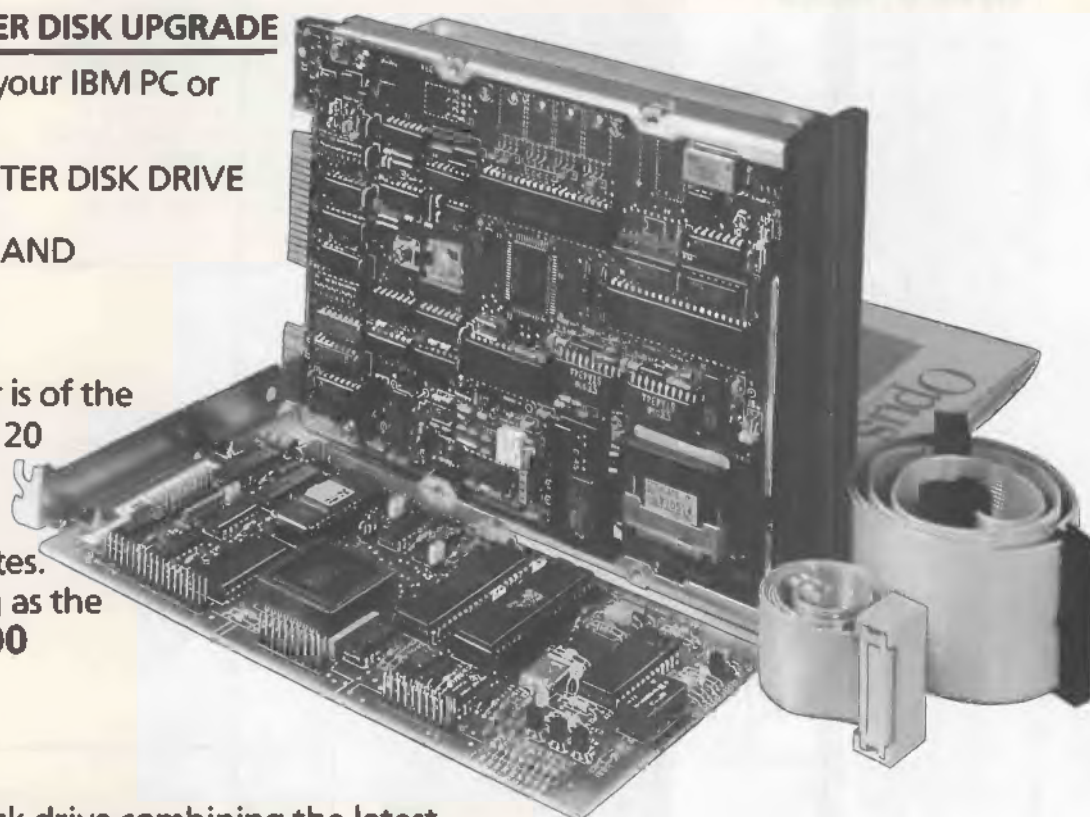
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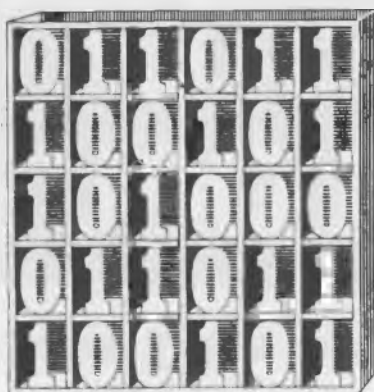
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Z80 TREE STRUCTURES

The five datasheets this month, from John Hardman of Welling in Kent, include nine subroutines which form the basis of a tree structure control suite.

The tree format used by John is to separate the data structured in this way from the actual nodes of the tree which each contain only a set of four addresses. In the Z80, and other machines limited to 16-bit addresses, each node requires eight bytes of contiguous random access memory.

Processors with larger address capabilities would obviously need correspondingly larger blocks of RAM for each node. The 68020, for example, has a 32-bit addressing capacity, and would need a 16-byte block of memory to hold each node if the full memory complement were to be accessed.

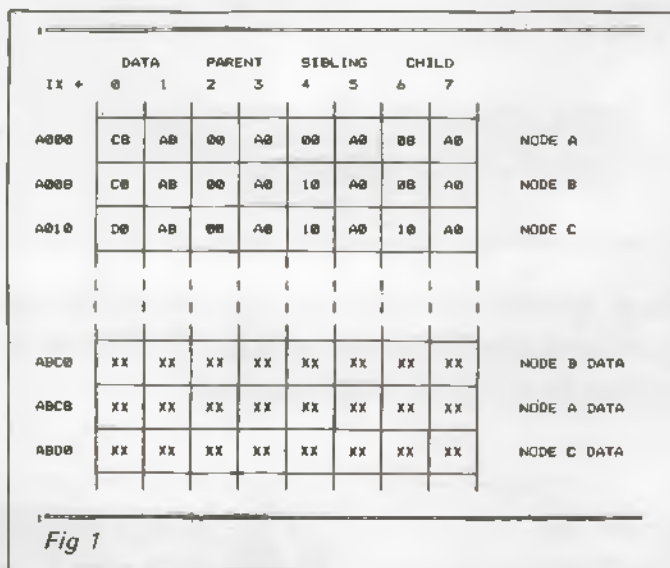
Fig 1 shows the connecting links of a simple tree structure of three nodes,

with each node having the four fields needed by John's suite. Node A is the parent of nodes B and C. Note that since node A has no parent itself, nor no sibling, its parent and sibling link fields are self-referential and address the first byte of node A.

Similarly, the child link fields of both nodes B and C and the sibling link field of node C are self-referential. The data address fields are not links and are never self-referencing.

The data ordered and accessed by this simple tree structure exists in a separate area of memory. It may be of variable length and arranged quite randomly, as the start address of each data block is read from the data address field of the appropriate node. This, too, is shown in Fig 1.

Although the suite is capable of starting new trees, appending new nodes or searching in depth-first or breadth-first order through an existing tree, John has not provided the means to delete nodes from a tree, nor the memory management routines which would be needed to keep a list of free blocks in a real application.



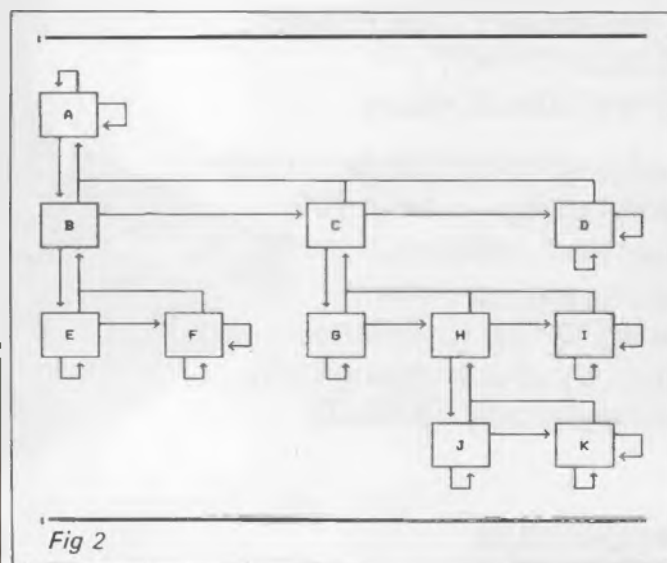
David Barrow presents more documented machine code routines and useful information for the assembly language programmer. If you have a good routine, an improvement or conversion of one already printed, or just a helpful programming hint, then send it in and share it with other programmers. Subroutines 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.

SEARCH ORDER

John has provided two methods of searching, or traversing, through the tree. Referring to Fig 2, a depth-first search would visit all the nodes in the order ABFCGJKIDA, while a breadth-first search would visit in the order ABCDEFGHIJK.

Knuth, in *The Art of*

Computer Programming: Volume 1. Fundamental Algorithms (Addison-Wesley, 1973), gives a full account of various tree structures and describes two principal ways to traverse non-binary trees. These are preorder, which corresponds to the depth-first search; and postorder, which would visit the nodes of the tree in Fig 2 in the order EFBGJKHICDA.



LINKAGE

The quadruple field linkage (actually three links plus data pointer) used in John's suite may be wasteful of memory and unnecessary in some applications. A similar method, which — with a little more computation — will provide equivalent information, disposes of the parent link in every node and uses only the sibling link of the youngest (right-most) child to refer back to the parent. This method does require a single bit flag to distinguish sibling from parent link.

With even greater reliance on computation and stacking of node addresses whenever

reference passes to a deeper level, the parent link can be eliminated completely — although this usually results in slower access.

Alternatively, if greater linkage information is built into the structure, perhaps vertically up several levels or horizontally across branches of the tree, traversal times can be speeded up considerably. This type of distant linkage is known as 'threading' and is used to produce tolerable operating times in tree-structured computer languages, such as Forth.

The type and amount of linkage required for a useful tree structure depends entirely on the particular applications for which it is

used. John's suite is generally useful and does provide a simple introduction to a fascinating field. He suggests that anyone interested in pursuing the subject should read *Artificial Intelligence*, by Patrick Henry Winston (Addison-Wesley,

second edition 1984). Knuth is a better bet but is rather complex.

More information on machine intelligence can be obtained from the three-volume, *The Handbook of Artificial Intelligence* (Pitman, 1981).

DATASHEET 1

== PARENT	- Address parent node.
> SIBLING	- Address next younger sibling node.
> CHILD	- Address child node.
JOB	To address the next related node in a tree structure as either the PARENT, next youngest SIBLING or eldest CHILD or return the input address with flag information to say no such node exists.
	Node fields give the addresses of (a) node data, (b) node above (PARENT), (c) node along (SIBLING) and (d) node below (FIRST CHILD). Where no relative node exists, the field is self-referent to the node.
ACTION	Read address of required node from current node. Compare new address - current address to set flag.
CPU	Z80
HARDWARE	RAM containing 8-byte nodes.
SOFTWARE	None.
INPUT	IX = current node address (1st byte).
	NODE FORMAT (8 bytes, 4 fields):
	Byte 1,0: Address of node DATA.
	Byte 3,2: Address of PARENT node / current node.
	Byte 5,4: Address of SIBLING node / current node.
	Byte 7,6: Address of CHILD node / current node.
	(N.B. where no PARENT, SIBLING or CHILD node exists, the field contains the current node address.)
OUTPUT	Z = 0: IX addresses required node. Z = 1: IX unchanged.
ERRORS	None.
REG USE	IX F
STACK USE	6
RAM USE	None.
LENGTH	38
CYCLES	PARENT: 171. SIBLING: 171. CHILD: 159.
CLASS 1	discreet interruptible pronable reentrant relocatable robust
PARENT	PUSH HL : Save HL for use reading LD L, (IX+2) : address of parent node LD H, (IX+3) : JR PSCZ : jump to common code.
SIBLING	PUSH HL : Save HL for use reading LD L, (IX+4) : address of next sibling node LD H, (IX+5) : JR PSCZ : jump to common code.
CHILD	PUSH HL : Save HL for use reading LD L, (IX+6) : address of first child node LD H, (IX+7) : fall through to common code.
PSCZ	PUSH DE : Save DE for use comparing PUSH IX : addresses. Get address of POP DE : current node in DE from IX. PUSH HL : Copy address of desired node POP IX : from HL to IX. AND A : Clear Cy and subtract current SBC HL, DE : from new address, setting Z. POP DE : Restore DE and HL used in POP HL : routines, and exit with Z set RET : if output IX equals input IX.

DATASHEET 2

== NUTREE	- Start a new tree structure.
> ADCHLD	- Add node to existing tree.
JOB	NUTREE: To initialise the first node of a new tree. ADCHLD: To initialise a node appended to an existing tree, adjusting the node(s) at place of insertion.
ACTION	NUTREE: Store new node addresses: (a) DATA (b) SELF (c) SELF (d) SELF. ADCHLD: IFTE (PARENT node CHILD field valid.) [Address youngest CHILD. Change CHILD node SIBLING field to address new node. Change PARENT node CHILD field to address new node.]
	Store new node addresses: (a) DATA (b) PARENT (c) SELF (d) SELF.
CPU	Z80
HARDWARE	RAM containing 8-byte nodes.
SOFTWARE	SIBLING, CHILD, (Datashet 1).
INPUT	(For node format see Datashet 1.) NUTREE: HL = address for new node. DE = node data address. ADCHLD: IX = address of PARENT node to which CHILD node is to be dependent. HL = address for CHILD node.

DE	= CHILD node data address.
OUTPUT	NUTREE: IX = address of new node. All other registers & flags unchanged. ADCHLD: IX = address of CHILD node. HL = address of PARENT node. Flags altered, other registers unchanged.
ERRORS	No check for overwrite of existing tree memory use (either data or nodes) by new node.
REG USE	DE HL IX (also F in ADCHLD).
STACK USE	8 (including subroutine usage).
RAM USE	None.
LENGTH	66
CYCLES	NUTREE: 220. ADCHLD: No SIBLING: 438. x SIBLING: 493 + (200 * SIBLING).
CLASS 2	discreet interruptible pronable reentrant relocatable robust NUTREE: discreet. ADCHLD: -discreet.
NUTREE	PUSH HL : Put address of new tree 1st node JR TWIN : on stack and go set new node.
ADCHLD	CALL CHILD : Get address of parents 1st child JR Z, SINGLE : else skip if a terminal node.
ACLP	CALL SIBLING : Repeat, get address of next JR NZ, ACLP : sibling until youngest child.
	LD (IX+4), L : Write new sibling address in LD (IX+5), H : earliest while youngest node. PUSH HL : Save new node address. LD L, (IX+2) : Get parent node address from LD H, (IX+3) : earliest while youngest... on stack EX (BP), HL : and new node address in HL. JR TWIN : Jump to new node write.
SINGLE	LD (IX+6), L : Write new node address in LD (IX+7), H : sibling field of parent. PUSH IX : Save parent node address.
TWIN	PUSH HL : Copy new node address to POP IX : current node pointer IX. LD (IX+0), E : Write data address to data LD (IX+1), D : field of new node. LD (IX+4), L : Write new node address to LD (IX+5), H : sibling field and LD (IX+6), L : child field as self reference LD (IX+7), H : because a terminal node. POP HL : Get parent node address and LD (IX+2), L : write to parent field in LD (IX+3), H : new node. RET : Exit, new node formed.

DATASHEET 3

== DFIRST	- Depth first movement through tree.
JOB	To address the next node in depth first search pattern - moving down to eldest child if possible or across to next branch if not - or set a flag showing no further nodes available.
ACTION	Save input node address. IFTE (CHILD node exists.) [Address CHILD node. Discard saved input node address. Set node found flag. REPU (Node found or search end.) [IFTE (SIBLING node exists.) [Address SIBLING node. Discard saved input node address. Set node found flag. IFTE (PARENT node exists.) [Address PARENT node. Restore input node address. Set search end flag.]
CPU	Z80
HARDWARE	RAM containing 8-byte nodes.
SOFTWARE	CHILD, SIBLING, PARENT, (Datashet 1).
INPUT	IX = address of current node.
OUTPUT	Z=0: IX = address of new found node. Z=1: input node was last in depth first search. IX is unchanged.
ERRORS	None.
REG USE	IX F
STACK USE	10 (including subroutine usage).
RAM USE	None.
LENGTH	23
CYCLES	Not given.
CLASS 1	discreet interruptible pronable reentrant relocatable robust
DFIRST	PUSH IX : Save address of current node CALL CHILD : and address 1st child, but skip JR Z, NXTNOD : to next sibling if no child.
DONE	INC SP : Clear stack and exit with INC SP : address of new found node RET : in IX and Z reset.
NXTNOD	CALL SIBLING : Get address of any next younger JR NZ, DONE : sibling and exit, else... CALL PARENT : (re-get) parent node and loop JR NZ, NXTNOD : for sibling at higher level.

POP IX unless at last node, retrieve DD E1
RET node address and exit, Z set. C9

DATASHEET 4

NXTTRM - Next terminal node of tree.

JOB To address the next terminal node of a tree structure using depth first search technique, or set flag showing no further terminal nodes available.

ACTION Save input node address.
IFTE (Next depth first search node exists.)
[
Address new node.
REPW (CHILD node exists.)
[
Address CHILD node.
]
Discard saved input node address.
Set node found flag.
Restore input node address.
Set search end flag.
]

CPU Z80
HARDWARE RAM containing 8-byte nodes.
SOFTWARE CHILD (Datashet 1), DFIRST (Datashet 3).

INPUT IX = address of current node.
OUTPUT Cy=0: IX = address of new found terminal node.
Cy=1: Input node was last terminal node in depth first search pattern.
IX is unchanged.
ERRORS Other flags changed, no other registers changed.
REG USE None.
STACK USE IX F
RAM USE 12 (including subroutine use).
LENGTH None.
LENGTH 28
CYCLES Not given.

CLASS 1 *discreet *interruptable *promable
***** *entrant *relocatable *robust

NXTTRM PUSH IX :Save address of current node. DD E5
CALL DFIRST :Get next node by depth first. CD 10 h1
JR NZ,OK :search, skip if another node. 20 04

POP IX :Else recover input node address DD E1
OR A :and clear Cy to show input was B7
RET :last terminal node, on exit. C9

OK CALL CHILD :Repeat, find oldest child of CD 10 h1
JR NZ,OK :this node, until terminal node. 20 F8
INC SP :Clear stacked input address. 33
INC SP : 33
SCF :Set Cy to show new terminal 37
RET :node found, on exit. C9

DATASHEET 5

NXTROW - Leftmost node of next depth.
LEVEL - Next node at current depth.

JOB NXTROW: To address the leftmost node of the tree structure at one level greater depth or set flag showing no further node exists.
LEVEL: To address the neighbouring node at the same level of the tree structure or set flag showing no further node exists.

ACTION NXTROW: Save input node address.
Set count = 1.
REPW (PARENT node exists.)
[
Address PARENT node.
Count = count + 1.
]
PROC: "FURTHA"

LEVEL: Save input node address.
Set count = 0.
REPW (SIBLING node does not exist AND search end flag not set.)
[
IFTE (PARENT node exists.)
[
Address PARENT node.
Count = count + 1.
]
Set search end flag.
]
Address SIBLING node.
PROC: "FURTHA"

FURTHA: REPW (Count > 0 AND end flag NOT set.)
[
CASE (CHILD | SIBLING | PARENT | CASED.)
[
Address CHILD node.
Count = count - 1.
]
Address SIBLING node.
]
Address PARENT node.
Count = count + 1.
Set search end flag.
]

IFTE (Count = 0.)
[
Discard saved input node address.
Set node found flag.
Restore input node address.
]

CPU Z80
HARDWARE RAM containing 8-byte nodes.
SOFTWARE PARENT, SIBLING, CHILD, (Datashet 1).

INPUT IX = address of current node.
OUTPUT Z=0: IX = address of new found node.
Z=1: Input node was last in breadth first search.
IX is unchanged.
ERRORS Other flags changed, no other registers changed.
REG USE None.
STACK USE IX F
RAM USE 12 (including subroutine use).
LENGTH None.
LENGTH 57
CYCLES Not given.

CLASS 1 *discreet *interruptable *promable
***** *entrant *relocatable *robust

NXTROW PUSH BC :Save for use as depth counter. CD 05
PUSH IX :Save current node address. DD E5
LD BC,0 :Depth count = 0 for extra INC. 01 00 00

REPEAT INC BC :Find highest node address and 03
CALL PARENT :calculate depth of input node. CD 10 h1
JR NZ,REPEAT : 20 FA
JR FURTHA :Get next depth, leftmost node. 10 15

LEVEL CALL SIBLING :If younger sibling exists, then CD 10 h1
RET NZ :return its address, Z reset. C0
PUSH BC :Else save to use as depth count. C5
PUSH IX :Save current node address. DD E5
LD BC,0 :Depth count = 0. 01 00 00

AGAIN CALL PARENT :If top node, exit with Z set CD 10 h1
JR Z,TOP :returning input node address. 20 10
INC BC :Else address parent, inc count. 03

RIGHT CALL SIBLING :Address next sibling, else no CD 10 h1
JR Z,AGAIN :sibling so go get parent. 20 F5

FURTHA CALL CHILD :Address 1st child, else no CD 10 h1
JR Z,RIGHT :child so go get sibling. 20 F6

DEC BC :Child got so dec depth count. 0B
PUSH AF :Save AF for count test. F5
LD A,B :Test depth count BC for 0. 78
OR C :If right depth got then exit. B1
JR Z,ZERO :clearing Z, with new node addr. 20 03
POP AF :Else restore AF and go seek F1
JR FURTHA :correct level. 10 F2

ZERO POP AF :Restore AF from count test. F1
INC C :Reset Z to show node found. 0C
POP BC :Clear input node addr off stack. C1
DEFB 1 :Do byte miser's trick to make 01
next POP IX into LD BC,0E1DDH.

TOP POP IX :Restore input node address. DD E1
POP BC :Restore BC. C1
RET :Exit, addr in IX, Z flags. C9

DATASHEET ACTION

A few readers have complained that conversion of some SubSet routines to other codes is not helped by a tendency of these formal descriptions to reflect the coding capabilities of the processor for which the routine is written, nor by the confusing compact use of square brackets.

From suggestions put to me by various people, I have revised the format of the ACTION section to display the structure far more clearly. I have also made the attempt to describe the operation performed in such a way that the job could easily be coded for any processor, rather than echoing the more 'optimised' structuring of the code.

I have introduced several

control words which are limited to a four-letter length for spatial economy. Their meanings should be quite clear to anyone used to a structured language, but to dispel any doubts, here's a full definition:

'IFTE' — IF...THEN...ELSE: binary selection on condition
'CASE' — Case — multiple selection, nested 'IFTE'
'REPW' — REPEAT IF condition true (end tested)
'REPU' — REPEAT UNTIL condition true (end tested)
'REPW' — REPEAT (or DO) WHILE condition holds (start tested)
'PROC' — PROCESS described separately
Conditions are contained in braces (curly brackets) and are separated, if multiple, by the vertical bar.
Corresponding actions are enclosed in square brackets and are separated by the reverse oblique (backslash).

END

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Maths on the double

Samuel Dick opens the Pandora's Box of high-speed mathematics and discovers that everyone can benefit from a new species of computer chips.

Are computers really quicker than humans? Many people believe so — but is this belief justified? For many tasks the answer is actually 'no'. Think back to your childhood. Take an event at random and then remember as much about it as you can: the colours, the sounds, the ambience. How long did that take? Perhaps a few seconds.

That sort of memory recall and the ability of the brain to perform advanced functions, such as image processing, are taken for granted in everyday life. Of course, the brain is very selective about what information it does process so that the load is kept to a minimum but, for certain tasks, humans can make computers

look really slow.

Mathematics is one area where machines are always thought to be much quicker — and more accurate — than their human counterparts. Although this is certainly true, machines are still rather slower than their reputation would have us believe. Even some 16-bit micros can take a few milliseconds to perform a multiply — not exactly instantaneous.

Who needs fast maths?

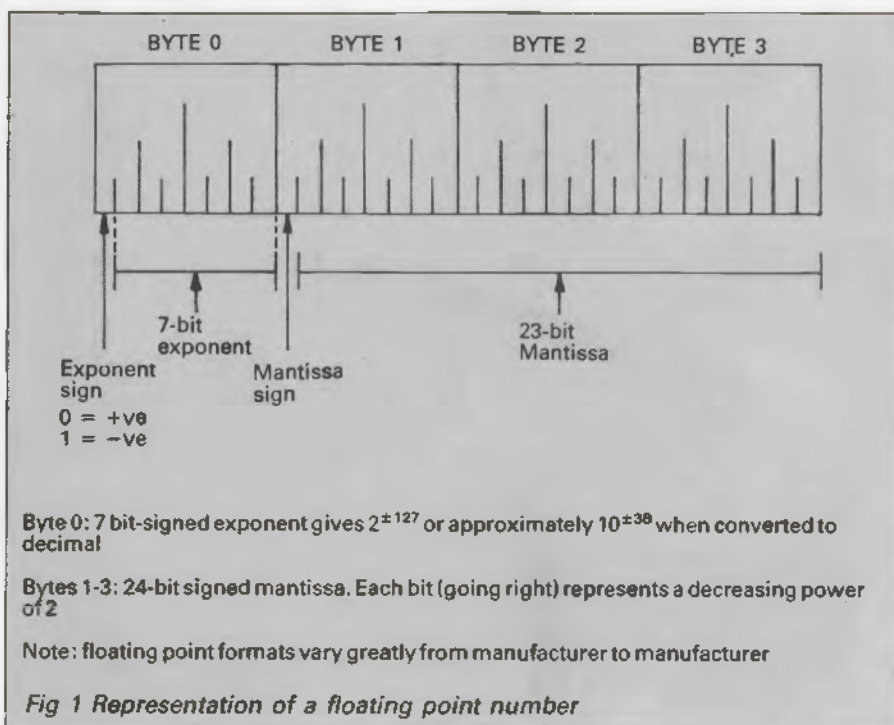
The ability of machines to perform numeric operations quickly is important in all fields. In office automation, the speech-controlled word processor or management workstation will

depend on fast maths to perform speech recognition. Busy executives would then be able to speak to their word processor. And the workstation will be able to talk back, naturally. The ultimate convenience in the man/machine interface, perhaps?

One of the major inhibitions of people new to computers is the need to master the keyboard; hence the popularity of mouse-based systems. But detecting the spoken word by the different frequencies each word contains demands fast Fourier analysis of the speech after it has been digitised, and small machines are currently unable to cope with the workload satisfactorily.

In banking, electronic fund transfer demands encryption — this time, long integer words need to be logically shifted to provide the necessary protection against cryptanalysis. In telecommunications, analysis of signals decreases errors. For example, all-digital modems will perform the frequency detection needed to translate between audio tones and bits. They will include more comprehensive error coding to reduce the error rate associated with dial-up telephone lines.

Radar processing will make the airways safer — but a fast-maths machine would have to be compact to fit into an aeroplane. Processing of satellite imagery will help the Third World to manage the earth's resources. Satellite imagery in 1024×1024 arrays means a million operations for even the simplest of image processing functions; the handling of large arrays of data is also common in medical tomography. Tomograph scanners already help us to detect cancer and enable doctors to diagnose and treat many other



disorders. Speeding all these tasks along requires real number-crunching power.

Nearly everyone could reap benefits from machines which have an enhanced maths ability. And that is exactly what a new species of computer chip is achieving — sometimes cutting calculation time by a factor of 100 or more. But why are existing machines slow at maths?

Slow start

It's difficult to understand why computers are slow at maths until you look at the way in which they perform calculations. Part of the prob-

lem is that humans work to base-10 (decimal) while computers work to base-2 (binary). This means that each time a number is input or output in a human-readable form, it has to be converted between ASCII and binary. However, the biggest consumer of time is the actual manipulation of the number, even when it is in its internal, binary format.

This format stores the number as a mantissa and exponent in base-2. Typically, a four-byte length is used where the exponent is held in one byte — giving a range of $2^{+/-128}$ — and the mantissa is held in the remaining three bytes with each bit representing a $2^{-(n)}$ component of the number; one bit is used for the sign of the mantissa. Fig 1 shows the format graphically. This refers to floating point numbers — integers, both signed and unsigned, are held in the more conventional form which duplicates how we would write a binary number.

Integers are very common in computing, but the majority of the applications that need fast maths tend to use floating point because its range allows real-world figures to be manipulated — the real world never comes in integer form!

Looking at the simple algorithm for floating point multiplication shown in Fig 2 allows us to see why machines are slow at maths and also why processors with small words, such as the 8-bit word of most home micros, are much worse than, say, mainframes with their 32- or 64-bit words.

To take a few examples — look at the loop. Note that there is a 31-bit logical shift of the mantissa. A 32-bit processor uses one word to cope with this — an 8-bit processor would have to take each byte as an individual operation and check for 'carry' into the next byte. Even the 32-bit processor would have to do the addition loop many times — perhaps 63 times for a double-precision number in Fortran (equivalent to about 16 digits of accuracy).

Similarly, addition, subtraction and division have their own algorithms. The use of trigonometric or logarithmic functions compounds the problems because they are calculated from long series, and each term in the series might need a multiplication and a division.

The author's home computer manages only about 200 SIN or COS calculations per second. An 8086 processor can take 20ms to perform a square root depending on number format and clock rate. So how is the problem of speeding-up machine maths to be solved?

Solutions

The slowness with numbers in the examples above is caused by the processor using its general-purpose instruction set to handle bits and

bytes under software control. If the whole operation could be done using dedicated hardware, then the speed might be improved.

And this is just what the major silicon houses have done. Gradually, each has introduced a floating point processor as an add-on to its range of processors. Mainframes and minis have had such devices for a long time; the 'industry standard' VAX II/series from Digital Equipment Corporation comes with a floating point accelerator which carries out most operations in around one microsecond.

Intel introduced the 8087 co-processor for its 8086 in the early 1980s. The use of the co-processor typically gives a factor of one-hundred increase in speed. National Semiconductor has the NS16081 Floating Point unit for its 1600 series and Motorola is introducing the MC68881 Floating Point Co-processor which is mainly aimed at the 68020 32-bit processor, although it is designed to work with processors having 16- or 8-bit data paths.

The typical internal architecture of an FPU (floating point unit) is shown in Fig 4. Note how there are separate execution units within the processor for the mantissa and the exponent; a special shifter for the mantissa allows the adjusting of the mantissa (before addition) to be done quickly. The internal registers of the FPU can hold all the data types handled: integers and reals of various lengths and packed BCD formats are held in registers which are 80 bits long in the 8087.

In operation, FPUs can be expected to perform the four simple math operations as well as logarithms, raising-to-a-power, and the calculation of trigonometric functions and their inverses.

Driving the chips

Integrating these mini-brains into a system is very easy — despite the complex task that they perform. When a compiler or interpreter comes across a math operation in a program — say, the SQRT (square root) function — it will place a call to a system routine in the resultant object code list. This system routine will, in simple systems, then calculate the required function using the standard instruction set of the processor. For example, the multiply function ('*') will be referred to a routine which obeys the algorithm shown earlier. However, if a floating point unit is present, the equivalent routine would just be the machine instructions to drive the unit.

This may mean that you have to buy a different language compiler depending on whether or not your system has the unit added. Some systems will sense the presence of the unit and translate math-operation

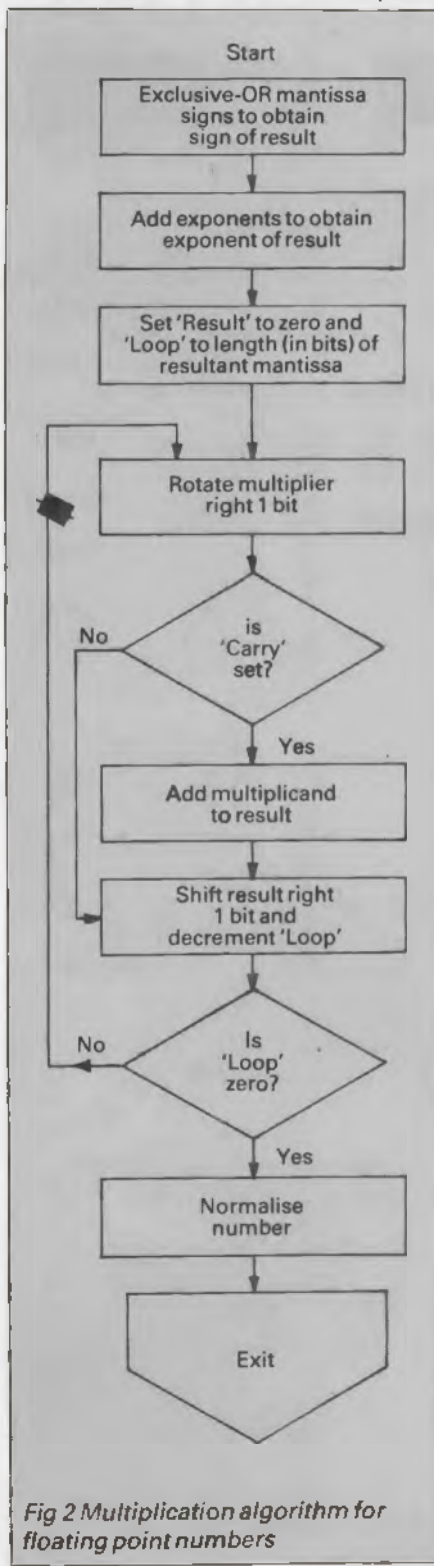


Fig 2 Multiplication algorithm for floating point numbers

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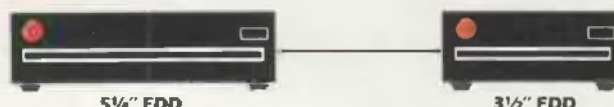
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PROGRAMMING

calls by the compiler accordingly.

If you have a threaded interpretative language like Forth, then adding an FPU into your system may just involve the defining of a few new commands — one of the advantages of extensibility.

Each of the three devices mentioned above has its own way of interfacing with the rest of the system. The 8087 shares the system bus with its host processor — typically an 8086 or 8088. The 8087 watches the CPU's status lines and also decodes the instructions fetched by the CPU from memory. When an 8087 instruction is fetched, perhaps FMUL for multiplication, the CPU interprets it as an ESCAPE instruction. For operations that do not require a memory fetch, such as those that operate on the 8087's internal registers, the 8087 proceeds to perform the calculation. If a memory fetch is needed, the CPU obtains the word from memory but ignores it: the 8087 reads it in. If more than one word is needed by the 8087 to execute the instruction, then, once the first word has been read, the 8087 takes control of the bus and fetches the remainder of the words.

The 68881, by comparison, is never allowed to take control of the bus. All fetches and stores are performed by its host CPU. When the host has performed any memory operations for the 68881, the host is free to execute the next instructions. If the next instructions need the result of the task given to the 68881, then the host halts until the result is available, so a certain amount of concurrency is possible.

The NS16081 receives its orders and data from its host CPU. Memory references involving the FPU cause it to read or write data from the data bus when the SLAVE-PROCESSOR-

6800 CPU

```
; address of most significant byte is in X
; only 8-bit shifts available
LSR 3,X ; shift msby right
CLC      ; clear carry bit
LSR 2,X ; shift next byte
BBC LBL1 ; if no carry then goto lbl1
LDA A 80 ; carry was set so set msbi in 1sby
ADD A 3,X ; add in msbit
STA A 3,X ; store result away
LBL1: CLC      ; clear carry
LSR 1,X ; shift next byte
BCC LBLO ; if no carry then goto lbl0
LDA A 80 ; set msbi in accumulator
ADD A 2,X ; set msbi in byte
STA A 2,X ; store result away
LBLO: RTS      ; return
```

Total of 70 clock cycles

6803 CPU

```
; same algorithm as above but with 16-bit shifts
LSR 3,X ; shift least significant byte
CLC      ; clear carry bit
LDD 1,X ; load 16-bit accumulator with top
        ; two bytes
LSRD      ; shift them 1-bit right
STD 1,X ; store them away
BCC EXIT ; if no carry set then end
LDA A 80 ; set msbi in 8-bit accumulator
ADD A 3,X ; add least significant byte into
        ; this accumulator
STA A 3,X ; store result away
EXIT: RTS      ; return
```

Total of 41 clock cycles

Fig 3 Algorithms to shift a 24-bit mantissa 1-bit right for processors with different abilities

CONTROL line goes low; instructions are also sent over the data-bus to the FPU.

If you think that floating point units are quick, you may be surprised to hear that they are actually beaten for speed by the latest members of the fast-maths species.

Known as 'digital signal processing' chips, these devices are the state-of-the-art in speedy sums.

While still not quite up to the speed of a mainframe or supermini, they do offer the designer of tomorrow's advanced systems a chip-level solution to computation problems. For example, the Texas Instruments TMS320 series boasts a sine or cosine calculation time of under 5ms; a 64-point Fast Fourier Transform (FFT) takes a little under 600 microseconds. Simpler chips designed to multiply are available from a number of sources including AMD, Analog Devices, and TRW. Some are capable of a 16-bit by 16-bit multiply in only 40 nanoseconds.

Current array processors, which can carry out many calculations in parallel, have speeds up to around 100 million floating operations per second — or 100Megaflops, in the jargon. Perhaps this is the way forward for the future fast-maths chips?

Conclusion

The future in fast maths may be closer than we think. After all, the Transputer from Inmos can form an array of computers to offer concurrent program execution — true concurrency, too, not just one processor multi-tasking. So how long will it be before we see arrays of Transputers on one silicon chip? **END**

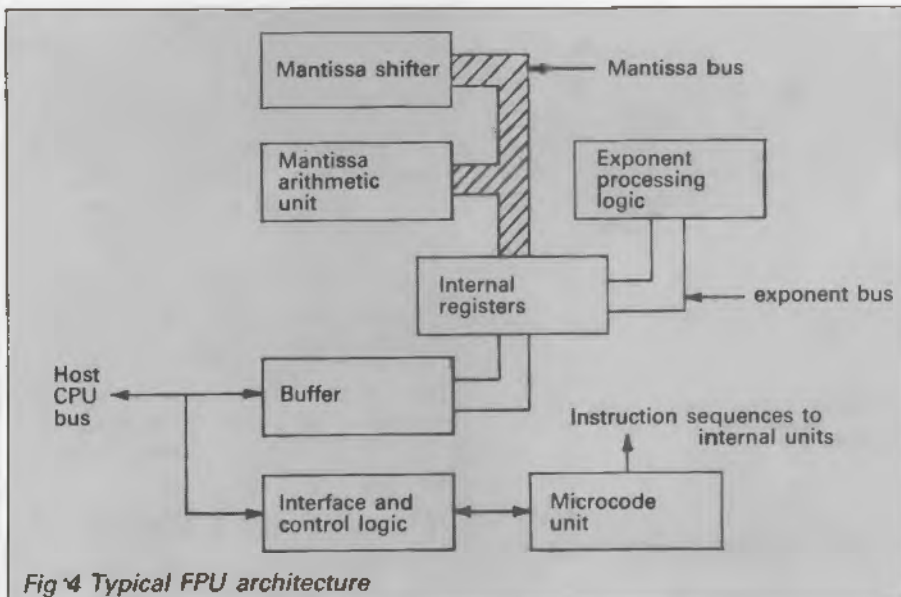
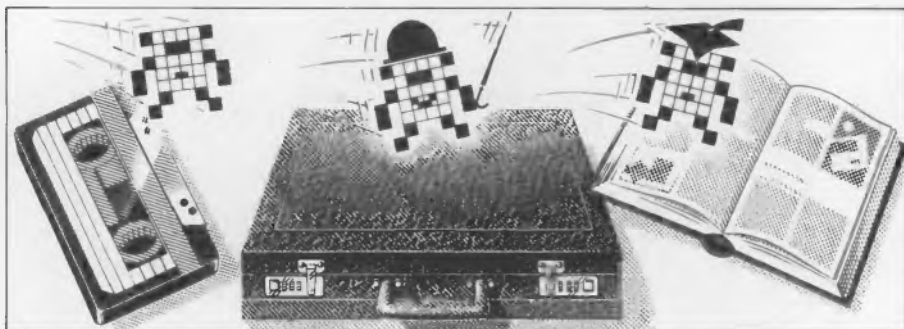


Fig 4 Typical FPU architecture

PROGRAM FILE



-  Games
-  Scientific/mathematic
-  Business
-  Toolkit/utilities
-  Educational/Computer Aided Learning

*Owen Linderholm selects the best of readers' programs.
For details on submitting your own, see the end of
this section.*

In summertime, when the weather is fine, even programmers' thoughts turn to things other than computers. Nevertheless, I hope that some of you have taken off your designer sunglasses for long enough to read 'Program File': it will be a welcome rest from the ups and downs of the British sporting summer, and the physical strains of sunburn and too many long, cool drinks.

What we want

I'm glad to see a slow improvement in the standard of submissions to 'Program File'. This is partly due to the fact that some of the better regular contributors have stepped up their output, but some new names have been producing rather good programs. Especially encouraging is that some programs include adequate documentation and clear comments within the programs them-

selves — this makes my job of selection easier, and also means that I am likely to be favourably disposed towards such programs. After all, if a program has no accompanying documentation and then doesn't seem to do much when run, I'll assume that it isn't any good and return it.

The ideal program is interesting, performs a useful function, is clearly written, and is documented well enough that anyone could convert it to run on another machine. Unfortunately such jewels are rare, and I usually have to accept a compromise — a very good program with poor documentation, or a reasonable program with documentation good enough to make the program easy to improve.

I have been ignoring games programs for some months simply because the games which come in are not good enough: most are tacky rip-offs of standard arcade games. They

are written in awful bastardisations of machine code and Basic, without any explanation of which bits do what, and to round it all off, they are all plagued by bugs. I realise that for some forms of action some machine code is necessary, but please use it in a separate routine and explain how it works and what it does.

Strategy games are submitted less often. They suffer from fewer problems but still aren't up to scratch. Generally they are faithful reproductions of various games, but they don't encourage the computer to play a good game. It would be nice to see strategy games use some of the methods expounded by David Levy in his old PCW computer game column; this column was widely used and reprinted, and much of it is available in book form. Other authors have written books covering computer game-playing, and any good computer bookshop should be able to help you out with finding them. (Incidentally, please don't send in programs for things like noughts and crosses or hangman; write something more exciting and challenging like a good poker player.)

Another area in which contributors have been slipping is in supplying hints and tips. Despite the demise of 'TJ's Workshop', we are quite happy to accept a wide range of tips for publication, including hardware hints. These will be paid for at much the same rate as the listings in 'Program File', and any tips which improve computer usage are welcome.

Please keep sending in Amstrad PCW8256 and Sinclair QL programs. Due to the lack of these machines in the PCW office, I may take a little longer than usual in dealing with the programs — but I haven't forgotten about them.

This month's programs

I was getting worried this month about what should be the Program of



PROGRAM FILE

the Month, since nothing wonderful had come in. At the last moment, Gavin Stark came to the rescue with an unusual program to generate three-dimensional fractal images. Most people should be familiar with the Sierpinski curve and other, standard two-dimensional fractal curves. This program uses similar techniques, but starts with a cube as a generator to produce something known as a Menger Sponge. Other generators can be used, but since the results can only be shown as a projection of the three-dimensional object, some of the detail can be lost. The program is for any BBC or Electron, and it shouldn't be too difficult to convert to other 6502-based machines such as the Commodore 64, but some knowledge of machine code will be needed.

Amstrad Pro-Menu provides a set of subroutines to implement sophisticated pop-up menus on the Amstrad. These can then be incorporated into user programs to give them a more professional look.

There is a program to produce graphics printout from a daisywheel printer. This sounds like (and probably is) a misuse of technology, but the technique is interesting and could be useful to people who have only a daisywheel printer and need to print the occasional graphics. The program is written in MBasic for an IBM or compatible, but should be easy to convert to any other machine.

There is one program for the Spectrum this month — a machine code utility to provide a patterned fill routine. The program includes examples of it in action, and it looks extremely impressive. The filling action is very robust and fills in any area correctly. The patterns used are reminiscent of the Apple Macintosh and MacPaint, and show that flashy high-technology isn't the only way to get good results.

For the BBC there's a cross-referencing program that produces a list of which variables are used where within a Basic program. The program works extremely well, and should prove an invaluable aid to any BBC programmer who is in the middle of a long project.

One machine that's proving to be a real survivor in the computer wars is the old 8-bit Atari. When Jack Tramiel took over at Atari and started slashing prices, sales of the 8-bit machines finally took off. This is especially amazing when you consider that the basic Atari 8-bit machine was introduced long before even the Commodore 64. NLQ Printing provides letter-quality printing from an ordinary dot-matrix printer; this is achieved by redefining character fonts and using several passes of the print head. The limitations on the printers with which the program will work are that they should be capable of moving the print head by half the width of a single dot on the matrix, and ideally the printer should be

Epson-compatible. Naturally the printing is slower than for ordinary quality, but the results are remarkable. Sample output is included with the listing.

There is only one game this month, for the BBC, which isn't easy to convert to other machines. It's a version of the game where you have to blast down the edges of a web-shaped chute. The game is called Chasm, and although it doesn't follow any of the guidelines I have stipulated for arcade games, it's quite playable. I have used it because I wanted to include a game, and this was the best of the bunch.

Mark Needham pops up yet again this month. You might be forgiven for thinking that he has some kind of hold on me from the way that his name appears so regularly in 'Program File'; in fact, he just has an incredible ability to write good programs very quickly. If anyone is looking for a model on which to base their programs for 'Program File', they should look at Mark's programming style. SIDEPRINT prints text files sideways on an Epson-compatible printer. It's written in Turbo Pascal for an IBM, but shouldn't be too hard to convert to other machines.

Programs which have already appeared in 'Program File' should be on PCW Online now. These listings will continually be added to until all the best ones are on the system. There is also some selected public domain software.

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).

All programs should be fully debugged and your own original, unpublished work.

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.



Program of the Month

BBC Sponge

by Gavin Stark

Recently there has been an explosion of interest in the world of 'linear' fractals, snowflakes and their relatives, and many computer programs have been written to draw them. However, there is another facet of fractals, almost completely ignored by the computer enthusiasts, which is perhaps even more interesting than these linear fractals. This aspect is 'three'-dimensional fractals.

When drawing a linear fractal you take an initiator, say, a straight line, and then apply a generator, which is also made up of straight lines, to the line. To each of the newly-formed lines you apply the generator again. Then to each of the next lot of newly-formed lines you apply the same generator again, and again ... *ad infinitum*. The resulting 'line' formed is infinitely long, infinitely wiggly and quite pretty. As it is infinitely long but has no area, it lies somewhere between shapes such as squares, circles, and so on (dimension of two), and lines (dimension of one). It is said to have a dimension somewhere between one and two, dependent on the generator. The definition of a fractal is a shape which has a non-integral, that is, fractional, dimension.

Now, imagine another kind of initiator, a cube (Fig 1). If you marked nine equal squares on each of the six faces, you could push the middle square on each face through the cube, leaving 20 smaller cubes as shown in Fig 2. Stretch your imagination a little further. Mark nine squares on each side of these 20 smaller cubes and push through the middle squares of these, leaving something like Fig 3. If your imagination can take any more, repeat the process (Fig 4). And again ... *ad infinitum*. A 'sponge' of four iterations is shown in Fig 5. Pretty? This is known as the Menger Sponge.

Each time the generator is applied to the sponge, its volume drops by a factor of 20/27 (20 cubes afterwards, 27 before). Also, its surface area goes up by a factor of 4/3 (72 faces afterwards, 54 before). After the generator has been applied *ad infinitum*, its volume will be zero (since $20/27 < 1$), and its area will be infinite (since $4/3 > 1$). As it has no volume it is less than a sphere or a cube, and

so on (dimension three), but its infinite surface area means that it's more than a square, or a circle, and so on (dimension two). Its actual dimension is about 2.7268 ... ($\log 20/\log 3$)!

The program takes its initiator as a cube, and the generator is set by the data statements in lines 380-410. The generator is defined as what a cube will look like after one iteration, and it can be based on any cube of size n by n by n . The above example has $n=3$, since each face is marked in 3 by 3 squares. Also, you can define the number of iterations which the program will draw your sponge to — the depth of the sponge. The general size of the sponge can be defined, and I call this 'block' (note that block must be larger than, or equal to, depth). These three values are put into the data statement in line 380 in the order n , depth, block.

The next stage is to define the generator. The program needs the cube to be cut down into n squares of size n by n , the lowest one coming first. Working from the back to the front of each square as it appears onscreen, a series of n rows of 0s and 1s is required; 0 denoting a space in the generator, 1 denoting a block. It works exactly like a 3D noughts & crosses board, a piece denoting a block and no piece representing a hole, working your way from the bottom plate to the top plate (see Fig 9). The data statement on line 390 should denote the bottom plate, 400 the middle plate, and line 410 the top plate. The first item in each line corresponds to position one on the plate, the second to position two, and so on.

The data statements for the generator in Fig 9 (the Menger Sponge generator) would thus read:

```
1,1,1, 1,0,1, 1,1,1 — line 390
1,0,1, 0,0,0, 1,0,1 — line 400
1,1,1, 1,0,1, 1,1,1 — line 410
```

The program will cope with generators of any size n , but best with $n < 8$. It can go into greater depth with smaller n , managing six steps with $n=2$, four with $n=3$, three with $n=4$, and three with $n=5$. This is because any larger n produce a sponge which overflows off the edge of the screen. As the program uses the OS plot routines legally, however, you

could repeat the sponge many times, redefining the graphics origin in-between versions, so producing different parts of the sponge each time. Screendump each part of the sponge as you go along, and you can then stick all the screendumps together at the end. I have done this to produce a Menger Sponge nine-screens big (to a depth of 5)!

The algorithm

The program draws the sponges by plotting tiny cubes, three pixels by two pixels as in Fig 6, from the back to the front of the cube. The row of cubes which is furthest away is plotted first, then the one in front of it, and so on. After a whole layer has been plotted, the computer plots the next layer up, and so on; this provides the hidden line removal, since anything which you can't see is removed by the block in front of it which you can see (see Figs 7 and 8). Each tiny cube has an (x,y,z) coordinate inside the sponge. This is represented in the program in two ways: as a number between 0 and $n \text{ block} - 1$ in normal binary form (note that there are n block squares in each of the x,y and z directions); also as a number in base n . Each tiny cube must be checked to see whether it must be plotted, and to do this the program examines the x,y,z coordinates in base n , and checks whether the most significant digits combined in (x,y,z) form point to a hole in the generator cube. If so, then the tiny cube at (x,y,z) need not be plotted, as it's in the middle of a large hole. However, if there isn't a hole, the next most significant digits are checked, and so on, until the computer has checked to the correct depth. If the computer has not found a hole at all, the cube must be plotted at (x,y,z) . This is done by calculating the screen (X,Y) position of the cube from (x,y,z) by:

$X = (\text{furthest right } x \text{ point}) - x + y/2$

$Y = (\text{highest } y \text{ point}) - y + z$

Converting the program

As each of the $(n*n*n)$ block tiny cubes in the sponge must be checked, the program is quite slow, and it can take about an hour to plot a sponge. It has been written in machine code to speed up the plotting, but this cuts down its compatibility with other 6502 machines. The

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PROGRAM FILE

prime contender for conversion is, probably best just for disk systems. If therefore, the Commodore 64, and if the code could be assembled and a different plot routine written, it should run quite happily.

Note that a macro is used in the assembler code (OPT FNstore), and this will have to be expanded by hand on the 64. The cubes are impossible to draw on the Spectrum since all four colours might be needed in one character square, but a version could be written for the Amstrad range based on the algorithm I have used. Note that the screen on the BBC has a resolution of 320 by 256, but the pixels are addressed by a coordinate in the range 1280 by 1024. To plot a point, both the x-coordinate and the y-coordinate must be multiplied by four. The OS routines used by the program are: GCOL (oswrch with the accumulator containing 18) to define the plotting colour, 1 as red, 2 as yellow, 3 as white; PLOT a point (oswrch with A equal to 25, then again with A equal to 69), sending X lo-byte, hi-byte then Y lo-byte, hi-byte; and test a key (osbyte with A=129, X=Y=0) to check to see if the Escape key has been pressed.

Saving and printing a sponge

Due to the length of time it takes to do a sponge, if you press the Escape key, the computer will stop plotting after it has finished a row and save the sponge as far as it has gone. You can restart the plotting by answering 'Y' to the 'Load ?' prompt at the start. The program saves the sponge as 'Sponge' on disk or tape. As it is a whole mode one screen it might take a long time to save on tape, so it's

Defining your own generators

For the adventurous people who want to define generators of their own, I have a few words of advice. Keep n small, less than six, and don't cut out too much of the cube in each iteration, otherwise the illusion of three dimensions is lost. The program listed has the generator for the Menger Sponge, which has just about as many holes cut out of it as possible. Note that the generator need not be symmetrical, for example Fig 10, which was drawn using a 2 by 2 by 2 generator with one of its top corners left out. More often than not, the simpler the generator, the prettier the final sponge. To impress your friends, you can find out the dimension of the sponge you have made by substituting into the formula:

Dimension=log (no. blocks in generator) / log n

Fractals can be more exciting than the Mandelbrot set or mere linear fractals if you set your mind to it.

```

10 MODE 7
20 *FX 229 1
30 READ n,depth,block
40 PROCassemble
50 FOR A=1 TO n*n
60 FOR B=n TO 1 STEP -1
70 READ cubedata:cube?(A*n+B-n-1)=cubedata
80 NEXT
90
100 REM ----- Load partially finished screen ? -----
110 call_address=program
120 PRINT"Load ?";
130 REPEAT
140 G$=GET$
150 UNTIL G$="Y" OR G$="N"
160 MODE 1
170 HIMEM=42700
180 IF G$="N" THEN 290
190
200 REM ----- Load old screen -----
210 *L.Sponge
220 Y=1&2FFC AND &FFFF
230 Z=1&2FFE AND &FFFF
240 PROCstore2(Y,y)
250 PROCstore2(Z,z)
260 call_address=loopy
270
280 REM ----- Call sponge routine -----
290 X=USR(call_address)
300
310 REM ----- Save sponge -----
320 *FX 229
330 1&2FFC=(1y AND &FFFF)+65536*(1z AND &FFFF)
340 *S.Sponge 2FFC 8000
350 END
360
370 REM ----- Data for generator cube -----
380 DATA 3,3,4
    
```


PROGRAM FILE

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```

390 DATA 1,1,1 , 1,0,1 , 1,1,1
400 DATA 0,0,0 , 1,0,1 , 0,0,0
410 DATA 1,1,1 , 1,0,1 , 1,1,1
420
430 DEF PROCassemble
440
450 REM ----- Initialisation -----
460 prog=&900
470 zp=&60
480 x=zp:zh=x+1:xb=xh+1
490 y=xb+block:yh=y+1:yb=yh+1
500 z=yb+block:zh=z+1:zb=zh+1
510 du1=zb+block
520 du2=du1+1
530 du3=du2+1
540 du4=du3+1
550 du5=du4+1
560 du6=du5+1
570 xcoord=du6+1
580 ycoord=xcoord+1
590 zcoord=ycoord+1
600 oswrch=&FFEE:osbyte=&FFF4
610
620 REM ----- Assemble code -----
630 FOR pass=0 TO 3 STEP 2
640 P%=prog
650
660 | OPT pass
670
680 \ ----- Main routine -----
690 .program
700
710 LDA &0:\ Z-coordinate loop
720 STA z:STA zh
730 OPT FNstore(zb)
740
750 .loopz
760
770 LDA &0:\ Y-coordinate loop
780 STA y:STA yh
790 OPT FNstore(yb)
800
810 .loopy
820
830 LDA &0:\ X-coordinate loop
840 STA x:STA xh
850 OPT FNstore(xb)
860
870 .loopx
880
890 LDX &xb:\ Check generator cube
900 LDY &yb:\ for block at (X,Y,Z)
910 LDA &zb
920 JSR compare
930 BEQ end_loop_x
940
950 JSR draw:\ Plot cube
960
970 .end_loop_x
980
990 LDX &0:\ End of loop for X-coordinate
1000 JSR next
1010 BNE loopx
1020
1030 .end_loop_y
1040
1050 \ Check escape key - for save
1060 LDA &129:LDX &0:LDY &0
1070 JSR osbyte
1080
1090 CPX &27:BEQ esc
1100
1110 LDX &y-x:\ End of loop for Y-coordinate
1120 JSR next
1130 BNE loopy
1140
1150 .end_loop_z
1160 LDX &z-x:\ End of loop for Z-coordinate
1170 JSR next
1180 BNE loopz
1190
1200 .esc :\ End of sponge routine
1210 RTS
1220
1230 \ +++++ Subroutines +++
1240
1250 \ Check for block at (X,Y,Z)
1260 .compare
1270 STX du1
1280 STY du3
1290 STA du5
1300
1310 LDA &0
1320 BTA du2
1330 STA du4
1340 STA du6
1350

```


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PROGRAM FILE

```

1360 LDY £block-depth
1370 loopp
1380 LDA (du1),Y:STA xcoord
1390 LDA (du3),Y:STA ycoord
1400 LDA (du5),Y:STA zcoord
1410
1420 LDA £0:\
1430 LDX zcoord
1440 loop3
1450 CPX £0:BEQ endloop3
1460 CLC
1470 ADC £n*n
1480 DEX
1490 JMP loop3
1500 endloop3
1510
1520 LDX ycoord:\
1530 loop4
1540 CPX £0:BEQ endloop4
1550 CLC
1560 ADC £n
1570 DEX
1580 JMP loop4
1590 endloop4
1600
1610 \
1620 CLC:ADC xcoord
1630 TAX
1640 LDA cube,X:\
1650
1660 INY
1670 CPY £block:BEQ end
1680 CMP £0:BNE loopp
1690 RTS
1700
1710 end
1720 CMP £0
1730 RTS
1740
1750 \
1760 next
1770 \
1780 LDA x,X
1790 CLC:ADC £1
1800 STA x,X
1810 INX
1820 LDA x,X
1830 ADC £0
1840 STA x,X
1850
1860 \
1870 LDY £0
1880 loop2
1890 INX
1900 INY
1910 INC x,X
1920 LDA x,X
1930 CMP £n:BNE nexend
1940
1950 LDA £0:STA x,X
1960 CPY £block:BNE loop2:\
1970
1980 nexend
1990 RTS
2000
2010 \
2020 draw
2030
2040 \
2050 \
2060 \
2070 \
2080 LDA x:STA du1
2090 LDA xh:STA du2
2100 ASL du1:ROL du2
2110
2120 \
2130 LDA £(2*n*block-2) MOD 256
2140 SEC:SBC du1
2150 STA du1
2160 LDA £(2*n*block-2) DIV 256
2170 SBC du2
2180 STA du2
2190
2200 \
2210 LDA du1
2220 CLC:ADC y
2230 STA du1
2240 LDA du2
2250 ADC yh
2260 STA du2
2270
2280 \
2290 \
2300 LDA £(n*block-1) MOD 256
2310 SEC:SBC y
2320 STA du3

```

Z-coordinate

Y-coordinate

X-coordinate

Check for block

End of loop routine

Increment coordinate in hexadecimal

Increment coordinate in base 'n'

End of loop ?

Plot small cube

Evaluate screen X and Y coordinates
(from x,xh and y,yh)
X-coordinate
 $X = 2^*x$

$X = 2^*x - (2^*n^*block-2)$

$X = 2^*x - (2^*n^*block-2) + y$

Y-coordinate
 $Y = (n^*block-1) - y$

PROGRAM FILE

```

2330 LDA E(n*block-1) DIV 256
2340 SBC yh
2350 STA du4
2360 \
2370 LDA du3
2380 CLC:ADC z
2390 STA du3
2400 LDA du4
2410 ADC zh
2420 STA du4
2430 \
2440 LDY E0
2450 LDX E0
2460
2470 loop
2480 LDA E10 :JSR oswrch:\
2490 LDA E0 :JSR oswrch
2500 LDA data:X:JSR oswrch
2510
2520 LDA E25 :JSR oswrch:\
2530 LDA E69 :JSR oswrch
2540
2550 \
2560 \
2570 LDA du2:STA du5
2580 TYA
2590 CLC:ADC du1
2600 PMA
2610 LDA du5
2620 ADC E0:STA du5
2630 PLA
2640 \
2650 ASL A:ROL du5
2660 ASL A:ROL du5
2670 JSR oswrch
2680 LDA du5:JSR oswrch
2690
2700 \
2710 \
2720 LDA du4:STA du5
2730 LDA du3
2740 ASL A:ROL du5
2750 ASL A:ROL du5
2760 JSR oswrch
2770 LDA du5:JSR oswrch
2780
2790 \
2800 INX
2810 INY
2820 CPY E3:BNE loop
2830
2840 \
2850 LDY E0
2860 LDA du3
2870 CLC:ADC E1
2880 STA du3
2890 LDA du4
2900 ADC E0
2910 STA du4
2920 CPX E6:BNE loop
2930
2940 RTS
2950
2960 \ ***** Data ***
2970 .data EQU B1:EQU B2:EQU B3
2980 EQU B3:EQU B3:EQU B3
2990
3000 .cube
3010
3020 I
3030 NEXT pass
3040
3050 ENDPROC
3060
3070 REM ----- Macro -----
3080 DEF FNstore(address)
3090 FOR A=0 TO block-1
3100 I OPT pass
3110 STA address+A
3120 I
3130 NEXT
3140=pass
3150
3160 REM ----- Procedure -----
3170 DEF PROCstore2(A,a)
3180 !a=A
3190 FOR B=1 TO block
3200 ?(a+1+B)=A MOD n
3210 A=A DIV n
3220 NEXT B
3230 ENDPROC

```

Y = (n*block-1) - y + z

Plot cube at (X,Y)

Graphics colour (GCOL)

Plot point (PLOT 69)

X-coordinate
Add pos. pixel in tiny cube

Times 4 for 0-1280

Y-coordinate
Times 4 for 0-1024

Next point in tiny cube

Next row in tiny cube

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Amiga CPC 66400000 Colour	£2099	£1999	£999	£499	£249	£124
Amiga CPC 612800000 Colour	£2199	£2099	£1049	£524	£262	£130
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Amiga CPC 640000000000000000 Colour	£4999	£4899	£2449	£1224	£612	£306
Amiga CPC 664000000000000000 Colour	£5099	£4999	£2499	£1249	£624	£312
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Amiga CPC 6640000000000000000 Colour	£5399	£5299	£2649	£1324	£662	£330
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Amiga CPC 64000000000000000000 Colour	£5599	£5499	£2749	£1374	£687	£343
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Amiga CPC 6640000000000000000000000000000000 Colour	£9899	£9799	£4899	£2449	£1224	£612
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Amiga CPC 664000000000000000000000000000000000000 Colour	£11399	£11299	£5649	£2824	£1412	£706
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Amiga CPC 64000000000000000000000000000000000000000 Colour	£11899	£11799	£5899	£2949	£1474	£737
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Generating a Menger Sponge



figure 1



figure 2

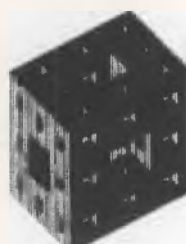


figure 3

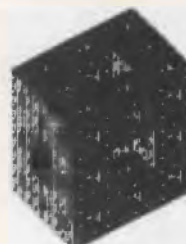


figure 4



figure 5



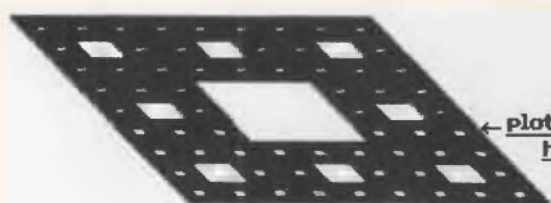
The tiny cubes

figure 6



plotting here

figure 7



plotting here

figure 8

PROGRAM FILE

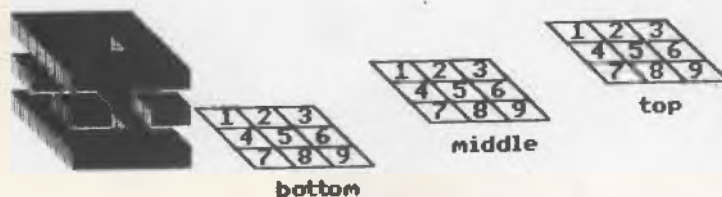


figure 9

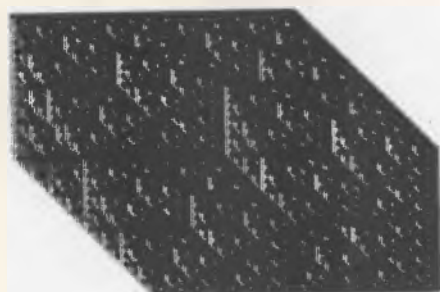


figure 10



Amstrad CPC Promenu

by Kevin Nixon

This program allows menus to be easily included in your own programs. Examples of how to create and use menus within programs are given.

Two lines could not be printed and must be added to the program:

```
50370 LOCATE 1,v:CALL &BD19:
PRINT"[CONTROL-X]" + m$(v) +
SPACE$(wi) - LEN(m$(v)) + "
[CONTROL-X];
50750 IF mh$ <> "" THEN WINDOW
Ew,ml-1,mt-2,mb:LOCATE
Ew,1,1:PRINT Ew"[CONTROL-X]
[SPACE]" + mh$ + "[SPACE]
[CONTROL-X]";
```

In these lines, type the bits between square brackets as single characters.

To create windows, certain variables have to be set and then a particular subroutine called. An example is line 130. The variables are:

ml — left position of window
mt — top of window
am — height of window
wi — width of window
w — the window number (0-7)
mh\$ — the title of the window

GOSUB 50420 is used to create a window with a normal frame, GOSUB 50620 for one with a pull-down menu frame. If a window is accidentally positioned off-screen, it will be moved back on at the nearest point.

To create a menu, the options have to be in data statements as in line 180. The data is held as follows:

```
DATA menunum,type,title,xpos,ypos,option,option...
menunum — used in conjunction with
off(menunum,optionno)
```

type — 1 for ordinary, 2 for pull-down menu

title — any string, can be blank

xpos — left position for menu, 0 to centre on x plane

ypos — top position for menu, 0 to centre on y plane

option — the option name; if left blank, a line of separators will appear in its place

* — marks the end of the list of options

The maximum number of options in a menu is 23, or 22 if a title is used. Options within a menu can be switched off at any time using the off function:

```
off(menunum,optionno)=1
```

The result is to display the option in light type and prevent it from being selected until it's set to 0, which switches it on again.

The program only works on the 464 and 664, but to convert it for the 6128, delete lines 70 and 51110 to 51200. Then replace the RSX calls in lines 50030 and 50260 with the equivalent on the 6128 using the bank manager RSXs supplied with the machine.

To use the menus, use the cursor and copy keys. To incorporate them into your own programs, lines 50200-50260 do the selecting and v holds the value of the position of the selection bar at the end, so this can be used to determine the course of action to be taken.

The variables holding the key codes for up, down and select are ku, kd and kf respectively.

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```

10 MODE 2:RESTORE 5110:GOSUB 5110
20 INK 0,24:INK 1,0: BORDER 20
30 FOR a=1 TO 25:PRINT STRING$(80,2071):NEXT
40 DRAW 639,0,1: DRAW 639,398: DRAW 0,398: DRAW 0,0
50 DIM a$(24),off(25,24)
60 x=a: a=a+2: k=k+1
70 RESTORE 5110:GOSUB 5110
80 REM *****
90 REM " EXAMPLE DATA "
100 REM " NO NEED TO "
110 REM " TO TYPE IN "
120 REM *****
130 a1=6: a2=10: a3=10: a4=30: w=1: GOSUB 50420
140 LOCATE 1,16,3: PRINT C1, "PRO MENU": LOCATE 1,13,5: PRINT 1, "By Kevin Nixon":
LOCATE 1,4,9: PRINT C1, "For the Amstrad CPC464 computer."
150 off(1,2)=1: REM " Option 2 ( complicated ) is unavailable.
160 REM " DATA FOR EXAMPLE MENU "
170 CALL a$B10: RESTORE 100
180 DATA 1,2,3,4,5,6,7,8,9,0, Creating, complicated, menus, is easy, with, Pro menu,
190 GOSUB 50030: GOTO 170
50000 REM *****
50010 REM " PRO MENU "
50020 REM *****
50030 |COPY: v=0: w=0: u1=0: n=0: opt=1
50040 READ menu.type: m$. u1, st: IF type=1 THEN type=1: ELSE IF type=2 THEN type=2
50050 WHILE a$(n)<>"": n=n+1: READ a$(n): WEND: a=n-1
50060 IF a=1 THEN a=1
50070 GOSUB 51000
50080 FOR n=1 TO a: IF LEN(a$(n))>w1 THEN w1=LEN(a$(n))
50090 NEXT
50100 IF LEN(m$)>w1 THEN w1=LEN(m$)
50110 IF m1=0 THEN m1=41-INT(w1/2)
50120 IF a=0 THEN a=13-INT(a/2)
50130 ON type GOSUB 50420, 50620
50140 GOSUB 50990: REM " PRINT OPTIONS "
50150 GOSUB 50200
50160 WINDOW Lw, 1, 90, 1, 25: RETURN
50170 REM *****
50180 REM " UP 'N' DOWN "
50190 REM *****
50200 GOSUB 50360
50210 WHILE INKEY$(k)=0
50220 IF INKEY$(k)=0 AND v>1 THEN GOSUB 50300: GOSUB 50010: GOSUB 50360
50230 IF INKEY$(k)=0 AND v<0 THEN GOSUB 50300: GOSUB 50900: GOSUB 50360
50240 WEND
50250 CALL a$P70, 6C9, 6C90, 6C90: REM " CLEAR KEYBOARD BUFFER "
50260 |SHOW: RETURN
50270 REM *****
50280 REM " DELETE HIGHLIGHT "
50290 REM *****
50300 IF v<1 THEN v=1 ELSE IF v>24 THEN v=24
50310 LOCATE 1, v: CALL a$D19: PRINT a$(v)+SPACES((w1)-LEN(a$(v)))
50320 RETURN
50330 REM *****
50340 REM " PRINT HIGHLIGHT "
50350 REM *****
50360 IF v<1 THEN v=1 ELSE IF v>24 THEN v=24
50390 REM *****
50400 REM " ORDINARY MENU "
50410 REM *****
50420 IF m$="" AND a=23 THEN a=23: ELSE IF a=22 THEN a=22
50430 IF w1>70 THEN w1=70
50440 IF a1<2 THEN a1=2: a2=a1+1
50450 IF (a1<2 AND a$1="") THEN a1=3: a2=a1+a
50460 IF (a1<2 AND a$1="") THEN a1=2: a2=a1+a
50470 IF (a1<2 AND a$1="") THEN a1=2: a2=a1+a
50480 a1=a1+1: a2=a1+1
50490 IF a1>79 THEN a1=79: a2=a1+1
50500 IF a1>24 THEN a1=24: a2=a1+1
50510 g1=a1*0-12: g2=(a1*0)+3: g3=396-a1*16-2
50520 IF a$1="" THEN g1=396-a1*16+44: ELSE g1=396-a1*16+20
50530 ORIGIN 0,0: g1=4, g2=4, g3=4: CLG
50540 MOVE g1, g2: DRAW g1, g2: DRAW g1, g2: DRAW g1, g2
50550 MOVE g1=4, g2=4: DRAW g1=4, g2=4: DRAW g1=4, g2=4: DRAW g1=4, g2=4: DRAW g1=4, g2=4
50560 IF a$1="" THEN g1=g1+1: g2=g1+1: g3=g1+1: g4=g1+1: g5=g1+1: g6=g1+1: g7=g1+1: g8=g1+1: g9=g1+1: g10=g1+1
50570 WINDOW Lw, 1, 90, 1, 25: RETURN
50580 REM *****
50590 REM " PULL DOWN MENU "
50600 REM *****
50610 REM *****
50620 IF m$="" AND a=22 THEN a=22
50630 IF a$1="" AND a=23 THEN a=23
50640 IF a1<2 THEN a1=2: a2=a1+1
50650 IF (a1<2 AND a$1="") THEN a1=3: a2=a1+a
50660 IF (a1<2 AND a$1="") THEN a1=2: a2=a1+a
50670 IF (a1<2 AND a$1="") THEN a1=2: a2=a1+a
50680 a1=a1+1: a2=a1+1
50690 IF a1>79 THEN a1=79: a2=a1+1
50700 IF a1>24 THEN a1=24: a2=a1+1
50710 g1=a1*0-12: g2=(a1*0)+3: g3=396-a1*16-2
50720 IF a$1="" THEN g1=396-a1*16+44: ELSE g1=396-a1*16+20
50730 ORIGIN 0,0: g1=4, g2=4, g3=4: CLG
50740 MOVE g1=4, g2=4: DRAW g1=4, g2=4: DRAW g1=4, g2=4: DRAW g1=4, g2=4: DRAW g1=4, g2=4
50750 "a$1="
50760 WINDOW Lw, 1, 90, 1, 25: RETURN
50770 RETURN
50780 REM *****
50790 REM " SEARCH UP FOR NEAREST LEGAL OPTION "
50800 REM *****
50810 opt=v
50820 opt=opt-1
50830 IF opt=0 THEN 50650
50840 IF a$(opt)="" OR off(menu, opt)=1 THEN GOTO 50620
50850 IF opt=0 THEN v=opt
50860 RETURN
50870 REM *****
50880 REM " SEARCH DOWN FOR NEAREST LEGAL OPTION "
50890 REM *****
50900 opt=v
50910 opt=opt+1
50920 IF opt>24 THEN RETURN: REM 5110
50930 IF a$(opt)="" OR off(menu, opt)=1 THEN GOTO 50910
50940 IF opt>24 THEN v=opt
50950 RETURN
50960 REM *****
50970 REM " PRINT OPTIONS "
50980 REM *****
50990 FOR n=1 TO a

```


PROGRAM FILE

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MBasic Daisywheel Graphics

by Christopher Lawton



This program simulates graphics statement could be used to load a printing on a daisywheel. It has been previously-created graphics screen. written to work with a Brother HR25. The program needs to use line but can be rewritten to work with lengths of 640 characters because it's printing a full stop every sixtieth of an inch. This is done by typing BASICA/S:640 from DOS.

The program uses the full stop as a notional pixel, and uses microjustification to move the print head by sufficiently small amounts. The printer head can be moved in 1/60ths of an inch horizontally and 1/60ths of an inch vertically. As the program moves the print head, it scans the computer screen. If a pixel on the screen is on, then it prints a full stop; otherwise it prints nothing.

The program takes a long time, however, because to print one screen of graphics it needs to effectively print 128,000 characters.

The printing routine is in lines 90-380, and lines 1000 onward should hold a routine to display the graphics to be drawn on screen two. A BLOAD

The printer control codes used are:
line 130 — CHR\$(27)+CHR\$(&H1E)+CHR\$(4) — set VMI to 3/4in
line 140 — CHR\$(27)+CHR\$(&H1F)+CHR\$(3) — set HMI to 3/2oin
line 200 — CHR\$(32) — print a space
line 240 — CHR\$(&H2E) — print a full stop
line 260 — CHR\$(27)+CHR\$(&H55) — advance paper by VMI
line 310 — CHR\$(27)+CHR\$(34) — re-set auto line feed
line 320 — CHR\$(27)+CHR\$(83) — re-set HMI and VMI

These codes can be used to run the program with other printers.

```

10 CLS:KEY OFF
20 SCREEN 2
30 GOSUB 390:
40
50
60
70
80
90 OPEN "LPT1:" AS #1 LEN=640
100 WIDTH#1,255
110
120
130 PRINT#1,CHR$(27)+CHR$(&H1E)+CHR$(3)
140 PRINT#1,CHR$(27)+CHR$(&H1F)+CHR$(2)
150
160
170
180 FOR T=0 TO 199
190 FOR TT=0 TO 639
200 IF POINT (TT,T) = 0 THEN
    PRINT#1,CHR$(32):
    GOTO 250
210
220
230
240 PRINT#1,CHR$(&H2E):
250 NEXT TT
260 PRINT#1,CHR$(27)+CHR$(&H55)
270 NEXT T
280
290
300
310 PRINT#1,CHR$(27)+CHR$(34)
320 PRINT#1,CHR$(27)+CHR$(83)
330
340
350 CLOSE#1
360
370
380 END
390

```

JUMP TO DRAW PICTURE.

OPEN FILE TO PRINTER WITH
LINE LENGTH OF 640 CHARACTERS

SET VERTICAL SPACING
SET HORIZONTAL SPACING

BEGIN VERTICAL SCANNING
BEGIN HORIZONTAL SCANNING

PRINT SPACE IF PIXEL IS OFF

OTHERWISE PRINT FULL STOP

MOVE ROLLER UP ONE LINE

RESET PRINTER TO INITIAL
SETTINGS

CLOSE PRINTER FILE

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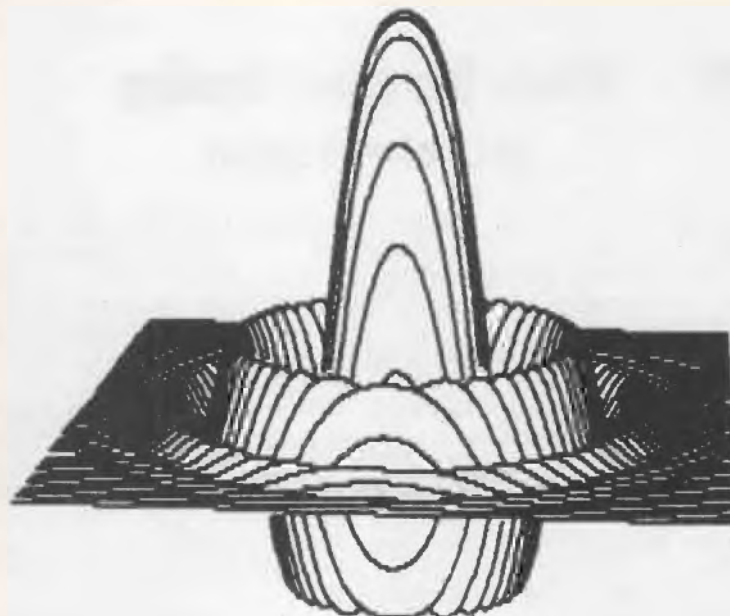
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PROGRAM FILE

```

400 :
410 :
420 :
430 :
440 PRINT
450 LOCATE 25,1:PRINT "  Daisywheel
    Graphics"
460 PI=3.14159:SC=5/12
470 X=250 :Y=0:CX=320:CY=100:SF=.95
480 C=COS(PI/5):S=SIN(PI/5)
490 CI=COS(PI/36):SI=SIN(PI/36)
500 FOR J=1 TO 40
510 FOR I=0 TO 10
520 SX=X+CX:SY=CY-Y*9C
530 IF I=0 THEN PSET (SX,SY)
540 LINE - (SX,SY)
550 XN=X*C-Y*S:YN=X*S+Y*C:X=XN
560 NEXT I
570 XN=SF*(X*CI-Y*SI):YN=SF*(X*SI+Y*CI):X=XN
580 NEXT J
590 RETURN
  
```



Spectrum Textured Screen Print

by Nathan Walker

This program demonstrates the SAVE "fill" CODE 50000,250. This file accompanying machine code routine can then be used by loading it into memory and calling which performs an area fill using patterns. The routine is stored in memory from location 50000 onwards and will fill any shape with any one of the 21 graphics characters. By altering these, it is possible to fill any shape with any character of 8 by 8 pixels. To use the routine in your own programs, type the program in and run it. When 'press any key to continue' is displayed, break into the program. Save the machine code as:

```

10 REM Textured Screen Print for ZX Spectrum 48K
20 REM Nathan Walker
30 REM 16.4.86 - 19.4.86
40 REM
50 CLEAR 49999
60 BORDER 7: PAPER 7
70 INK 0
80 BRIGHT 1: FLASH 0
90 CLS
95 REM
99 REM
100 REM Read machine code
110 REM
  
```


PROGRAM FILE

```

120 RESTORE 9000
130 FOR I=50000 TO 50249
140 READ byte
150 POKE I,byte
160 NEXT I
190 REM
199 REM
200 REM Read graphic characters
210 REM
220 RESTORE 0000
230 FOR I=USR "a" TO USR "u"+7
240 READ udg
250 POKE I,udg
260 NEXT I
1000 REM Demonstration 1 Bars
1010 REM
1020 FOR I=1 TO 21
1030 PLOT I*12,0
1040 DRAW 0,175
1050 PLOT I*12-1,0
1060 RANDOMIZE I
1070 LET fill=USR 50000
1080 NEXT I
1090 GO SUB 4000
1490 REM
1499 REM
1500 REM Demonstration 2 Circles
1510 REM
1520 FOR I=1 TO 21
1530 CIRCLE 20+I*10,20+160*(I/4-INT (I/4)),19
1540 PLOT 20+I*10,20+160*(I/4-INT (I/4))
1550 RANDOMIZE I
1560 LET fill=USR 50000
1570 NEXT I
1580 GO SUB 4000
1990 REM
1999 REM
2000 REM Demonstration 3 Spiral
2010 REM
2020 PLOT 120,0
2030 FOR I=2 TO 162 STEP 8
2040 DRAW 0,1
2050 DRAW 1,0
2060 DRAW 0,-(I+4)
2070 DRAW -(I+4),0
2080 NEXT I
2090 DRAW 4,4
2100 PLOT 129,0
2110 RANDOMIZE 1
2120 LET fill=USR 50000
2130 GO SUB 4000
2990 REM
2999 REM
3000 REM Demonstration 4 Random Lines
3010 REM
3020 RANDOMIZE
3030 FOR I=1 TO 20
3040 LET x1=INT (RND*256)
3050 LET x2=INT (RND*256)
3060 LET y1=INT (RND*176)
3070 LET y2=INT (RND*176)
3080 PLOT x1,y1
3090 DRAW (x2-x1),(y2-y1)
3100 NEXT I
3110 PLOT 0,0
3120 RANDOMIZE 1+INT (RND*21)
3130 LET fill=USR 50000
3140 GO SUB 4000
3150 GO TO 3000
4000 REM
4010 REM
4020 PRINT 0:" Press any key to continue"
4030 PAUSE 0
4040 CLS
4050 RETURN
7990 REM
7999 REM
8000 REM Data for the graphic characters
8010 REM
8020 DATA 05,170,05,170,05,170,05,170,204,204,51,51,204,204,51,51
8030 DATA 136,68,34,17,136,68,34,17,238,119,238,238,119,119,238
8040 DATA 254,130,254,0,239,40,239,0,254,254,0,239,239,239,0
8050 DATA 238,245,251,245,238,95,191,95,170,119,221,119,170,221,119,221
8060 DATA 204,107,119,119,51,238,221,221,0,05,0,170,0,05,0,170
8070 DATA 170,109,190,19,200,99,102,05,136,136,136,255,136,136,136,255
8080 DATA 170,255,170,255,170,255,170,255,124,216,141,199,227,177,27,62
8090 DATA 17,34,60,136,17,34,60,136,160,64,160,17,10,4,10,17
8100 DATA 170,170,170,170,170,170,170,170,255,0,255,0,255,0,255,0
8110 DATA 136,136,136,136,136,136,136,136,255,0,0,0,255,0,0,0
8120 DATA 120,64,32,16,0,4,2,1
8990 REM
8999 REM
9000 REM Data for the machine code
9010 REM
9020 DATA 237,75,125,92,205,170,34,71,4,62,254,15,16,253,166,119,33,0,64,17,139,
202,1,0,24
9030 DATA 237,176,33,75,196,237,75,125,92,113,35,112,33,1,0,34,71,196,33,0,0,34,
73,196,33
9040 DATA 75,196,17,107,199,78,35,70,35,229,121,254,255,40,6,197,12,205,221,195,
193,121,254,0,40
9050 DATA 6,197,13,205,221,195,193,120,254,0,40,6,197,5,205,221,195,193,4,120,25
4,176,196,221,195
9060 DATA 42,71,196,43,34,71,196,124,181,225,32,199,42,73,196,124,181,40,62,77,6
8,203,33,203,16
9070 DATA 33,107,199,17,75,196,237,176,42,73,196,34,71,196,24,158,197,205,170,34
,71,4,126,7,16
9080 DATA 253,230,1,193,192,235,113,35,112,35,235,42,73,196,35,34,73,196,205,170
,34,71,4,62,1
9090 DATA 15,16,253,102,119,201,42,123,92,17,0,64,237,75,117,92,175,5,203,32,203
,32,203,32,176
9100 DATA 40,3,35,16,253,14,3,6,0,229,197,6,0,26,166,18,19,16,250,35,193,16,243,
225,13,32
9110 DATA 236,33,0,64,17,139,202,1,0,24,26,102,119,19,35,11,120,177,32,246,201,0
,0,1,0

```

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BBC Cross-Reference Lister

by Jagdish Sah

This machine code routine produces seconds to analyse a 10k program. a cross-reference listing of a Basic After analysis, it gives you the option program resident in memory. It of outputting to printer or screen. makes use of the fact that the details The results are printed in groups af- of variables, PROCs, and so on, are ter being sorted into alphabetical stored as linked lists at LOMEM. The order. If, being displayed on the various items are divided into 10 screen, they are shown in paged groups: integer variables; real vari- mode, you will need to hit Shift to ables; string variables; integer bring up the next screen. arrays; real arrays; string arrays; Type in the program as listed. PROCedures; FNs; system variables; Then type CALL &BC0 to analyse the and line-number references. program — this gives a cross-

The details for the first occurrence reference of the assembler section as of an item are stored in an 8-byte well. To suppress this, use CALL block like this:

byte 0-1 points to the next item

byte 2-3 points to its name

byte 4-5 points to its next value

byte 6-7 points to its current value

The information about subsequent

occurrences is held in a 4-byte block:

byte 0-1 points to its next value

byte 2-3 points to its current value

Here, 'value' means the line number on which the item was found.

Disk users should not use *RUN to

run the program, but *LOAD it and

use the CALLs as given above.

Whenever a line is printed with an *

it shows that a label, PROC or FN is

defined on that line. The routine will

not work with Hi-Basic under the

second processor.

The program takes about 5-10

```
10REM XREF
20REM By Jagdish Sah
30REM Personal Computer World
40:
50start=&BC0
60PROCassemble:PROCcheck:IF SI<>chksum:PRINT"Checksum error":END
70PRINT"To save the machine code produced type"
80PRINT"SAVE XREFMC ";start;" ";P1:END
90:
100DEF PROCassemble
110byte=&FFFF:osasci=&FFFC:osnew1=&FFFE:osrdch=&FFFE
120osnew=&FFFE:osline=&FFFE:oslineptr=&FFFE:osline=&FFFE:osline=&FFFE:osline=&FFFE
130line=&FFFE:osline=&FFFE:osline=&FFFE:osline=&FFFE:osline=&FFFE:osline=&FFFE
140osline=&FFFE:osline=&FFFE:osline=&FFFE:osline=&FFFE:osline=&FFFE:osline=&FFFE
150IF &FFFE=&FFFE:osline=&FFFE:osline=&FFFE:osline=&FFFE:osline=&FFFE:osline=&FFFE
160DEF detokenise,ptokenise,chkprog,plinenos,osline,oslineptr,osline,oslineptr
170:
180FOR pass=0 TO 2 STEP 2:PI=start:OPT pass
190JSR chkprog:LDA page:STA lineptr+1:LDA &C0
200STA lineptr:STA osasci:STA defflg:LDA &19
210:Init STA intptr,X:DEX:BPL Init:STX lineptr:TSX:STX stack
220:mainloop LDY &1:STY yline:JSR getbyte
230BNE exitmain:STA lineos+1:JSR getbyte:STA lineos:JSR getbyte:STA lineos
240:lineos JSR getnonospace:CHP EASC(""):BNE exitline
250CHP &F4:BNE exitline:CHP EASC:BNE exitline:JSR asm:BCC exitstat
260:statement JSR skipchars:JSR getvar:BCC exitstat:JSR linkvar
270:exitstat CHP &F0:BNE lineos
280CHP &F0:BNE lineos:CHP EASC:BNE lineos:JSR getnonospace:BNE statement
290:exitline LDA lineos:CLC:ADC lineptr
300STA lineptr:BCC mainloop:INC lineptr+1:BNE mainloop
310:exitmain LDY &C0
320:exitmain LDA osnew,X:JSR osasci:INX
330CPX &15:BNE exitmain:TXA:LDX &F7:STX lineos:INX:STX index:INX:JSR osbyte
340:getyn JSR osrdch:CHP &E7:BNE exitmain:LDY &F7:LDY &F7
350CHP EASC("Y"):BNE printeron:CHP EASC("N"):BNE getyn:LDY &F4
360:printeron JSR osasci:TXA:JSR osasci:JSR osnew1:JSR osnew1
370:results LDY index:CPX &F0:BCC exitmain:JSR getvarblk
380BNE nextgroup:JSR sort:JSR printvar:JSR osnew1:LDA &FF:BNE exit
390:nextgroup INC index:INC index:BNE results
400:exit LDA &F3:JSR osasci:LDA &F5:JSR osasci:JMP basic
410:getbyte
420LDY yline:CPY lineos:BNE getbyte2:INC yline:LDA (lineptr),Y:RTS
430:getbyte2 LDA &C0:RTS
440:getnonospace JSR getbyte:BNE getbyte2:CHP &F3:BNE getnonospace:RTS
450:skipchars CHP EASC(""):BNE skiphex
460:skipptring JSR getnonospace:BNE exitkip:CHP EASC(""):BNE skipptring
470:skiphex CHP EASC("a"):BNE exitkip
480:skiphex2 JSR getnonospace:CHP EASC("0"):BCC exitkip:CHP EASC("0")
490BCC exitkip:CHP EASC("9")+1:BCC skiphex2:CHP EASC("a"):BCC skiphex2
500:exitkip RTS
510:asm CHP EASC("("):BNE asm2:INC osasci:JSR getnonospace
520:asm2 LDY osasci:BNE asm3:SEC:RTS
530:asm3 LDY &F0:CPY &F2:BCC asm6:CHP EASC("("):BNE asm4:INC defflg
540JSR getbyte:JSR getvar:BCC asm6:JSR linkvar:DEC yline:JSR getnonospace
550:asm4 LDY &F0:BNE asm6
560CHP &F0:BNE asm7:CHP EASC("\"):BNE asm6:CHP EASC(")"):BNE exitasm
570:asm5 JSR getbyte:CHP EASC("Q"):BNE asm6:JSR getbyte
580:asm5 JSR getnonospace:CHP EASC("(")
590BQ asm5:CHP EASC("E"):BNE asm5:JSR skipchars:JSR getvar:BCC asm6
600CPX &1:BNE asm6:LDY name:CPY EASC("A"):BNE asm6:JSR linkvar
610:asm6 CHP &F0:BNE asm7:JSR skipchars
620CHP EASC(")"):BNE exitasm:JSR getnonospace:BNE asm6
630:asm7 CLC:RTS
```


PROGRAM FILE

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```

640.exitasm DEC asmflg:CLC:RTS
650.getvar LDY yline:DEY:STY savey
660.getvar4 LDY £0:STY vartype:CMF £A00:BCS chkproc
670.CMP £ASC("E")+1:BCC getvar2:CMF £ASC("Z")+1:BCS getvar2
680.CMP £ASC("Z")+1:BCC getvar3:CMF £95:BCS getvar3
690.getvar2 SEC:RTS
700.getvar5 STY vartype
710.getvar3 LDX £0
720.getv2 STA name.X:INX:JSR getbyte:CMF £ASC("e"):BCC getv3
730.CMP £ASC("9")+1:BCC getv2:CMF £ASC("e"):BCC getv3
740.CMP £ASC("Z")+1:BCC getv2:CMF £95:BCS getv3:CMF £ASC("z")+1:BCC getv2
750.getv3 LDY £0:CMF £ASC("Z"):BEQ getv4:INX:CMF £ASC("S"):BNE getv5:INX
760.getv4 STY ytemp:STA name.X:INX:JSR getbyte:DEC yline:LDY ytemp
770.getv5 CMP £ASC("("):BNE getv6:INX:INX:INX
780.getv7 STA name.X:INX
790.getv8 PHA:LDA vartype:BNE getv6:STY vartype
800.getv6 LDA £0:STA name.X:PLA:CLC:RTS
810.chkproc LDY £6:CMF £A2:BEQ getvar5:INX:CMF £A4
820.BEQ getvar5:LDY £9:STY vartype:CMF £A80:BNE chkysvar:DEC yline
830.JSR detokenize:LDY inta+1:STY name:LDA inta:LDX £1:BNE getv7
840.chkysvar DEC vartype:LDX £1:CMF £A80:BNE sysvar2
850.STA name:JSR getbyte:CMF £ASC("P"):BEQ getv7:DEC yline
860.sysvar2 DEY:CMF £A8F:BCS sysvar3:CMF £A04:BCS sysvar3
870.CMP £A94:BCS getv7:CMF £A8F:BCS sysvar3:AND £A8F:BNE getv7
880.sysvar3 CMP £A8D:BNE sysvar4:INC defflg
890.sysvar4 SEC:RTS
900.sovenname LDX £0
910.soven2 LDA name.X:STA name2.X:BEQ soven3:INX:BNE soven2
920.soven3 TXA:BEQ soven2:RTS
930.getname LDA lineptr:PHA:LDA lineptr+1:PHA
940.LDA yline:PHA:LDY £2:LDA (varbik).Y:STA lineptr:INX:LDA (varbik).Y
950.STA lineptr+1:LDY £0:STY yline:JSR getbyte:JSR getvar:PLA:STA yline
960.PLA:STA lineptr+1:PLA:STA lineptr:RTS
970.linkvar PHA:JSR sovenname
980.LDA vartype:ASL A:TAX:JSR getvarbik:BNE linkv2:LDA loame:STA intptr.X
990.STA varbik:LDA loame+1:STA intptr+1.X:STA varbik+1
1000.newbik LDY £1:LDX £0:JSR incloame
1010.LDA lineptr:CLC:ADC savey:STA (varbik).Y:INX:LDA lineptr+1:ADC £0
1020.STA (varbik).Y:INX:INX:JSR setzero:BNE oldbik3
1030.linkv2 JSR getname:JSR compare
1040.BEQ oldbik:JSR nextbik:BEQ newbik:BNE linkv2
1050.oldbik LDY £5:BNE oldbik2
1060.oldbik7 LDY £1
1070.oldbik2 JSR nextbik2:BNE oldbik7
1080.INX:LDA (varbik).Y:TAX:INX:LDA (varbik).Y:DEY:DEY
1090.AND £A7F:CMF line+1:BNE oldbik5:CPX line+1:BEQ oldbik6
1100.oldbik5 LDX £4:JSR incloame
1110.oldbik3 LDA line+1:STA (varbik).Y
1120.INX:LDA line+1:LSR defflg:BCS oldbik4:ORA £A00
1130.oldbik4 STA (varbik).Y
1140.oldbik6 PLA:RTS
1150.nextbik LDY £1
1160.nextbik2 LDA (varbik).Y:BEQ nextbik3
1170.PHA:DEY:LDA (varbik).Y:STA varbik:PLA:STA varbik+1
1180.nextbik3 RTS
1190.incloame LDA loame:PHA:TXA
1200.LDX loame+1:CLC:ADC loame:STA loame:BCS incloame2:INC loame+1
1210.incloame2 CMP hime:TXA:SBC hime+1:BCS noroom:TXA
1220.STA (varbik).Y:PLA:DEY:STA (varbik).Y:STA varbik:STX varbik+1:LDY £1
1230.setzero LDA £0:STA (varbik).Y:INX:RTS
1240.noroom LDX stack:TXS:LDX £0
1250.noroom2 LDA see2.X:JSR osasci:INX:CPX £11:BNE noroom2
1260.LDX line+1:STA inta:STA inta+1:JSR plineno:JMP exitasm
1270.compare LDA name:CMF name2:BNE compare3:LDX £1
1280.compare2 LDA name.X:CMF name2.X
1290.BNE compare3:INX:CMF £0:BNE compare2
1300.compare3 RTS
1310.sort STA temp+1:LDA varbik:STA temp:JSR getname
1320.sort2 JSR sovenname
1330.sort3 JSR nextbik:BEQ exit2:JSR getname:JSR compare:BCS sort3:LDY £2
1340.swap LDA (varbik).Y:PHA:LDA (temp).Y
1350.STA (varbik).Y:PLA:STA (temp).Y:INX:CPY £0:BNE swap:BEQ sort2
1360.exit2 LDA temp:STA varbik
1370.LDA temp+1:STA varbik+1:JSR nextbik:BNE sort:LDX index
1380.getvarbik LDA intptr.X:STA varbik:LDA intptr+1.X:STA varbik+1:RTS
1390.pntvar PHA:LDA varbik:PHA:JSR getname
1400.LDY £0:LDX £9:CPX vartype:BNE pntv2:JSR plineno+4:LDX £4:BNE pntv3
1410.pntv2 LDA name.Y:BEQ pntv3:JSR ptokens:DEX:INX:BNE pntv2
1420.pntv3 LDA £32:JSR osasci:DEX:BPL pntv3:LDY £6
1430.pntv4 LDA (varbik).Y:STA inta:INX:LDA (varbik).Y:PHA:AND £A7F
1440.STA inta+1:STY savey:JSR plineno:PLA:BPL pntv6:LDA £ASC("e"):JSR osasci
1450.pntv6 LDY savey:DEY:DEY:JSR nextbik2
1460.BEQ nextvar:LDA £ASC("e"):JSR osasci:LDY £2:BNE pntv4
1470.nextvar JSR osnew:PLA:STA varbik
1480.PLA:STA varbik+1:LDA A:F:BPL pntv5:JSR nextbik:BNE pntvar
1490.pntv5 RTS
1500.ses OPT Fnequb(£00):OPT Fnequb("Printer (Y/N)?")
1510.ses2 OPT Fnequb(£00):OPT Fnequb("upto line=")
1520:NEXT:ENDPROC
1530:
1540.DEF Fnequb(x):?PI=x:PI=PI+1:=pass
1550:
1560.DEF Fnequb(x):?PI=x:PI=PI+LEN(x):=pass
1570:
1580.DEF PROCcheck:SI=0:FOR JI=start TO PI-1:SI=SI+?JI:NEXT:ENDPROC
1590:
1600.REM Basic-II entry points & checksums value
1610.DATA £97AE,£B53A,£B8E8,£98F1,£8A96,126968
1620.REM Basic-II entry points & checksums value
1630.DATA £97DF,£B50E,£B8E6F,£991F,£8AF3,126434

```



Atari NLQ Printing by Matthew Dunn

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PROGRAM FILE

fully with several printers and computers.

The program should work with any printer capable of producing high-resolution graphics, since the main requirement is that the printer should be able to move the paper by about half the spacing of the print heads. The program will not, however, work correctly with a 7-bit printer interface.

Each character the program prints has been redefined in a matrix 16 dots high by 18 dots wide. This is done in the data statements at the end of the program, and it should be possible to alter these to produce alternative typefaces. The program takes in one line of text at a time from the input file. Each line is scanned and 32 taken from each character, so the code for a space becomes 0 and for a lower-case z, 90. This number is used to locate the appropriate number in the data

array, which is stored as a string in the Atari because integers and two-dimensional string arrays are not possible in Atari Basic. The string array also allocates one byte per character and so uses less memory. A two-dimensional array is simulated by multiplying each character by 36 to find its starting position in the string.

In the first printing pass, the first 18 bytes of data are sent to the printer, unless it's a character that has a descender. If a descender is used, spaces are printed at this point. The line is then reprinted and the second 18 bytes for each character are sent to the printer. The third pass prints the first 18 bytes for characters with descenders, and the fourth the last 18. The four passes are necessary to maintain resolution and produce true descenders. An example of printout is given at the end of the listing.

```

1000 Rem #####
1010 Rem #
1020 Rem # NLD PRINTING FOR #
1030 Rem # EPSON, GEMINI AND EPSON #
1040 Rem # COMPATIBLE PRINTERS #
1050 Rem # COPYRIGHT M.DUNN 1986 #
1060 Rem #
1070 Rem #####
1080 Rem
1090 GOSUB 2380:REM INITIALISE DATA ARRAY
1100 Graphics 0:Print "Filespec of list file:";
1110 Trap 1100:Input Files
1120 Close #1:Open #1,4,0,Files
1130 Print "Press RETURN when printer ready";
1140 Trap 1160:Input Lines:Rem Wait for RETURN to be pressed
1150 Close #7:Open #7,B,0,"P:":Goto 1170
1160 Print "PRINTER FAILED TO OPEN";Chr$(253):Goto 1130
1170 Rem
1180 Rem #####
1190 Rem # MAIN LOOP #
1200 Rem # GETS ONE LINE OF TEXT #
1210 Rem # FROM THE TEXT FILE & #
1220 Rem # PASSES IT TO THE NLD #
1230 Rem # ROUTINE IN LINES. #
1240 Rem #####
1250 Rem
1260 Trap 1100:Rem Start again at end of file
1270 Input #1,Lines:Rem Get a line of text from file
1280 GOSUB 1400:REM CONVERT & PRINT ONE LINE
1290 Goto 1270
1300 Rem
1310 Rem #####
1320 Rem # NLD CONVERSION ROUTINE #
1330 Rem # SOURCE LINE IN LINES #
1340 Rem # NLD SOURCE DATA IN DAT# #
1350 Rem # NLD OUTPUT DATA IN NLD# #
1360 Rem #####
1370 Rem
1380 Rem PHASE 1:Upper Half of Characters
1390 Rem
1400 Linepoint=1:Nlq#=""
1410 For Chpoint=1 To Len(Lines)
1420 A=Asc(Lines$(Chpoint,Chpoint))-32:Rem get and convert present character
1430 If A<0 Or A>90 Then A=0:Rem UNDEFINED CODES
1440 Rem IGNORE CHARACTERS WITH DESCENDERS
1450 If A=12 Or A=27 Or A=71 Or A=74 Or A=80 Or A=81 Or A=89 Then A=0
1460 For I=1 To 18
1470 Nlq$(Linepoint,Linepoint)=Dat$(A$36+I):Linepoint=Linepoint+1
1480 Next I
1490 For I=1 To 4:Rem INTER CHARACTER SPACES
1500 Nlq$(Linepoint,Linepoint)=Chr$(0):Linepoint=Linepoint+1
1510 Next I
1520 Next Chpoint
1530 Linepoint=Linepoint-1
1540 Rem Set linefeed to 1/144 inch
1550 Print #7:Chr$(27);Chr$(51);Chr$(1);
1560 A=Int(Linepoint/256):B=Linepoint-256&A
1570 Rem Print NLD# at 240 dots per inch
1580 Print #7:Chr$(27);Chr$(Hires);Chr$(B);Chr$(A);Nlq#
1590 Rem
1600 Rem PHASE 2:Lower Half of Characters
1610 Rem
1620 Linepoint=1:Nlq#=""
1630 For Chpoint=1 To Len(Lines)
1640 A=Asc(Lines$(Chpoint,Chpoint))-32
1650 If A<0 Or A>90 Then A=0
1660 If A=12 Or A=27 Or A=71 Or A=74 Or A=80 Or A=81 Or A=89 Then A=0
1670 For I=19 To 36
1680 Nlq$(Linepoint,Linepoint)=Dat$(A$36+I):Linepoint=Linepoint+1
1690 Next I
1700 For I=1 To 4
1710 Nlq$(Linepoint,Linepoint)=Chr$(0):Linepoint=Linepoint+1
1720 Next I
1730 Next Chpoint
1740 Linepoint=Linepoint-1

```


MICROMART

```

1750 Print #7;Chr$(27);Chr$(51);Chr$(5);
1760 A=Int(Linepoint/256):B=Linepoint-256%A
1770 Print #7;Chr$(27);Chr$(Hires);Chr$(B);Chr$(A);Nlq$
1780 Rem -----
1790 Rem PHASE 3 :Upper Half of descenders
1800 Rem -----
1810 Linepoint=:Nlq$="" :Underline=0
1820 For Ctpoint=1 To Len(Lines)
1830   A=Asc(Lines(Ctpoint,Ctpoint))-32
1840   If A=-5 Then GOSUB 2270:Rem ESCAPE CHARACTER
1850   If A=12 Or A=27 Or A=71 Or A=74 Or A=80 Or A=B1 Or A=89 Then 1870
1860   A=0
1870   For I=1 To 18
1880     Nlq$(Linepoint,Linepoint)=Chr$(Asc(Date$(A#36+I))+Underline)
1890     Linepoint=Linepoint+1
1900   Next I
1910   For I=1 To 4
1920     Nlq$(Linepoint,Linepoint)=Chr$(Underline):Linepoint=Linepoint+1
1930   Next I
1940 Next Ctpoint
1950 Linepoint=Linepoint-1
1960 Print #7;Chr$(27);Chr$(51);Chr$(1);
1970 A=Int(Linepoint/256):B=Linepoint-256%A
1980 Print #7;Chr$(27);Chr$(Hires);Chr$(B);Chr$(A);Nlq$
1990 Rem -----
2000 Rem PHASE 4 :Lower Half of descenders
2010 Rem -----
2020 Linepoint=:Nlq$=""
2030 For Ctpoint=1 To Len(Lines)
2040   A=Asc(Lines(Ctpoint,Ctpoint))-32
2050   If A=12 Or A=27 Or A=71 Or A=74 Or A=80 Or A=B1 Or A=89 Then 2070
2060   A=0
2070   For I=19 To 36
2080     Nlq$(Linepoint,Linepoint)=Date$(A#36+I):Linepoint=Linepoint+1
2090   Next I
2100   For I=1 To 4
2110     Nlq$(Linepoint,Linepoint)=Chr$(0):Linepoint=Linepoint+1
2120   Next I
2130 Next Ctpoint
2140 Linepoint=Linepoint-1
2150 Print #7;Chr$(27);Chr$(65);Chr$(11);
2160 A=Int(Linepoint/256):B=Linepoint-256%A
2170 Print #7;Chr$(27);Chr$(Hires);Chr$(B);Chr$(A);Nlq$
2180 Return
2190 Rem
2200 Rem #####
2210 Rem * ROUTINE TO CHECK FOR *
2220 Rem * EPSON UNDERLINE CODES *
2230 Rem * UNDERLINE ON=27,45,1 *
2240 Rem * UNDERLINE OFF=27,45,0 *
2250 Rem #####
2260 Rem
2270 If Len(Lines)<Ctpoint+2 Then 2560
2280 If Lines(Ctpoint+1,Ctpoint+1)>"-" Then 2560
2290 If Lines(Ctpoint+2,Ctpoint+2)=Chr$(1) Then Underline=2:GOTO 2550
2300 Underline=0
2310 Ctpoint=Ctpoint+2
2320 Return
2330 Rem
2340 Rem #####
2350 Rem # Initialise data table #
2360 Rem #####
2370 Rem
2380 Dia Data(91#36),Files(16),Nlq$(1920),Lines(87)
2390 Graphics 2:Print #6:Print #6:" nlq printer driver":Print #6
2400 Print #6:" BY M.DUNN 1986":Print #6
2410 Print #6:" initialising array"
2420 Rem Load NLQ character set into DATA
2430 Restore 2600
2440 For J=0 To 90:Checksum=0
2450   For I=1 To 36
2460     Read A:Data$(J#36+I)=Chr$(A):Checksum=Checksum+A
2470   Next I
2480 Position 9,7:Print #6;90-I;" "
2490 Read A:If A<>Checksum Then Print "Error in data:Character";I+32
2500 Next I
2510 Rem Delete or alter following lines as appropriate
2520 Rem For wide characters use L instead of Z
2530 Hires=Asc("Z"):Rem For Epson Printers
2540 Hires=Asc("z"):Rem For Gemini Printers
2550 Return
2560 Rem
2570 Rem #####
2580 Rem # Start of NLQ character set #
2590 Rem #####
2600 Rem
2610 Rem Character 32=SPACE
2620 Data 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2630 Data 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2640 Rem Character 33=!
2650 Data 0,0,0,0,0,0,0,0,56,61,56,0,0,0,0,0,0,0,0
2660 Data 0,0,0,0,0,0,0,0,48,124,48,0,0,0,0,0,0,0,393
2670 Rem Character 34="
2680 Data 0,0,0,0,96,112,96,0,0,0,0,96,112,96,0,0,0,0
2690 Data 0,0,0,16,80,64,96,0,0,0,16,80,64,96,0,0,0,1120
2700 Rem Character 35=#
2710 Data 0,3,0,8,8,11,62,8,9,73,64,64,64,64,0,0,33,1
2720 Data 2,0,3,5,5,0,62,66,64,0,0,1,1,1,1,63,65,32,0,847
2730 Rem Character 36=$
2740 Data 16,8,33,33,33,33,127,33,33,33,33,127,33,33,33,33,4,2
2750 Data 18,34,8,8,8,8,127,8,8,8,127,8,8,8,8,34,36,1152
2760 Rem Character 37=%
2770 Data 32,81,80,82,80,84,32,8,8,3,0,16,0,32,0,67,0,0
2780 Data 97,0,2,0,4,0,104,0,0,18,21,5,37,5,69,2,0,0,969
2790 Rem Character 38=&
2800 Data 2,36,17,65,72,72,72,72,72,64,69,21,16,34,0,5,0,0
2810 Data 4,34,72,24,1,1,1,1,9,25,16,64,70,32,6,0,9,9,1067
2820 Rem Character 39=-
2830 Data 0,0,0,0,0,0,0,96,112,96,0,0,0,0,0,0,0,0
2840 Data 0,0,0,0,0,0,16,80,64,96,0,0,0,0,0,0,0,560
2850 Rem Character 40=_
2860 Data 0,0,0,12,18,32,1,64,0,0,0,0,0,0,0,0,0,0
2870 Data 0,0,0,24,36,2,64,1,0,0,0,0,0,0,0,0,0,254
2880 Rem Character 41=*
2890 Data 0,0,0,0,0,0,0,0,0,0,64,1,32,18,12,0,0,0,0
2900 Data 0,0,0,0,0,0,0,0,0,1,64,2,36,24,0,0,0,0,254
2910 Rem Character 42=x
```



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PROGRAM FILE

2920 Data 0,0,0,0,18,0,12,0,18,0,0,0,0,0,0,0
2930 Data 0,8,8,42,8,28,8,8,28,8,42,8,8,0,0,0,272
2940 Rem Character 43=+
2950 Data 0,0,0,0,0,0,0,0,30,0,0,0,0,0,0,0,0
2960 Data 0,0,0,8,8,8,8,8,62,8,8,8,8,8,0,0,0,172
2970 Rem Character 44=+
2980 Data 0,0,0,0,0,0,0,12,14,12,0,0,0,0,0,0,0
2990 Data 0,0,0,0,0,0,2,10,8,12,0,0,0,0,0,0,0,70
3000 Rem Character 45=+
3010 Data 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
3020 Data 0,0,0,8,8,8,8,8,8,8,8,8,8,8,0,0,0,88
3030 Rem Character 46=+
3040 Data 0,0,0,0,0,0,0,0,1,1,1,0,0,0,0,0,0,0
3050 Data 0,0,0,0,0,0,0,0,3,3,3,0,0,0,0,0,0,0,12
3060 Rem Character 47=+
3070 Data 0,0,1,0,2,0,4,0,8,0,16,0,32,0,64,64,0,0
3080 Data 1,1,0,2,0,4,0,8,0,16,0,32,0,64,0,0,0,0,319
3090 Rem Character 48=0
3100 Data 28,34,3,64,64,68,64,64,72,72,64,80,80,1,34,28,0,0
3110 Data 28,34,64,5,5,1,9,9,1,1,17,1,1,96,34,28,0,0,1154
3120 Rem Character 49=1
3130 Data 0,0,0,0,16,0,32,0,127,0,0,0,0,0,0,0,0
3140 Data 0,0,0,1,1,33,1,65,127,1,1,1,1,1,0,0,0,408
3150 Rem Character 50=2
3160 Data 0,16,33,0,2,66,64,64,68,68,68,64,64,72,72,0,48,1
3170 Data 1,33,1,67,65,1,5,5,1,1,9,9,1,1,81,33,1,1086
3180 Rem Character 51=3
3190 Data 0,66,64,65,65,64,64,64,80,80,64,64,96,105,73,64,70,64
3200 Data 0,0,2,0,0,1,17,17,17,17,49,49,17,0,64,74,4,0,1540
3210 Rem Character 52=4
3220 Data 0,0,4,0,8,0,16,0,32,0,64,127,0,0,0,0,0,0
3230 Data 0,4,4,12,4,20,4,36,5,69,5,127,5,5,5,4,0,0,560
3240 Rem Character 53=5
3250 Data 0,122,73,73,72,72,72,72,72,72,72,72,73,73,64,70,0
3260 Data 0,114,0,0,1,1,1,1,1,1,1,1,0,0,10,68,0,1397
3270 Rem Character 54=6
3280 Data 6,1,8,0,16,0,32,0,64,64,0,0,0,5,2,0,0
3290 Data 6,8,9,25,9,41,9,73,73,9,9,9,9,9,0,0,502
3300 Rem Character 55=7
3310 Data 0,0,96,64,64,64,64,64,67,68,64,72,72,64,64,80,96,0
3320 Data 0,0,64,0,0,0,0,0,7,0,8,0,0,16,16,32,64,0,1270
3330 Rem Character 56=8
3340 Data 50,5,0,72,72,72,72,72,72,72,72,72,0,5,50,0,0
3350 Data 38,80,89,1,1,1,1,1,1,1,1,1,89,80,38,0,0,1254
3360 Rem Character 57=9
3370 Data 48,0,72,72,72,72,72,73,73,72,74,72,76,72,8,48,0,0
3380 Data 32,80,0,0,0,0,1,1,0,0,2,0,4,0,8,64,48,0,0,1216
3390 Rem Character 58=+
3400 Data 0,0,0,0,0,0,0,18,18,0,0,0,0,0,0,0,0
3410 Data 0,0,0,0,0,0,0,54,54,0,0,0,0,0,0,0,0,216
3420 Rem Character 59=+
3430 Data 0,0,0,0,0,0,0,44,44,0,0,0,0,0,0,0,0
3440 Data 0,0,0,0,0,0,2,106,104,108,0,0,0,0,0,0,0,0,454
3450 Rem Character 60=+
3460 Data 0,0,0,0,12,12,0,0,18,18,0,0,33,33,0,0,0,0
3470 Data 0,0,8,8,0,0,20,20,0,0,34,34,0,0,65,65,0,0,380
3480 Rem Character 61=+
3490 Data 0,0,2,2,2,2,2,2,2,2,2,2,2,2,2,0,0
3500 Data 0,0,16,16,16,16,16,16,16,16,16,16,16,16,0,0,252
3510 Rem Character 62=+
3520 Data 0,0,0,0,33,33,0,0,18,18,0,0,12,12,0,0,0,0
3530 Data 0,0,65,65,0,0,34,34,0,0,20,20,0,0,8,8,0,0,380
3540 Rem Character 63=+
3550 Data 0,0,32,0,0,64,64,64,70,68,64,64,72,8,0,48,0,0
3560 Data 0,0,32,64,64,0,0,0,5,0,8,8,0,64,80,32,0,0,975
3570 Rem Character 64=+
3580 Data 30,32,1,64,76,64,82,82,82,82,82,64,76,66,82,0,36,24
3590 Data 60,2,64,1,9,21,1,1,1,1,1,21,13,17,1,69,0,56,1364
3600 Rem Character 65=A
3610 Data 0,0,1,2,4,8,16,32,64,64,32,16,8,4,2,1,0,0
3620 Data 1,1,3,5,13,20,36,68,4,4,68,36,20,13,5,3,1,1,556
3630 Rem Character 66=B
3640 Data 64,64,64,127,72,72,72,72,72,72,72,72,72,1,52,2,0
3650 Data 1,1,1,127,1,1,1,1,1,1,1,1,1,1,88,34,4,0,1360
3660 Rem Character 67=C
3670 Data 8,20,2,32,1,1,64,64,64,64,64,64,64,1,32,34,0
3680 Data 8,20,32,2,64,64,1,1,1,1,1,1,1,64,2,34,0,941
3690 Rem Character 68=D
3700 Data 64,64,64,127,64,64,64,64,64,64,1,1,32,2,20,8,0,0
3710 Data 1,1,1,127,1,1,1,1,1,1,1,64,64,2,32,20,8,0,0,1093
3720 Rem Character 69=E
3730 Data 64,64,127,72,72,72,72,72,72,72,72,72,64,64,64,64,64,64
3740 Data 1,1,127,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1431
3750 Rem Character 70=F
3760 Data 64,64,127,72,72,72,72,72,72,72,72,72,72,64,64,64,64,64,64
3770 Data 1,1,127,1,1,0,0,0,0,0,0,0,0,0,0,0,0,0,1418
3780 Rem Character 71=G
3790 Data 8,20,2,32,1,1,64,64,64,64,64,64,68,69,5,36,4,4
3800 Data 8,20,32,2,64,64,1,1,1,1,1,1,0,64,70,32,0,938
3810 Rem Character 72=H
3820 Data 0,64,64,127,72,72,8,8,8,8,8,8,72,72,127,64,64,0
3830 Data 0,1,1,127,1,1,0,0,0,0,0,0,0,1,1,127,1,1,0,1108
3840 Rem Character 73=I
3850 Data 0,0,0,0,0,64,64,64,127,64,64,64,0,0,0,0,0,0
3860 Data 0,0,0,0,0,1,1,1,127,1,1,1,0,0,0,0,0,0,644
3870 Rem Character 74=J
3880 Data 0,6,0,1,1,0,0,0,0,0,65,65,66,124,64,64,64,0
3890 Data 0,4,2,0,0,1,1,1,1,0,0,2,124,0,0,0,0,657
3900 Rem Character 75=K
3910 Data 64,64,127,64,64,8,12,4,0,16,18,2,64,96,97,65,64,64
3920 Data 1,1,127,9,9,8,0,16,20,4,0,32,35,3,65,65,1,1,1290
3930 Rem Character 76=L
3940 Data 0,64,64,127,64,64,0,0,0,0,0,0,0,0,0,0,1,0,0
3950 Data 1,1,1,127,1,1,1,1,1,1,1,1,1,1,1,3,0,0,528
3960 Rem Character 77=M
3970 Data 64,64,127,0,32,0,16,0,8,8,0,16,0,32,0,127,64,64
3980 Data 1,1,127,65,1,32,0,16,0,0,16,0,32,1,65,127,1,1,1108
3990 Rem Character 78=N
4000 Data 64,64,127,0,32,0,16,0,8,0,4,0,66,64,65,127,64,64
4010 Data 1,1,127,65,1,32,0,16,0,8,0,4,0,2,0,127,1,1,1151
4020 Rem Character 79=O
4030 Data 8,20,2,32,1,1,64,64,64,64,64,64,1,32,2,20,8
4040 Data 8,20,32,2,64,64,1,1,1,1,1,1,64,64,2,32,20,8,898
4050 Rem Character 80=P
4060 Data 64,64,64,127,64,64,64,64,64,64,64,64,64,64,8,32,16
4070 Data 1,1,1,127,9,9,9,8,8,8,8,8,8,8,64,64,16,32,1412
4080 Rem Character 81=Q

PROGRAM FILE

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4090 Data 8,20,2,32,1,1,64,64,64,64,68,1,3,32,3,21,8,0
4100 Data 8,20,32,2,64,64,1,1,1,9,1,68,64,2,32,20,9,1,855
4110 Rem Character 82=R
4120 Data 64,64,64,127,64,64,64,64,64,64,68,64,66,64,9,8,32,16
4130 Data 1,1,1,127,9,9,9,8,8,8,8,12,9,11,65,65,17,33,1431
4140 Rem Character 83=S
4150 Data 3,48,1,1,72,72,72,72,72,72,72,72,72,72,1,1,36,98
4160 Data 39,2,80,80,1,1,1,1,1,1,1,1,1,1,72,72,2,100,1366
4170 Rem Character 84=T
4180 Data 96,64,64,64,64,64,64,64,127,64,64,64,64,64,64,96,0
4190 Data 96,0,0,0,0,1,1,1,127,1,1,1,0,0,0,0,96,0,1540
4200 Rem Character 85=U
4210 Data 64,64,126,64,65,64,0,0,0,0,0,0,64,65,64,126,64,64
4220 Data 0,0,124,2,0,1,1,1,1,1,1,1,1,0,2,124,0,0,1154
4230 Rem Character 86=V
4240 Data 64,64,96,80,72,68,2,1,0,0,1,2,68,72,80,96,64,64
4250 Data 0,0,64,32,16,8,4,2,1,1,2,4,8,16,32,64,0,0,1148
4260 Rem Character 87=W
4270 Data 64,64,124,66,65,0,0,1,2,12,2,1,0,64,65,126,64,64
4280 Data 0,0,120,6,0,1,1,0,6,24,4,2,1,1,0,126,0,0,1076
4290 Rem Character 88=X
4300 Data 64,64,64,65,96,66,80,4,8,8,4,80,66,96,65,64,64,64
4310 Data 1,1,1,65,3,33,5,16,8,8,16,5,33,3,65,1,1,1,1288
4320 Rem Character 89=Y
4330 Data 64,64,64,96,64,80,0,8,7,8,0,16,64,96,64,64,64,64
4340 Data 0,0,64,0,32,1,17,1,15,1,17,1,32,0,64,0,0,0,1132
4350 Rem Character 90=Z
4360 Data 0,0,96,65,64,66,64,68,64,72,64,80,64,96,64,65,0,0
4370 Data 0,0,65,1,3,1,5,1,9,1,17,1,33,1,65,3,0,0,1198
4380 Rem Character 91=[
4390 Data 0,0,0,0,127,64,64,64,64,64,64,0,0,0,0,0,0,0
4400 Data 0,0,0,0,127,1,1,1,1,1,1,0,0,0,0,0,0,0,644
4410 Rem Character 92=\
4420 Data 8,20,32,2,1,64,64,64,64,64,64,64,64,1,2,32,20,8
4430 Data 24,33,5,65,67,1,1,0,0,0,0,1,1,67,65,5,33,24,1030
4440 Rem Character 93=]
4450 Data 0,0,0,0,0,64,64,64,64,64,127,0,0,0,0,0,0,0
4460 Data 0,0,0,0,0,1,1,1,1,1,1,127,0,0,0,0,0,0,644
4470 Rem Character 94=^
4480 Data 1,0,2,4,8,16,36,4,4,4,0,8,0,24,36,0,0,0
4490 Data 0,2,4,8,16,40,64,0,0,0,0,0,16,40,64,0,0,0,413
4500 Rem Character 95=_
4510 Data 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
4520 Data 1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
4530 Rem Character 96=`
4540 Data 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
4550 Data 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
4560 Rem Character 97=a
4570 Data 0,0,3,11,0,0,0,0,0,0,0,0,0,0,9,6,1,0,0
4580 Data 0,2,0,0,21,21,21,21,21,21,21,21,21,4,14,0,1,0,240
4590 Rem Character 98=b
4600 Data 0,64,65,126,6,0,9,0,0,0,0,0,0,0,9,0,6,0
4610 Data 0,1,0,126,0,10,0,17,17,17,17,17,17,17,0,10,4,0,555
4620 Rem Character 99=c
4630 Data 0,0,0,0,9,9,0,0,0,0,0,0,0,0,9,9,0,0,0
4640 Data 0,0,4,10,0,0,17,17,17,17,17,17,17,0,0,0,0,175
4650 Rem Character 100=d
4660 Data 0,6,0,9,0,0,0,0,0,0,0,9,65,68,126,1,0,0
4670 Data 0,4,10,0,17,17,17,17,17,17,17,17,0,8,2,126,0,1,1,555
4680 Rem Character 101=e
4690 Data 0,6,0,9,9,0,0,0,0,0,0,0,0,8,9,1,5,0
4700 Data 0,4,14,4,4,21,21,21,21,21,21,21,21,5,12,4,0,267
4710 Rem Character 102=f
4720 Data 0,0,0,0,0,63,0,64,64,64,64,64,64,64,0,32,0,0
4730 Data 0,16,17,17,17,63,81,17,17,16,0,0,0,0,64,0,0,0,868
4740 Rem Character 103=g
4750 Data 2,0,33,21,76,68,68,68,68,68,68,84,21,37,4,66,64
4760 Data 0,6,36,64,25,17,17,17,17,17,17,17,1,64,32,66,4,0,1301
4770 Rem Character 104=h
4780 Data 64,64,127,4,0,8,0,0,0,0,0,0,0,8,0,7,0,0
4790 Data 1,1,127,1,9,0,16,16,16,16,16,16,16,1,9,7,1,1,552
4800 Rem Character 105=i
4810 Data 0,0,0,0,0,0,0,0,0,47,0,0,0,0,0,0,0,0,0
4820 Data 0,0,0,0,0,1,17,17,93,1,1,1,0,0,0,0,0,0,180
4830 Rem Character 106=j
4840 Data 0,0,0,1,0,0,0,0,0,32,33,126,0,0,0,0,0,0,0
4850 Data 0,0,2,0,1,1,1,1,1,1,0,62,0,0,0,0,0,0,262
4860 Rem Character 107=k
4870 Data 0,64,64,127,66,66,0,0,6,6,0,0,9,9,0,0,0,0
4880 Data 0,1,1,127,1,4,4,0,0,27,27,17,17,17,17,0,0,678
4890 Rem Character 108=l
4900 Data 0,0,0,0,0,64,64,127,0,0,0,0,0,0,0,0,0,0
4910 Data 0,0,0,0,0,1,1,1,127,1,1,1,0,0,0,0,0,0,388
4920 Rem Character 109=m
4930 Data 0,0,15,0,8,0,0,0,8,7,0,8,0,0,15,0,0
4940 Data 17,17,15,9,1,16,16,16,9,7,9,0,16,17,17,15,1,1,260
4950 Rem Character 110=n
4960 Data 0,0,0,15,0,8,0,0,0,0,0,0,0,8,7,0,0,0
4970 Data 0,17,17,15,9,1,16,16,16,16,16,16,17,1,15,1,1,0,228
4980 Rem Character 111=o
4990 Data 0,6,0,9,9,0,0,0,0,0,0,0,0,9,9,0,6,0
5000 Data 0,4,10,0,0,17,17,17,17,17,17,17,0,0,10,4,0,212
5010 Rem Character 112=p
5020 Data 0,64,64,63,40,0,68,68,68,68,68,68,0,0,40,16,0
5030 Data 0,1,1,127,1,72,0,0,0,0,0,0,0,72,72,0,48,0,1157
5040 Rem Character 113=q
5050 Data 0,16,40,0,0,68,68,68,68,68,68,0,40,31,32,64,65,0
5060 Data 0,48,0,72,72,0,0,0,0,0,0,0,72,0,63,65,1,0,2,1091
5070 Rem Character 114=r
5080 Data 0,0,0,8,7,0,8,0,0,0,0,0,0,8,0,0,0,0
5090 Data 0,0,17,1,15,9,1,16,16,16,16,16,16,16,0,8,0,0,194
5100 Rem Character 115=s
5110 Data 0,9,5,1,0,0,0,0,0,0,0,0,0,0,8,10,9,0
5120 Data 0,1,16,20,21,21,21,21,21,21,21,21,21,5,1,26,0,331
5130 Rem Character 116=t
5140 Data 0,0,0,0,126,1,0,0,0,0,0,0,0,0,1,0,0,0
5150 Data 0,0,16,16,126,16,17,17,17,17,17,17,1,1,0,2,0,0,408
5160 Rem Character 117=u
5170 Data 0,0,0,14,1,0,0,0,0,0,0,0,1,0,14,1,0,0
5180 Data 0,16,16,30,16,17,1,1,1,1,1,16,18,30,16,17,1,230
5190 Rem Character 118=v
5200 Data 0,0,8,0,4,0,2,0,1,0,2,0,4,0,8,0,0,0
5210 Data 16,16,16,24,16,4,0,2,1,2,0,4,16,24,16,16,0,218
5220 Rem Character 119=w
5230 Data 0,0,14,1,0,1,0,2,4,2,0,1,0,1,14,0,0,0
5240 Data 16,16,30,16,17,0,2,4,8,4,2,0,17,16,30,16,16,0,250
5250 Rem Character 120=x

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760 TAY
770 LDA £25:JSR os
780 LDA£4:JSR os
790 LDA £1110,Y:JSR os
800 LDA £1111,Y:JSR os
810 LDA £1112,Y:JSR os
820 LDA £1113,Y:JSR os
830 LDXL4:LDA £1110,Y:CMP £64:BPL adg:LDXL6
840 adg LDA £1111,Y:CMP £2:BEQ adg:LDXL32
850 adg LDA £1113,Y:CMP £2:BEQ adf:CMP £1:BEQ adf:LDXL32
860 adf LDA £25:JSR os
870 LDA£1:JSR os
880 LDA £8:JSR os:JSR os
890 TXA:JSR os
900 LDA£0:JSR os
910 :
920 LDA £1110,Y:CMPE£0:BEQ p:CMPE£0:BPL p
930 CLC:ADC £1114,Y:STA £1110,Y:CMPE£0:BMI y
940 CMP £20:BPL y:TYA:TAX:INC £1111,X:JMP y
950 p CLC:ADC £1114,Y:STA £1110,Y:CMPE£0:BPL y
960 CMP £££0:BMI y:TYA:TAX:DEC £1111,X
970 y LDA £1112,Y:CMPE£0:BEQ q:CMPE£0:BPL q
980 CLC:ADC £1115,Y:STA £1112,Y:CMPE£0:BMI d
990 CMP £20:BPL d:TYA:TAX:INC £1113,X:JMP d
1000 q CLC:ADC £1115,Y:STA £1112,Y:CMPE£0:BPL d
1010 CMP £££0:BMI d:TYA:TAX:DEC £1113,X
1020 d
1030 LDA £1110,Y:STA £1102
1040 LDA £1111,Y:STA £1103
1050 LDA £1112,Y:STA £1104
1060 LDA £1113,Y:STA £1105
1070 STY£1106
1080 LDX £02:LDY ££11:LDA £9:JSR wd
1090 LDY£1106
1100 LDA £1106:CMP £0:BEQ £:CMP £14:BEQ £:CMP £15:BEQ £
1110 TYA:TAX
1120 £w LDA £1110,X:STA £1110,X
1130 INX:CPX £££0:BNE £ok
1140 DEC£1107
1150 LDX £1100:DEX:CPX £AFF:BNE £g:INX
1160 £g STX £1100
1170 JMP p1
1180 f
1190 LDA £25:JSR os
1200 LDA £4:JSR os
1210 LDA £1110,Y:JSR os
1220 LDA £1111,Y:JSR os
1230 LDA £1112,Y:JSR os
1240 LDA £1113,Y:JSR os
1250 LDXL4:LDA £1110,Y:CMP £64:BPL bdg:LDXL6
1260 bdg LDA £1111,Y:CMP £2:BEQ bde:LDXL32
1270 bde LDA £1113,Y:CMP £2:BEQ bdf:CMP £1:BEQ bdf:LDXL32
1280 bdf LDA £25:JSR os
1290 LDA£1:JSR os
1300 LDA £8:JSR os:JSR os
1310 TXA:JSR os
1320 LDA£0:JSR os
1330 p1 LDX £110F:INX:CPX £1100:BNE £op:RTS
1340 £op STX £110F:JMP loop
1350):NEXTpa
1360ENDPROC
1370DEF PROC£:DIND(96)
1380FORI=1TO96:READD(I):NEXTI:£=£+X=2
1390ENVELOPE£1,1,0,0,0,0,0,0,100,-2,0,-10,100,90
1400ENDPROC
1410DEF PROC£ound
1420£=£+1:N=D(£):IFN=99THENC=0:GOTO1420
1430IFN=1THENC=£+1:X=D(£):GOTO1420
1440SOUND£201,0,0,1:SOUND£202,0,0,1:SOUND£203,0,0,1
1450IFX=1THENSOUND£203,1,N*£+3:SOUND£201,1,N*£+12,3
1460IFX=1THENSOUND£202,1,N*£+36,3:ENDPROC
1470SOUND£203,1,N*£+6
1480SOUND£201,0,0,3:SOUND£202,0,0,6
1490SOUND1,1,N*£+12,6:SOUND2,1,N*£+36,3
1500ENDPROC

```

```

10level£=1:SC£=500
20ENVELOPE£1,1,0,0,0,0,0,0,120,-20,-40,-40,120,100
30ENVELOPE£2,1,-2,0,0,100,1000,1000,0,0,0,0,0,0
40ENVELOPE£3,1,0,0,0,0,0,0,120,-10,0,-10,120,100
50ENVELOPE£4,1,-1,-2,-3,10,10,10,120,-10,-1,-2,120,110
60ENVELOPE£5,1,1,1,1,100,100,100,120,-10,0,-10,120,100
70££1100=0
80XC£=640:YC£=512:FX£=0
90IF££1101=16THENS££=16*256ELSE S££=0
100TS£=(level£-1)*250:SH£=10
110P=level£:IFP>3THENP=3
120co£=30:N£=RND(P)+6:DD£=0
130*FX£11,0
140DINA(N£+1),L£(N£+1),P£(N£+2),Q£(N£+2)
150DIN££(7):FORI£=1TO7:READ seg£(I£):NEXTI£
160DATA6,5,4,3,2,1,4
170A£=0
180FORI£=1TON£
190IFA£>330 THEN C£=(360-A£)/2:GOTO210
200C£=100/N£+RND(300/N£):IFC£+A£>360THEN200
210A£=A£+C£:A£(I£)=A£:L£(I£)=SC£/4*3+RND(SC£/4)
220IFlevel£>3THENL£(I£)=SC£/2+RND(SC£/2)
230IFlevel£>6THENL£(I£)=SC£/4+RND(SC£/4*3)
240NEXTI£
250C£=360-A£(N£)
260IFC£<20 OR C£>90 THEN 170
270FORI£=1TON£:A£(I£)=RAD(A£(I£)):NEXTI£
280MODE2:COLOUR15

```



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PROGRAM FILE

```

290PRINTTAB(0,1):"HOLD";TAB(0,2):" ON":VDU19,15,7;0;
300COLOUR13
310A(NI+1)=0:LI(NI+1)=9CI
320white=VND(7):segI=segI(whiteI)
330PROCblack:VDU19,15,7;0;
340FORI=0TONI+1
350PI(I)=XCZ+SIN(A(I))*LI(I)
360QI(I)=YCZ+COS(A(I))*LI(I)
370NEXTI
380GCOL0,1:MOVEXCZ,YCZ,SCZ
390DRAWXCZ+SIN(A(1))*LI(1),YCZ+COS(A(1))*LI(1)
400FORI=1TONI
410GCOL0,14
420MOVEXCZ+SIN(A(I))*LI(I),YCZ+COS(A(I))*LI(I)
430GCOL0,1+1
440DRAWXCZ+SIN(A(I+1))*LI(I+1),YCZ+COS(A(I+1))*LI(I+1)
450NEXTI
460GCOL0,14
470FORI=1TONI+1
480MOVEXCZ+SIN(A(I))*LI(I)/8,YCZ+COS(A(I))*LI(I)/8
490DRAWPI(I),QI(I):NEXTI
500PORT=8TO28STEP-1
510FORI=1TONI
520MOVEXCZ+SIN(A(I))*LI(I)/T,YCZ+COS(A(I))*LI(I)/T
530DRAWXCZ+SIN(A(I+1))*LI(I+1)/T,YCZ+COS(A(I+1))*LI(I+1)/T
540NEXTI
550PRINTTAB(0,1):" ":TAB(0,2):" "
560MOVEXCZ,YCZ,SCZ:T:DRAWXCZ+SIN(A(1))*LI(1)/T,YCZ+COS(A(1))*LI(1)/T
570NEXTT:COLOUR14:PRINTTAB(15,0):"CHASM":TAB(17,1):levelI
580PRINTTAB(0,0):"SCORE":TAB(0,29):"SHIELD"
590PRINTTAB(15,29):"LASERS"

600GCOL0,12:FORI=0TO1024STEP4:PLUT77,0,I:PLUT77,1270,I:NEXTI
610FORI=1TO50:A=INKEY(0):NEXTI
620FORI=10TO0STEP-1:PROCblack
630FORI=1TOI:NEXTI:PROCwhite
640FORI=1TOI:NEXTI:NEXTI
650NI=NI+1
660SI=1
670SI=SI:SI=SI+INKEY(-98)-INKEY(-67)
680SI=SI+NI*((SI+NI)-(SI+1)):IFSI<0AND FFI<2THEN PROCseg
690IFINKEY(-1)THENSII=81000:741101=16
700IFINKEY(-2)THENSII=741101=0
710IF FFI=0 AND INKEY(0)=" "THENPROCfire
720PROCup
730IFFFI=2THENPROCblack:coI=coI+1:IFcoI=0THENFFI=0:coI=10:PROCwhite
740IFFFI=741101THEN790
750IF FFI=1 THEN TSZ=TSZ+10*(PPZ-741100):GOTO790
760SHI=SHI-(PPZ-741100):SOUNDSSI+10.1,4,5
770IFSHI<1THENSOUNDSSI+1,4,100,100:MODE1
780IFSHI<1THENPRINTTAB(5,5):"You scored ":TSZ," ":FORI=1TO1000:NEXTI:RUN
790IF FFI=1 THEN PROCafter
800COLOUR13:VDU19,13,2;0;
810PRINTTAB(0,1):TSZ:TAB(0,30):SHI:" ":TAB(17,30):coI:" "
820IF TSZ>levelI*250THENSOUNDSSI+111,5,40,25:SOUNDSSI+112,5,0,25
830IF TSZ>levelI*250THENSOUNDSSI+113,5,20,25:GOTO1290
840IFlevelI*4THENDDI=DI+1:IFDI=3THENDDI=0:GOTO720
850GOTO670
860DEFPROCblack:FORI=1TO15:VDU19,I,0;0;:NEXTI:ENDPROC
870DEFPROCwhite:FORI=1TO11
880VDU19,I,whiteI;0;:NEXTI
890VDU19,15,segI;0;:VDU19,14,whiteI;0;:ENDPROC
900DEFPROCseg:PROCwhite:VDU19,SI,segI;0;:ENDPROC
910DEF PROCfire:DZ=SI-1-NI*(SI=1)
920TSZ=TSZ-2-2*(TSZ=0)
930coI=coI-1:IFcoI=0THENFFI=2:coI=-20:ENDPROC
940SOUNDSSI+110,3,7,20:SOUNDSSI+111,2,250,20
950GCOL3,13:VDU19,13,0;0;:MOVEXCZ,YCZ
960MOVEPI(SI),QI(SI):PLOT85,PI(DI),QI(DI)
970VDU19,13,2;0;
980FFI=1:ENDPROC
990DEF PROCafter
1000GCOL3,13:VDU19,13,0;0;:MOVEXCZ,YCZ
1010MOVEPI(SI),QI(SI):PLOT85,PI(DI),QI(DI)
1020VDU19,13,2;0;
1030FFI=0:ENDPROC
1040DEF PROCclip:(?&1100)=7(&1100)+1
1050I(&1110+0*(I-1))=XCZ+RND(20)-10
1060I(&1112+0*(I-1))=YCZ+RND(20)-10
1070I(&1114+0*(I-1))=RND(33)-17
1080I(&1115+0*(I-1))=RND(33)-17
1090IF(&1114+0*(I-1))=0AND(&1115+0*(I-1))=0THEN1070
1100ENDPROC
1110DEF PROCup:IF741100=0THEN PROCclip
1120IF741100<10AND RND(10)=1THEN PROCclip
1130PPZ=741100
1140CALL1200:IF levelI>3THEN170
1150IF RND(20)=7THENPROCchange
1160ENDPROC
1170IF RND(20)=9THENPROCspeed
1180ENDPROC
1190DEF PROCchange:FORI=1 TO741100
1200I(&1114+0*(I-1))=RND(33)-17
1210I(&1115+0*(I-1))=RND(33)-17
1220NEXTI
1230ENDPROC
1240DEF PROCspeed:FORI=1TO741100
1250I(&1114+0*(I-1))=16*(SGN(I(&1114+0*(I-1))))
1260I(&1114+0*(I-1))=16*(SGN(I(&1114+0*(I-1))))
1270NEXTI
1280ENDPROC
1290REM new level
1300I(&1101)=SSI/256
1310PORT=3TO1 STEP-1
1320FORI=1TO15:segI=I:whiteI=I
1330PROCwhite:FORGI=1TOTI:10:NEXTGI,I,77
1340I(&1100)=levelI+1:CLEAR:levelI=741100
1350Q=levelI*30:IFQ>200THENC=200
1360SCI=530-Q
1370GOTO20

```


PROGRAM FILE



Turbo Pascal Sideways Printing

by Mark Needham

This program prints a file sideways on an Epson-type printer. The characters are printed using the bit image mode of the printer (ESC K). To get the character definitions on an IBM-type computer, the program fetches bytes from the ROM at \$fe00:1a6e; there are eight bytes for each of the characters 0 to 127 in the ROM. For other machines, or to define your own characters, put the definitions in

a file to be called CHARDUMP.TXT. This should hold eight values for each of the characters 0 to 127 — 1024 numbers altogether.

The size of the characters can be modified: height and width can be changed, and you can specify the number of lines to fit on a page.

To define a character, use the procedure given in the diagram after the listing.

```

program SideWaysPrinter; { SIDEPRNT.PAS }

type filedef = record b : char end;

var printFile
    printrec      : file of filedef;
    ptrs, lens    : array[1..132] of integer;
    CharDef       : array[0..127,0..7] of integer;
    LinesPerPage, MaxChars,
    rows, m.p, loop, line,
    CharHeight, mode, count, width : integer;
    CharFile      : Text;
    codes         : array[1..480] of byte;
    Key           : char;
    Pname        : string[20];
    Found        : boolean;
    main         : array[1..32767] of char;

procedure SendToPrinter(x : integer);
var loop : integer;
begin
    write(1st,chr(27)+'K'+chr(x mod 256)+chr(x div 256));
    for loop := 1 to x do write(1st,chr(codes[loop])); count := 0;
end;

function MakeBits(V,M3 : integer) : integer;
var m1,m2,loop,ans : integer;
begin
    m1 := M3; m2 := 3; ans := 0;
    for loop := 1 to 4 do
        begin
            if (m1 and v)=m1 then ans := ans + m2;
            m1 := m1 shl 1; m2 := m2 shl 2;
        end;
    MakeBits := ans;
end;

procedure DoPrint(len : integer); { Mode Values 0 normal, 1 Double Width }
var Height,NumBits,x,c,loop,bits : integer;
begin
    for loop := 1 to LinesPerPage do
        if ptrs[loop] <> 0 then if main[ptrs[loop]]=chr(26) then ptrs[loop] := 0;
        NumBits := 8*CharHeight;
        for x := 1 to len do
            begin
                for width := 1 to 2 do
                    if (width=1) or ((width=2) and (mode<>0)) then
                        begin
                            count := 0;
                            for loop := LinesPerPage downto 1 do
                                begin
                                    if count+NumBits >= 480 then SendToPrinter(count);
                                    if (x > lens[loop]) or (ptrs[loop] = 0) then c:=32
                                    else c:=ord(main[ptrs[loop]+pred(x)]);
                                    for bits := 7 downto 0 do
                                        for height := 1 to CharHeight do
                                            begin
                                                count := succ(count);
                                                if width=1 then
                                                    begin
                                                        if mode=0 then codes[count] := CharDef[c,bits]
                                                        else codes[count] := MakeBits(CharDef[c,bits],16)
                                                    end;
                                                if width=2 then codes[count] := MakeBits(CharDef[c,bits],1)
                                            end
                                        end;
                                    if count <> 0 then SendToPrinter(count);
                                    write(1st,chr(13)+chr(10));
                                end;
                            end;
                            write(1st,chr(12));
                        end;
                    end;
                end;
            end;
        end;
    end;

procedure GetFacts;
begin
    clrscr;
    gotoxy(1,1);
    write('SIDEWAYS PRINTER PROGRAM - By Mark Needham (May 1986).');
    repeat
        Found := false;
        gotoxy(1,3); write('Character Set from (F)ile or IBM (R)om ? ');
        repeat read(kbd,key); key := Ucase(key) until (key='F') or (key='R');
        case key of
            'F' : begin
                    assign(CharFile,'Chardump.txt'); ($I-) reset(CharFile) ($I+);
                    if IOresult=0 then
                        begin
                            gotoxy(1,5); write('LOADING CHARACTER SET FROM FILE ');

```

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PROGRAM FILE

```

for Chars := 0 to 127 do
  for rows := 0 to 7 do readln(CharFile.CharDef(Chars,rows));
  close(CharFile); Found := true
end else write($7)
end;
'A' : begin
  gotoxy(1,5); write('LOADING FROM ROM '); Found := true;
  for Chars := 0 to 127 do
    for rows := 0 to 7 do
      CharDef(Chars,rows) := Hex($fe00:$1a6e+Chars*8+rows)
    end
  end
until Found;
repeat
  CharHeight := 1;
  gotoxy(1,7); write('Enter Height 1=Normal, 2=Double (Default = 1) ? ');
  readln(CharHeight);
until CharHeight > 0;
repeat
  LinesPerPage:=0;
  gotoxy(1,9); write('Enter Number of Lines Per Page (Default = 60) ? ');
  readln(LinesPerPage);
  if LinesPerPage = 0 then LinesPerPage := 60
until (LinesPerPage > 0) and (LinesPerPage < 133);
repeat
  mode := 0;
  gotoxy(1,11); write('Enter Width 0=Normal, 1=Double (Default = 0) ? ');
  readln(mode);
until (mode = 0) or (mode = 1);
repeat
  gotoxy(1,13); write('Enter Name of File to Print ? '); readln(Fname);
  assign(PrintFile,Fname); ($I-) reset(PrintFile) ($I+);
  Found := (IOResult = 0); if not found then write($7)
until Found;
close(PrintFile);
gotoxy(1,15); write('Printing : ',Fname,' at x',CharHeight,' Height. ');
write('and ',LinesPerPage,' Lines Per Page. ');
gotoxy(1,17); write('Press ENTER to Confirm or "C" to Change ? ');
repeat read(kbd,key); key := Ucase(key) until (key = $13) or (key = 'C');
writeln
end;

begin
  repeat GetFacts until key = $13;
  gotoxy(1,19); write('PRINTING FILE - PLEASE WAIT ');
  assign(PrintFile,Fname); reset(PrintFile); seek(PrintFile,0);
  write(1st,chr(27)+'1');
  max := 0; for p := 1 to 132 do begin ptrs[p] := 0; lens[p] := 0 end;
  ptrs[1] := 1; loop := 1; line := 1; m := 0;
  repeat
    read(PrintFile.PrintRec);
    if printrec.b = chr(13) then
      begin
        read(printFile.printrec); { skip line feed character }
        lens[line] := m;
        if m > max then max := m;
        m := 0; line := succ(line); ptrs[line] := loop; {remember start of line}
        if pred(line) = LinesPerPage then
          begin
            DoPrint(Max);
            for p := 1 to 132 do begin ptrs[p] := 0; lens[p] := 0 end;
            ptrs[1] := 1; loop := 1; line := 1; max := 0;
          end
        end
      else begin main[loop]:=printrec.b; m:=succ(m); loop:=succ(loop) end
    until eof(PrintFile);
    if m <> 0 then begin lens[line] := m; if m > max then max := m end;
    close(PrintFile);
    if line <> 1 then DoPrint(Max);
    write(1st,chr(27)+'@'+chr(13)+chr(10))
  end.

```



Amstrad Club Record Controller

by Gavin Moffitt

This program is an icon-driven membership database suitable for small clubs with up to 250 members. It allows files to be stored and recalled from tape or disk, and produces membership lists and mailing labels to be produced on a printer.

When the main program has been typed in, it must be saved before it's run in case a mistake has been made with the machine code data. When this has been done, reload the program to test it.

You are presented with four onscreen windows, four icons and a pointer. The icons represent different options. To select one, use the cursor-up and down keys and the copy key to select (a joystick can also be used to do this). Icon one is the tape module which allows you to load and save data; these choices

are made from a pull-down menu. Select an option by pressing the appropriate number. Icon two is the monitor module which allows you, in a similar manner, to look at individual membership records or the full list. Icon three is the printer module. This allows you to send a reminder to members (held in lines 2220 to 2230 and easy to alter) or produce a list of members. Icon four is the keyboard module which allows you to edit a new file or update an old one by deleting or inserting records.

The program can be re-run while still in memory by pressing ''.

The program can be altered to deal with more records by changing 250 to 500 everywhere in the listing. If you do not have an Epson printer, you will have to alter the printer control codes in lines 2160 to 2230.

PROGRAM FILE

Other improvements to the program should be easy to add.

If you own a CPC6128, you don't need the machine code routine for screen-swapping. To alter your version of the program, omit lines 2420 to 2470, replace all the CALL 25000,2

commands with :SCREENSWAP and CALL 25000,1 with :SCREENSWAP. Also change line 80 to 80 MODE 1.

To use the program with a disk rather than tape, add the line 895 :DISC.

```

10 REM *****
20 REM Club Record Controller
30 REM Version 3.0
40 REM Version 3.0 Started December 1985
50 REM (c) 1986
60 REM *****
70 ON ERROR GOTO 2490
80 MODE 1:GOSUB 2430
90 REM Tape
100 SYMBOL 169,255,128,128,143,144,163,163,144
110 SYMBOL 170,255,0,0,255,0,0,0,0
120 SYMBOL 171,255,1,1,225,17,201,201,17
130 SYMBOL 172,135,128,128,143,136,147,144,255
140 SYMBOL 173,255,0,0,255,0,0,0,255
150 SYMBOL 174,225,1,1,241,17,201,9,255
160 REM Monitor
170 SYMBOL 175,255,128,159,160,160,160,160
180 SYMBOL 176,255,0,255,0,0,0,0,0
190 SYMBOL 177,255,1,193,45,45,33,33,33
200 SYMBOL 178,160,160,160,160,160,159,128,255
210 SYMBOL 179,0,0,0,0,0,255,0,255
220 SYMBOL 180,45,33,45,33,45,193,1,255
230 REM Printer
240 SYMBOL 181,255,128,150,128,146,128,150,128
250 SYMBOL 182,255,0,178,0,0,233,0,0
260 SYMBOL 183,255,1,57,1,193,1,25,1
270 SYMBOL 184,255,128,128,128,128,128,128,255
280 SYMBOL 185,255,0,0,0,0,0,0,255
290 SYMBOL 186,255,1,13,13,1,1,1,255
300 REM Computer
310 SYMBOL 187,255,128,190,128,255,128,128,149
320 SYMBOL 188,255,0,124,0,255,0,0,85
330 SYMBOL 189,255,1,13,1,255,1,1,85
340 SYMBOL 190,128,170,128,149,128,175,128,255
350 SYMBOL 191,0,170,0,85,0,254,0,255
360 SYMBOL 192,1,169,1,85,1,169,1,255
370 REM Hand
380 SYMBOL 193,5,10,10,26,42,42,42,42
390 SYMBOL 194,0,64,160,160,160,160,160,160
400 SYMBOL 195,42,32,32,32,32,33,16,16
410 SYMBOL 196,162,37,41,50,132,8,16,16
420 SYMBOL 197,8,8,8,16,58,39,32,32
430 SYMBOL 198,16,24,8,8,28,228,4,4
440 REM Pointer
450 SYMBOL 199,0,64,96,112,120,124,126,112
460 SYMBOL 200,24,12,6,3,0,0,0,0
470 INK 0,13:BORDER 13:INK 1,13:INK 2,13:INK 3,13
480 PEN 3:FOR a=1 TO 24:LOCATE 1,4:PRINT STRING$(40,207):NEXT
490 WINDOW#1,2,39,2,4:PAPER#1,3:PEN#1,1:CLS#1
500 WINDOW#1,3,38,3,3:PAPER#1,3:PEN#1,1:CLS#1
510 WINDOW#2,2,32,6,19:PAPER#2,3:PEN#2,1:CLS#2
520 WINDOW#2,3,31,7,18:PAPER#2,3:PEN#2,1:CLS#2
530 WINDOW#3,2,19,21,23:PAPER#3,3:PEN#3,1:CLS#3
540 WINDOW#3,3,18,22,22:PAPER#3,3:PEN#3,1:CLS#3
550 WINDOW#4,22,39,21,23:PAPER#4,3:PEN#4,1:CLS#4
560 WINDOW#4,23,38,22,22:PAPER#4,3:PEN#4,1:CLS#4
570 PLOT 0,16,1:DRAW# 639,0:DRAW# 0,383:DRAW# -639,0:DRAW# 0,-383
580 PLOT 16,32,1:DRAW# 288,0:DRAW# 0,48:DRAW# -288,0:DRAW# 0,-48:PLOT 18,31:DR
R 288,0:DRAW# 0,47
590 PLOT 336,32,1:DRAW# 288,0:DRAW# 0,48:DRAW# -288,0:DRAW# 0,-48:PLOT 338,31:DR
AW# 288,0:DRAW# 0,47
600 PLOT 16,96,1:DRAW# 496,0:DRAW# 0,224:DRAW# -496,0:DRAW# 0,-224:PLOT 18,95:DR
AW# 496,0:DRAW# 0,223
610 PLOT 16,336,1:DRAW# 607,0:DRAW# 0,48:DRAW# -607,0:DRAW# 0,-48:PLOT 18,335:DR
AW# 607,0:DRAW# 0,47
620 PAPER 3:PEN 1:LOCATE#4,2,1:PRINT#4,CHR$(164)+1985 GDM Soft
630 LOCATE 35,8:PRINT CHR$(169)CHR$(170)CHR$(171)CHR$(172)
640 LOCATE 35,9:PRINT CHR$(172)CHR$(173)CHR$(174)CHR$(175)
650 LOCATE 35,11:PRINT CHR$(175)CHR$(176)CHR$(177)CHR$(178)CHR$(179)
660 LOCATE 35,12:PRINT CHR$(178)CHR$(179)CHR$(180)CHR$(181)CHR$(182)
670 LOCATE 36,14:PRINT CHR$(181)CHR$(183)CHR$(184)CHR$(185)CHR$(186)
680 LOCATE 36,15:PRINT CHR$(184)CHR$(185)CHR$(186)CHR$(187)CHR$(188)
690 LOCATE 36,17:PRINT CHR$(187)CHR$(188)CHR$(189)CHR$(190)CHR$(191)
700 LOCATE 36,18:PRINT CHR$(190)CHR$(191)CHR$(192)CHR$(193)CHR$(194)
710 LOCATE#1,2,1:PRINT#1,"Club Record Controller Vers 3.16b"
720 INK 0,13:BORDER 13:INK 1,0:INK 2,13:INK 3,26:PAPER 0:PEN 1
730 REM Main menu choice
740 REM when a symbol is chosen,offer all options!
750 x=39:y=9
760 PRINT CHR$(122)+CHR$(1):LOCATE x,y:PRINT CHR$(199):LOCATE x,y+1:PRINT CHR$(20
0):PRINT CHR$(22)+CHR$(10)
770 KEY DEF 2,1,198:KEY DEF 0,1,196:KEY DEF 9,1,13:KEY DEF 72,1,196:KEY DEF 73,1
,198:KEY DEF 76,1,13
780 a=INKEY$:IF a=CHR$(198) THEN LOCATE x,y:PAPER 2:PEN 3:PRINT CHR$(1207):LOCA
TE x,y+1:PRINT CHR$(207):y=y+3:IF y>18 THEN y=9
790 IF a=CHR$(196) THEN LOCATE x,y:PAPER 2:PEN 3:PRINT CHR$(1207):LOCATE x,y+1:P
RINT CHR$(207):y=y+3:IF y<9 THEN y=18
800 b=INKEY$:IF b=CHR$(13) THEN B10 ELSE PEN 1:PAPER 0:GOTO 760
810 KEY DEF 76,0,13:KEY DEF 9,0,13
820 IF y=9 THEN ch=1
830 IF y=12 THEN ch=2
840 IF y=15 THEN ch=3
850 IF y=18 THEN ch=4
860 ON ch GOSUB 890,1080,2100,1390
870 LOCATE#1,2,1:PRINT#1,"Club Record Controller vers 3.16b"
880 GOTO 760
890 REM Option 1:save/load data
900 GOSUB 2350:LOCATE#5,2,2:PRINT#5,"Save Data":LOCATE#5,2,5:PRINT#5,"Load data"
:LOCATE#5,2,8:PRINT#5,"Abort"
910 ch=INKEY$:IF ch="" THEN 910
920 IF VAL(ch)<1 OR VAL(ch)>3 THEN 910
930 IF ch="1" THEN LOCATE#5,2,1:PRINT#5,"-----":LOCATE#5,2,2:PRINT#5,CHR$(2
4)+Save Data+CHR$(24):FOR b=1 TO 1000:NEXT:GOTO 960
940 IF ch="2" THEN LOCATE#5,2,4:PRINT#5,"-----":LOCATE#5,2,5:PRINT#5,CHR$(2
4)+Load Data+CHR$(24):FOR c=1 TO 1000:NEXT:GOTO 1020
950 IF ch="3" THEN LOCATE#5,2,7:PRINT#5,"-----":LOCATE#5,2,8:PRINT#5,CHR$(24)+
Abort+CHR$(24):FOR d=1 TO 1500:NEXT:CALL 25000,1:RETURN
960 REM Save data
970 CALL 25000,1
980 CLS#1:LOCATE#1,6,1:INPUT#1,"Enter the filename: ",f$:IF LEN(f$)>5 OR f$="" TH
EN 980
990 SPEED WRITE 1:CLS#1:LOCATE#1,8,1:PRINT#1,"Press REC and PLAY now."
1000 CLS#3:LOCATE#3,2,1:PRINT#3,"Filename: ",f$:OPENOUT "1"+f$:WRITE#9,m$:FOR p=
1 TO n:WRITE#9,n(p),a(p),b(p),c(p),d(p),e(p),f(p),g(p):NEXT:CLOSEOUT

```

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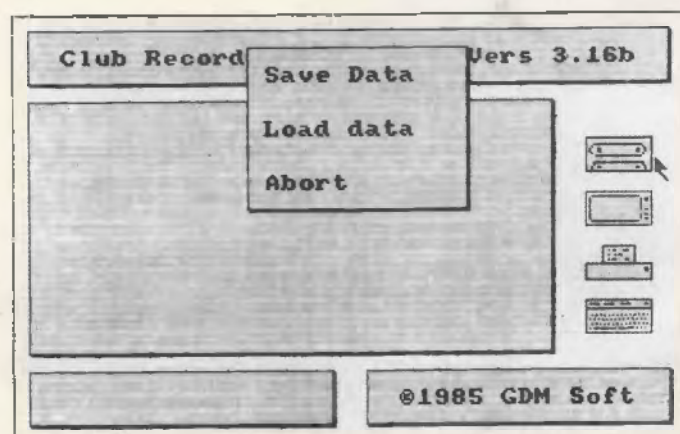
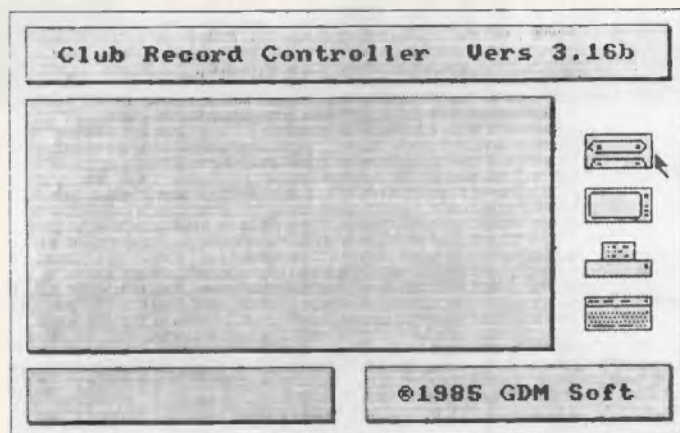
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```

1970 c$=INKEY$:IF c$="" THEN 1970
1980 IF c$="Y" OR c$="y" THEN CALL 25000,1:RETURN
1990 FOR q=1 TO 1000:NEXT:CALL 25000,1:GOSUB 2390
2000 LOCATE#5,16,2:PRINT#5,CHR$(193)CHR$(194)
2010 LOCATE#5,16,3:PRINT#5,CHR$(195)CHR$(196)
2020 LOCATE#5,16,4:PRINT#5,CHR$(197)CHR$(198)
2030 LOCATE#5,15,5:PRINT#5,"-----"
2040 LOCATE#5,15,6:PRINT#5,CHR$(24)+ "STOP"+CHR$(24)
2050 LOCATE#5,3,8:PRINT#5,"Make sure you saved the file!"
2060 IF s$="N" OR s$="n" THEN CALL 25000,1:RETURN
2070 CALL 25000,1:CLS#1:LOCATE#1,3,1:PRINT#1,"Thank you for using the program."
2080 FOR r=1 TO 3000:NEXT:CALL 18800:MODE 2:KEY 10,"RUN"+CHR$(13):END
2090 REM Print address labels/reminders
2100 GOSUB 2340:LOCATE#5,2,2:PRINT#5,"Reminder":LOCATE#5,2,5:PRINT#5,"Club list"
:LOCATE#5,2,8:PRINT#5,"Abort"
2110 c$=INKEY$:IF c$="" THEN 2110
2120 IF VAL(c$)<1 OR VAL(c$)>3 THEN 2110
2130 IF c$="1" THEN LOCATE#5,2,1:PRINT#5,"-----":LOCATE#5,2,2:PRINT#5,CHR$(24)
: "Reminder"+CHR$(24):FOR s=1 TO 1000:NEXT:GOTO 2160
2140 IF c$="2" THEN LOCATE#5,2,4:PRINT#5,"-----":LOCATE#5,2,5:PRINT#5,CHR$(24)
: "Club list"+CHR$(24):FOR t=1 TO 1000:NEXT:GOTO 2240
2150 IF c$="3" THEN LOCATE#5,2,7:PRINT#5,"-----":LOCATE#5,2,8:PRINT#5,CHR$(24)
: "Abort"+CHR$(24):FOR u=1 TO 1500:NEXT:CALL 25000,1:RETURN
2160 REM Print reminders
2170 CALL 25000,1
2180 PRINT#8,CHR$(27)+"E"+CHR$(27)+":R"+CHR$(3)
2200 FOR r=1 TO 40:IF UPPER(pas(r%40))="N" THEN GOSUB 2210
2205 NEXT:RETURN
2210 PRINT#8,"Dear ";n$(r%40)CHR$(10)CHR$(13)"We note that you membership is unpaid
d. Due to a large number of new members, we"CHR$(13)"are having to delete current
t unpaid ones. SO PLEASE PAY BEFORE YOU LOOSE OUT."
2220 PRINT#8,"Remember, there is a $5 joining fee as well as $5 subscription!"
CHR$(13)CHR$(10)CHR$(10)CHR$(10);
2230 RETURN
2240 REM Name and address
2250 CALL 25000,1
2260 PRINT#8,CHR$(27)+"E"
2270 FOR n=1 TO 40
2280 PRINT#8,n$(n%40)+":",CHR$(13);
2290 PRINT#8,a$(n%40)+":",CHR$(13);
2300 PRINT#8,t$(n%40)+":",CHR$(13);
2310 PRINT#8,pas(n%40)+":",CHR$(13);
2320 PRINT#8,CHR$(10);"Member No: ";n%40:CHR$(13);CHR$(13);CHR$(13);
2330 NEXT:RETURN
2340 REM Pull Down Menu Routine
2350 CALL 25000,2:WINDOW#5,15,27,3,11:PAPER#5,3:PEN#5,1:CLS#5
2360 PLOT 224,224,1:DRAW# 208,0:DRAW# 0,144:DRAW# -208,0:DRAW# 0,-144:PLOT 226,2
23:DRAW# 208,0:DRAW# 0,144
2370 RETURN
2380 REM Pull Down Menu Routine#2
2390 CALL 25000,2:WINDOW#5,5,36,7,17:PAPER#5,3:PEN#5,1:CLS#5
2400 PLOT 64,128,1:DRAW# 512,0:DRAW# 0,176:DRAW# -512,0:DRAW# 0,-176:PLOT 66,127
:DRAW# 512,0:DRAW# 0,176
2410 RETURN
2420 REM Screen Snap Routine
2430 IF PEEK(25000)+254 THEN RETURN ELSE 2440
2440 SYMBOL AFTER 168:MEMORY 24999
2450 FOR v=25000 TO 25033:READ d$:POKE v,VAL("%"+d$):NEXT
2460 RETURN
2470 DATA FE,01,C0,DD,7E,00,FE,02,2B,0C,11,00,E0,21,90,65,01,00,40,E0,B0,C9,11,9
0,65,21,00,C0,01,00,40,E0,B0,C9
2480 REM Error Report
2490 MODE 2:INK 1,0:PEN 1:PRINT"Error number":ERR:"In line":ERL
2500 CALL 18800:END

```



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Kevin O'Connell reports.*

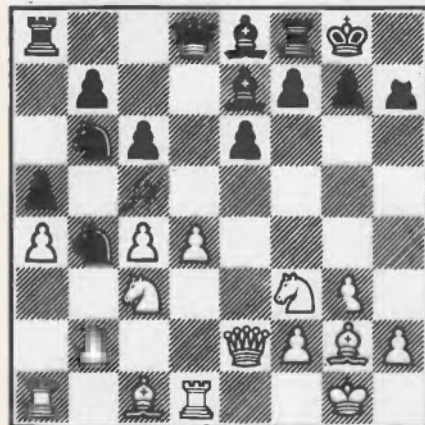
At the end of last year I featured a game from a simultaneous display given by the Dutch Grandmaster Genna Sosonko against 31 computers. He had a hard time against the machines and lost five games.

As a reminder that it is not always plain sailing for the computers, and as an indication of how far we have yet to go before we might see an electronic world chess champion, I am now going to show you a game from a simultaneous display against 32 computers given by Garry Kasparov not long before he became World Champion. Kasparov had some difficulties, but in the end the score line was 32-0.

Although no computer is yet even near to being a match for Kasparov, they are making very steady progress and a chart of significant computer results against human opposition suggests that at least one computer should register at least one tournament result in the Kasparov class before the end of the millennium.

White: Kasparov. Black: Turbostar 432. Opening: Reti Opening.

- | | | |
|----|--------|--------|
| 1 | c2-c4 | e7-e6 |
| 2 | g2-g3 | Ng8-f6 |
| 3 | Bf1-g2 | d7-d5 |
| 4 | Ng1-f3 | d5xc4 |
| 5 | O-O | c7-c6 |
| 6 | a2-a4 | Bf8-e7 |
| 7 | Qd1-c2 | Nb8-d7 |
| 8 | Qc2xc4 | Nd7-b6 |
| 9 | Qc4-c2 | Nf6-d5 |
| 10 | Nb1-c3 | Nd5-b4 |



15 Rf1-d1 f7f6

11 Qc2-d1 O-O
White does not seem to have been doing anything very much, but, in fact, he has full control of the centre, which he now occupies.

- | | | |
|----|--------|--------|
| 12 | d2-d4 | a7-a5 |
| 13 | e2-e4 | Bc8-d7 |
| 14 | Qd1-e2 | Bd7-e8 |
| 15 | Rf1-d1 | |

15 f7-f6
Rather weakening, but otherwise Black can barely move anything.

- | | | |
|----|--------|--------|
| 16 | Bc1-e3 | Be8-h5 |
| 17 | h2-h3 | f6-f5 |

To prevent g3-g4.

- | | | |
|----|--------|--------|
| 18 | Be3-f4 | Qd8-d7 |
| 19 | Rd1-e1 | Bh5xf3 |
| 20 | Bg2xf3 | Be7-d6 |

After 20 ... QD7xd4, 21 e4xf5 gets White's pawn back and gives tremendous pressure — practically all his pieces suddenly occupying dominating positions on open lines.

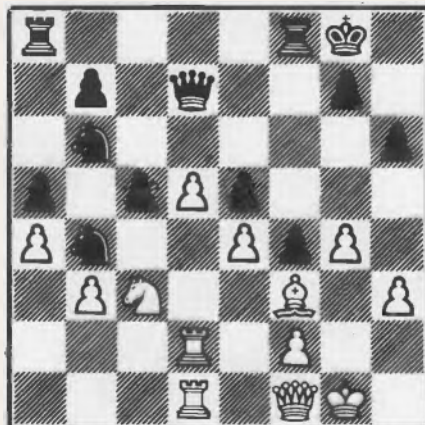
- | | | |
|----|--------|--------|
| 21 | Bf4xd6 | Qd7xd6 |
| 22 | Ra1-d1 | f5-f4 |
| 23 | g3-g4 | |

This leaves White's bishop very little scope, but then, as compensation, computers usually play blocked positions very badly.

- | | | |
|----|--------|--------|
| 23 | ... | Ra8-d8 |
| 24 | Rd1-d2 | e6-e5 |
| 25 | d4-d5 | |

Yet another white pawn goes onto a white square, almost entombing the bishop.

- | | | |
|----|--------|--------|
| 25 | ... | h7-h6 |
| 26 | Re1-d1 | c6-c5 |
| 27 | Qe2-b5 | Rd8-a8 |



29 b2b3 c5-c4!

- | | | |
|----|--------|--------|
| 28 | Qb5-f1 | Qd6-d7 |
| 29 | b2-b3 | |
| 29 | ... | c5-c4! |

An excellent break.

- | | | |
|----|--------|--------|
| 30 | b3xc4 | Ra8-c8 |
| 31 | g4-g5 | Nb6xc4 |
| 32 | Rd2-a2 | |

Rd2-e2 maintains the material equilibrium, but leaves White with a horrible position to defend. Kasparov much prefers to attack, which he does here most ingeniously.

- | | | |
|----|--------|--------|
| 32 | ... | Nb4xa2 |
| 33 | Nc3xa2 | Qd7xa4 |
| 34 | g5xh6 | Qa4xa2 |

At the cost of a rook Kasparov has pulled the black queen offside and has generated some attack against the black king.

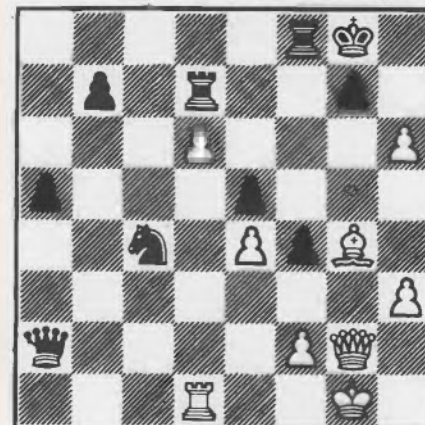
- | | | |
|----|--------|--------|
| 35 | Qf1-g2 | Rc8-c7 |
| 36 | d5-d6 | Rc7-d7 |
| 37 | Bf3-g4 | |

37 Qa2-b3?
Following the standard precept 'when ahead exchange pieces', but this is a mistake. It would have been much better to offer to give back some of the material, playing 37 ... Qa2-a4, to get the queen back into the game.

- | | | |
|----|--------|---------|
| 38 | Bg4xd7 | Qb3xd1+ |
| 39 | Kg1-h2 | Rf8-f7 |
| 40 | Bd7-e6 | Kg8-f8 |
| 41 | h6-h7 | |

Now it is all over.

- | | | |
|----|----------|----------------------|
| 41 | ... | Nc4xd6 |
| 42 | h7-h8=Q+ | Kf8-e7 |
| 43 | Be6xf7 | Nd6xf7 |
| 44 | Qh8xg7 | 1-0 (Black resigned) |



37 Bf3-g4 Qa2-b3?

NUMBERS COUNT

How long is a farey tale? This month Mike Mudge examines the construction and use of Farey Sequences.

Definition The Farey sequence, F_n , of order n is the ascending sequence of irreducible fractions between 0 and 1 whose denominators do not exceed n ; the numbers 0 and 1 are included in the forms $0/1$ and $1/1$. For example, F_5 is: $0/1, 1/5, 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 1/1$.

Notes:

(i) The fraction $1/2$ is the middle term of every Farey Sequence.

(ii) Two terms equidistant from the middle have a sum of unity. This property can be readily used to economise on the presentation of F_n , thus we write F_5 :

0 1 1 1 2 1
1 5 4 3 5 2
1 4 3 2 3 1

(iii) Clearly if m is any number smaller than n , the sequence F_m consists simply of those terms of F_n whose denominators are not larger than m , in unchanged order.

(iv) The sequence F_n exhibits, incidentally, for every value of m not larger than n , the sequence of numbers prime to m and not larger than n . The numbers prime to m and smaller than m are in ascending order the numerators which have m for denominator, while the numbers prime to m and larger than m are in descending order the denominators which have m for numerator.

Theorem The total number of terms in F_n is $\text{PHI}(n) + 1$ where $\text{PHI}(n)$ is the sum-function of Euler's Totient Function $\phi(n)$. For definitions of these functions see 'Numbers Count' May 1985.

Historical Notes Farey sequences are implicit in Henry Goodwyn's *A Tabular Series of Decimal Quotients* (London, 1823) and an earlier volume by the same author (1818); also in tables published by Achille Brocot in Paris in 1862; these are of order 100.

This value was not passed until 1935 when E Buckingham's *Manual of Gear Design* included an unreliable and incomplete table of F_{120} . This was corrected in RM Page's *14000 Gear Ratios* (1942); however, the 'ultimate' table of F_{1025} was designed and compiled by EH Neville and published for The Royal Society by The University of Cambridge Press in 1950. Here the 319765 terms are elegantly presented 400 to a page, 20 to a line.

Problem A Write a computer program to generate and display in a meaningful manner F_n for a given n . Warning: do not attempt to repro-

duce Neville's table in full, although computation time would be an interesting parameter.

Problem B Devise and implement an efficient routine for locating a given term in F_n .

Note: Except for small values of n , the fractions $1/b, 2/b, 3/b, \dots (b-1)/b$ divide F_n into subsequences, almost all of which contain approximately the same number of terms.

Would your routine be suitable for 'manual' implementation given printed tables?

Problem C Devise and implement a routine for inserting between two terms of a given Farey Sequence a batch of terms belonging to a Farey Sequence of a higher order.

Investigate the use of such a routine to generate rational approximations to say 'pi' or 'e'.

Problem D Observing that the application of Farey Sequences to the solution of the linear Diophantine Equation $Bx - ay = 1$ depends upon the result that if a/b and c/d are consecutive terms in F_n , then $bc - ad = 1$, and conversely that if $bc - ad = 1$, then a/b and c/d are consecutive in F_n for all values of n from $\max(b, d)$ to $b+d-1$, investigate the use of 'in-store' Farey Sequences to solve such equations.

Readers are invited to submit their attempts at some (or all) of the above problems to Mike Mudge, 'Square Acre', Stourbridge Road, Penn, Nr Wolverhampton, Staffordshire WV4 5NF. Tel: (0902) 892141.

It would be appreciated if such submissions could contain a brief summary of results obtained and thoughts relating to the problem in a form suitable for future publication in PCW. Submissions, which must reach me by 1 November 1986, will be judged using suitably vague criteria, and a prize will be awarded to the 'best' contribution received by the closing date.

Please note that submissions can only be returned if a suitable stamped addressed envelope is provided. Expanded reviews of previous problems, together with, subject to the approval of the contributor, copies of detailed programs from the winning entry may also be requested. However, in the interests of efficiency, interested readers are encouraged to contact the prize-winner directly. Mike Mudge welcomes cor-

respondence on any subject within the areas of number theory and other computationally related mathematics, particularly containing suggested subject areas for future Numbers Count Articles, and will endeavour to reply to all letters.

February review

Those readers who were frightened off by the mathematics of primitive roots and indices are referred to *Elementary Number Theory* by Allan M Kirch, Intext Educational Publishers 1974, where some simple Basic Programs are given to find, for example, the smallest primitive root of a given odd prime, and then to generate a table of indices and anti-indices.

Tables suitable for checking the correctness of routines are to be found in *An Introduction to the Theory of Numbers* by IM Vinogradov, Pergamon 1955; the theory of primitive roots is developed historically in LE Dickson's *History of the Theory of Numbers* volume 1, Chelsea, New York 1952, while some difficult mathematical examples are to be found in *Exercises in Number Theory* by DP Parent, Springer-Verlag 1984.

Responses to this problem included several very detailed and extremely well-presented pieces of work, but after careful consideration the prize-winner is Dr John HE Cohn of 23 Highfield Gardens, London NW11 9HD.

John chose to write in Basic on his PET in preference to his Amstrad 8256 which he believes has certain bugs associated with its Basic.

Following the input of N , checked to be a positive integer less than 10000 and of the required form, the program then offers the following choices:

- (1) to find all primitive roots;
- (2) to find the least primitive root only;
- (3) to find a table of indices wrt the least primitive root; and
- (4) to find a table of indices wrt any supplied primitive root.

John's routines should run on almost any machine given adequate memory; about 23k is needed in the worst case, the conscious decision being taken to save execution time by using memory to avoid long sorting routines; hence the restriction N less than 10000.

Brain teasers courtesy of JJ Clessa.

A continuous section of railway track is one mile long and fixed at both ends. It breaks in the middle and each half expands by one inch only. Assuming the middle goes up as it expands (like Tower Bridge), how far off the ground will the mid point be. After you've made a guess — check your answer using a calculator.

Prize puzzle

Following one of his earlier victories, Napoleon arranged his soldiers to stand in a straight line in order of increasing seniority.

He walked down the line and gave each man a medal. He then returned to the start, located the second man with a medal and gave him, and every third man thereafter, another medal.

He returned to the start again, located the second man with two med-

als, and gave him, and every third man who also had two medals, another medal. He returned to the start again, located the second man with three medals, and gave him and every third man who also had three medals, another medal. And so on.

His most senior officer was the only one to get 10 medals. How many men had he?

Answers on postcards, please, or backs of envelopes, to reach us not later than 31 August 1986. Send your entries to Leisure Lines, August Prize Puzzle, PCW, 32-34 Broadwick Street, London W1A 2HG.

May prize puzzle

This was a fairly tough problem — although with a bit of work and patience, it was solvable on most PCs. However, only 46 entrants submitted solutions and rather than return to

the controversy of whether 1 is a prime or not, we accepted either of the solutions:

1	7
41	67
241	467
2417	2467
62417	24671
862417	824671
9862417	9824671
98624173	98246713

Obviously all nine digits could not be used, since any number containing all nine digits would divide by nine.

The winning entry came from Mr P Pike of Uphaven, Wiltshire. Congratulations Mr Pike, your prize is on its way.

ACC NEWS

Don't be browbeaten into submission by computer jargon. Join the ACC and fight back.

Are you bewildered by the many micros on the market, and the technical jargon the salesmen insist on using? If you are, then you have good company, because everybody has to start somewhere, and a good place to start is your local computer club. Here you will probably meet people who have used a micro that you might be considering buying, and who will be able to give you impartial advice. Or you might meet someone who has mastered some particularly taxing adventure game. At other club meetings you might hear a talk from a leading expert in home computing, perhaps demonstrating some aspect of computer communications, or some new piece of hardware or software.

Where to start

How do you find your local computer club? A good place to look is your local library, or the events column in your local paper. Or you can look to the ACC. The Association of Computer Clubs is a body run by and for the UK's computer clubs, to help each other with publicity, insurance and contacts for speaking at club meetings. Many people find out about clubs through this column, while others use the ACC's service to put people in touch with their local clubs

— a service which has become a little erratic, as we seem to get ourselves in a frightful tangle every time we try to move the system from one machine to another. Anyway, it's heading in the direction of a Sperry IBM think-alike, which ought to resolve compatibility problems for good. We are of course very grateful to Sperry for the loan of this equipment (and several other machines which are being used by clubs around the country to run bulletin boards).

Our objective is to provide information, but we can only tell people about clubs we know about. So, please write to me, Rupert Steele, with details of your club. At the same time, I'll also send you club details of the ACC, and of how the group can benefit from our free insurance.

Club news

The big news in the club scene this month is the Amstrad PCW8256. Now that this machine has taken the market by storm, people are trying to extend its capabilities beyond its mainstream word processing function. Computer clubs and specialist user groups are springing up everywhere; two national user groups for the Amstrad PCW have written to me recently to announce their formation.

Robert Mobberley of 37 Clifford Bridge Road, Binley, Coventry CV3 2DW runs the PCW Users Group. This caters for users of the Amstrad PCW8256 and PCW8512 machines, and has been set up to help communications between users. A monthly newsletter is available which, along with the usual news and views, contains information on software, firmware (including the operating system and GSX graphics code) and hardware items such as interfacing and attaching additional disk drives. For more information, send an sae or call Robert on (0203) 441417.

For those of you who like to read something different with each eye, why not try The PCW Computer Club? Run by Ron Morland of 12 Deneve Avenue, Poole, Dorset BH17 7LR, the group has been formed for those wishing to get to grips with the PCW's powerful facilities. The group should have published its first newsletter by now; expected contents include details of discounts available for club members, a 'for sale/wanted' page and Locoscript. Enquiries: send an sae to Ron at the above address.

Despite the surge of interest in the Amstrad PCW, there is plenty of club life for the other Amstrad machines. The two main groups (or at least the



ones that always write to me) are AP.Ex and Group Advantage. AP.Ex is run by Nick Godwin of 4 Hurkur Crescent, Eyemouth, Berwickshire, Scotland TD14 5AP. The group is a collection of Amstrad users from around the world who are able to share expertise and work co-operatively on projects. A set of newsletters and an introductory cassette will set you back £5. For full details call Nick on Eyemouth 50965 or send an sae.

Or you could try Advantage. Run by Jeffrey M Green, the group aims to be an unprejudiced, inexpensive user group for the exchange of information and ideas. For £8.75 pa you get monthly newsletters, access to the club database as well as a chance to get hold of discount hardware and software. The club aims to produce reviews and to establish a lending library of software for the Amstrad CPC464. The database looks like a really effective way of getting hold of published programs for the computer. Details from 33 Malyns Close, Chinnor, Oxfordshire OX9 4EW.

Ahoy there! Mr CE Watson of 29 Doods Place, Doods Road, Reigate, Surrey RH2 0NS has written to me

saying that he is starting a computer club for seafarers, their families and anyone connected with the sea. The aim is to offer assistance to people taking computers away to sea, whether to help with their work or as a hobby. I'm not sure how the club will communicate with members afloat — perhaps they will be using amateur radio, possibly via Morse/ASCII translation programs. A monthly newsletter is planned, so why not sail down to the Post Office and throw Mr Watson a line?

Barry Ledbury has written in about the resurrection of his club. It is now called the Mid-monthly Computer Group and meets on the second Saturday of the month, catering for all computers. For more details write to Barry at 8 Linnet Close, Heron Estate, Gloucester GL4 9XA or call him on (0452) 23186.

John Schofield has now taken over as chairman of the Blackburn Computer Club. This group meets on Tuesdays at 7pm in the Mill Hill Community Centre, New Chapel Street, Mill Hill, Blackburn, and is presently compiling a calendar of events, demonstrations and field trips. For more information, contact John at 1 Sutton Street, Feniscowles,

Blackburn, Lancs BB2 5ES, or call him on Blackburn (0254) 28127.

Another recently metamorphosed group is the West Herts Micro Users Association (originally the West Herts 80 Users Association). Formed back in 1980, when the TRS-80 and Video Genie were popular, this group has expanded its interests steadily to include Commodore, BBC and Amstrad micros. With the later addition to the club's repertoire, it became appropriate to change the group's name. The group now meets fortnightly at St Stephens Parish Centre, Station Road, Bricket Wood, Herts from 7.30 to 10.30pm. For more details, contact the secretary, Brian Larkin, at 82 Church Street, Leighton Buzzard, Beds LU7 7BT, or call him on (0525) 373813.

For a mention in this column, to tell the ACC about your club, or to obtain address labels for mailing to UK computer clubs, contact: Robert Steele, 12 Philbeach Gardens, London SW5 9DY.

For any other enquiry, contact: Mike Mudge, 'Square Acre', Stourbridge Road, Penn, Wolverhampton, WV4 5NF, or call (0902) 892141.

DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making arrangements, in order to avoid wasted journeys due to cancellations, printers' errors, and so on.

London	Olympia; PC User Show & Conference. Contact: EMAP International Exhibitions (01) 608 1161	16-18 July
London	Barbican Centre; Acorn Computer User Christmas Show. Contact Edition Scheme (01) 349 4667	24-27 July

WRITING FOR PCW

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We're offering readers the chance to get rich (well, at least richer) and to influence what's published in the magazine — by writing for it. We welcome approaches from would-be writers, including those who have never appeared in print before. It's often users with practical experience who have the most interesting things to say, so don't worry if your prose is less than perfect, we can take care of the polishing.

If you have an idea for a feature write, with a brief synopsis, outlining the proposed structure and content. If your article is already written, then send it in

for consideration. Remember to put your name and address on both the covering letter and the manuscript — along with a daytime phone number if possible. Manuscripts should be typed or printed out (dot matrix output is fine), in double-line spacing, with margins top and bottom and on each side.

We'll try to return all submissions sent in with a suitable sae, but make sure you keep a copy of everything you submit as well for reference.

Any accompanying program listings should be supplied on disk or cassette, ideally with a printout as well.

Bear in mind that it's worth taking a

look at the Back Issues advertisement to see what sort of things we have already published — after all there's no point in reinventing the wheel. And please be sure to tell us if you've contacted another magazine (perish the thought): it would be very awkward if the same article appeared elsewhere. Frankly, we're more likely to accept something which has been offered exclusively to us.

Finally, we do pay for published work — the rate is £65 per 1000 words, and payment usually follows about four-six weeks after publication.

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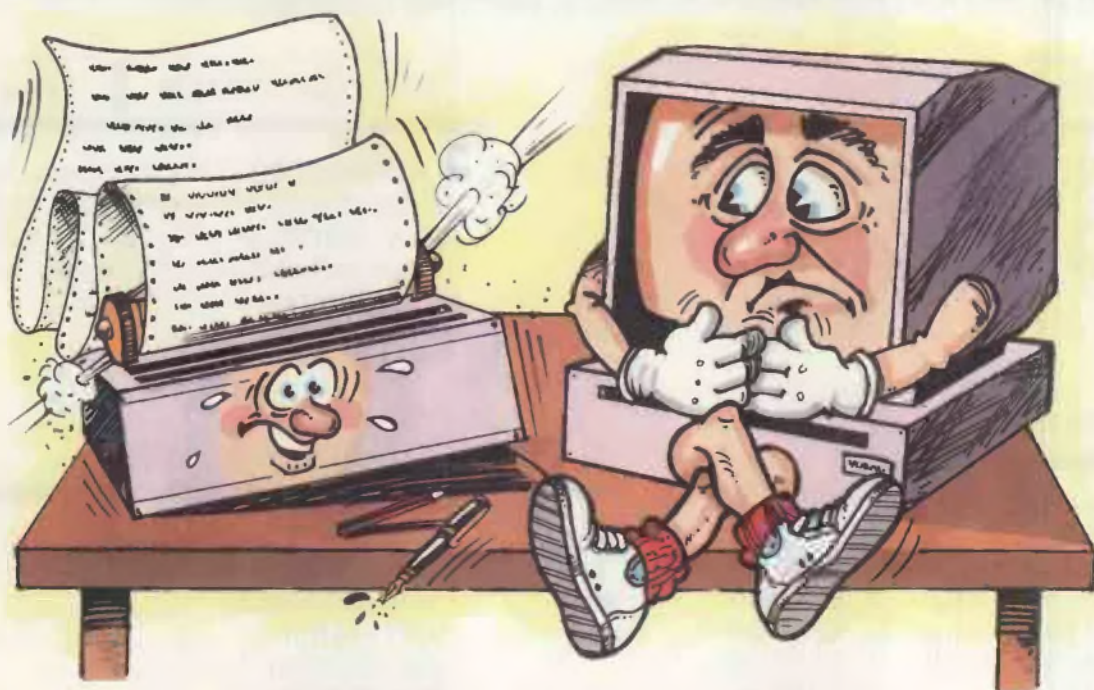
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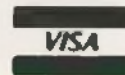
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ATARI ST

Power Without The Price!

FREE SOFTWARE

When you buy one of the new Atari ST computers from Silica Shop, you will receive a large and varied software package free of charge. This package covers several applications and comprises a total of nine titles. All STs now have TOS/GEM on ROM, and the total list of free software is as follows:

- 1) GEM - DR Desktop environment with WIMP (in ROM)
- 2) TOS - Tramiel Operating System (in ROM)
- 3) 1st WORD - Word Processor by GST using the GEM environment and multiple windows
- 4) BASIC - Personal Basic by DR (with manual)
- 5) LOGO - Logo language by DR (with manual)
- 6) DOODLE - Simple paint/doodle drawing package (works on mono or colour systems)
- 7) MEGARIDS - Asteroids type game by Megamax
- 8) NEOCHROME - A powerful colour paint and graphics package (only useable with colour systems)
- 9) CP/M EMULATOR - Allows the use of DR's Z80 CP/M software to run on any ST system

3rd PARTY SUPPORT

The power and potential of the ST range of computers is causing a flood of new software titles, peripherals and accessories from third party manufacturers. Titles range from word processing to spreadsheet programs, from graphics and games to database management - all with those easy drop-down menus and windows. With the list of companies producing ST software including dozens of top names, you can expect some first class titles for the new ST range. The following includes a selection of the third party manufacturers who have developed, or are working on, products for the ST range:

ARACUS	EXTENDED S/W	MICRO-ED INC	ROBINSON SYS
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ELECTRONIC ARTS	MICRON	MIRACOR	SECS
EXIGON	MICRODEAL	MIRACOR	SECS

520ST-M

NEW 512K 520ST-M KEYBOARD: The new 520ST-M keyboard costs only £346.95 (+VAT-£399) and is yet another price breakthrough for Atari Corporation. The keyboard now includes both an RF modulator and cable, allowing you to connect it to an ordinary domestic television set. In addition, the keyboard is supplied with 512K RAM, a mouse and a free set of 3 1/2" disks containing applications software. The TOS operating system and the GEM graphics package are now supplied on 192K ROM chips which are already installed in the keyboard. This means that the operating system will automatically boot in when you switch the power on. In addition to the keyboard, you will also need to purchase either a 1/2Mbyte disk drive (RRP £130+VAT) or a 1Mbyte disk drive (RRP £174+VAT). Either disk drive will provide you with fast information retrieval and a vast amount of storage space. If you prefer not to use your own TV set, you may connect your ST to a monitor. You may purchase the Atari SM124 monochrome monitor (RRP £130+VAT), or one of Atari's two Thomson colour monitors. Alternatively, you may choose one of the many third party colour monitors which are available.

NEW 1024K 520ST-M KEYBOARD: In addition to the standard 520ST-M, we have a new keyboard which we are calling the Atari 520ST-M+. The M+ is a 520ST-M keyboard which has been enhanced by a third party RAM upgrade to 1 megabyte of memory. The 520ST-M+ is available from Silica at a retail price of only £433.91 (+VAT-£499). This product will provide you with an alternative to the 1040ST-F, but at a lower price. Additionally, it features the advantage of the 520ST-M's built in modulator.

£347

1040ST-F

For the businessman and the more serious home user, Atari has introduced the 1040ST-F, a low cost powerhouse which can be introduced to a business environment as a stand-alone system, or can support a mainframe computer as a terminal. The new one megabyte 1040ST-F enhances Atari's 'value for money' reputation in the marketplace as it is the first personal computer available with one megabyte of memory for less than £800. You can purchase the 1040ST-F as a monochrome or colour system. The price of the monochrome system is £799 (+VAT = £918.85), with the colour system at only £999 (+VAT = £1146.85). The new 1040ST-F not only features twice as much memory as the 520ST-M, but also includes a one megabyte double sided disk drive and mains transformer, both built into the console to give a compact and stylish unit with only one main lead. The 1040ST-F is also supplied with a free software package. Unlike the 520ST-M, the 1040ST-F was manufactured solely with business use in mind and as such is supplied with a monitor. It does not include the RF modulator or lead. We now have stock of the 1040ST-F at all four branches of Silica Shop. Call into your nearest branch for a demonstration.

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THE ATARI EXPLOSION!

If you read the specialist computer press, you will have noticed that there is one company which is getting a large slice of editorial space at the moment, that company is Atari Corporation. Atari have been making the news since the launch of their new 16/32 bit range of ST computers. Led by the powerful figure of Jack Tramiel and under the banner 'Power Without The Price', Atari are manufacturing new computers at unheard of prices, with the power to challenge firmly established market leaders. With the introduction of IBM compatibility, a CP/M emulator, a powerful networking system and a communications package for their new low cost powerhouses, it doesn't look as if it will be long before there is an explosion of the magnitude which will see Atari placed firmly besides such names as IBM and Olivetti in the personal computer marketplace. Read on for more details of what Atari are doing, and how they are putting their 'Power Without The Price' computers beyond the reach of the competition.

FREE CP/M EMULATOR

This newly announced CP/M Emulation Package, will enable software written under Digital Research's Z80 CP/M operating system to be run on the ST family of computers. There are several thousand applications written for CP/M in the UK alone, and several of the major CP/M software development houses may convert their programs to 3 1/2" disk format for the ST range. The CP/M emulation package is supplied FREE OF CHARGE by Silica Shop with all ST computers.

IBM COMPATIBILITY

To make the ST available to those businesses who currently run IBM systems and are looking for a low cost expansion method, Atari have announced a co-processing unit for ST computers. This processor will open the ST range to all IBM or IBM compatible software applications. The unit, which attaches to the ST computers via the DMA (Direct Memory Access) port, contains an Intel 8088 processor with 512K of RAM and will accept a 5 1/4" disk drive. In its ST mode, the unit will also act as a second disk drive, offering the user an additional 500K of memory. The IBM co-processing unit should be available in late Summer 1986. If you would like to be informed when it is released, please complete and return the coupon below. We will send you further details as soon as we have them.

20Mbyte HARD DISK

The new Atari hard disk for the ST range has just been released. All ST computers already have a hard disk interface built into them so there is no external interface required. The memory size of the disk is a massive 20 megabytes (unformatted) with a data transfer rate of 1.33 Mbytes per second. At a price of £739 (+VAT-£849), the 5 1/4" hard disk offers massive storage with fast access at a very reasonable price.

NEW ST SOFTWARE PACKAGES

There are now hundreds of software packages which have been announced for the Atari ST range. Titles available now include DB Man, a DBase 3 clone as well as H & D Base, a DBase 2 clone. In addition, PC Intercomm is a VT100 emulator which enables you to use any ST keyboard as a terminal connected to a mainframe or mini. Other programs include a Lotus 1-2-3 clone (see paragraph below).

VIP PROFESSIONAL - LOTUS 1-2-3™ CLONE

This is probably the most impressive program to have been released so far for the ST range. VIP Professional is an extremely easy to use, integrated spreadsheet, database and graphics program which is identical both in features and commands to Lotus 1-2-3™. The same spreadsheet analysis, information management and extraordinary business graphics are all combined in one easy to learn, affordable package. What's more, VIP Professional not only has all the features of 1-2-3™, you can also type the same commands to do the same things. Probably the most surprising feature of VIP Professional is not its total compatibility with Lotus 1-2-3™, nor its ease of use, but its price. Lotus 1-2-3™ for the IBM PC/AT costs £395 (+VAT-£454.25), whereas VIP Professional for the ST is a mere £169 (+VAT-£194.35). That's less than half the price! If you would like further details of VIP Professional, please return the coupon below.

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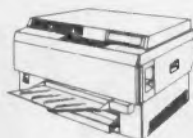
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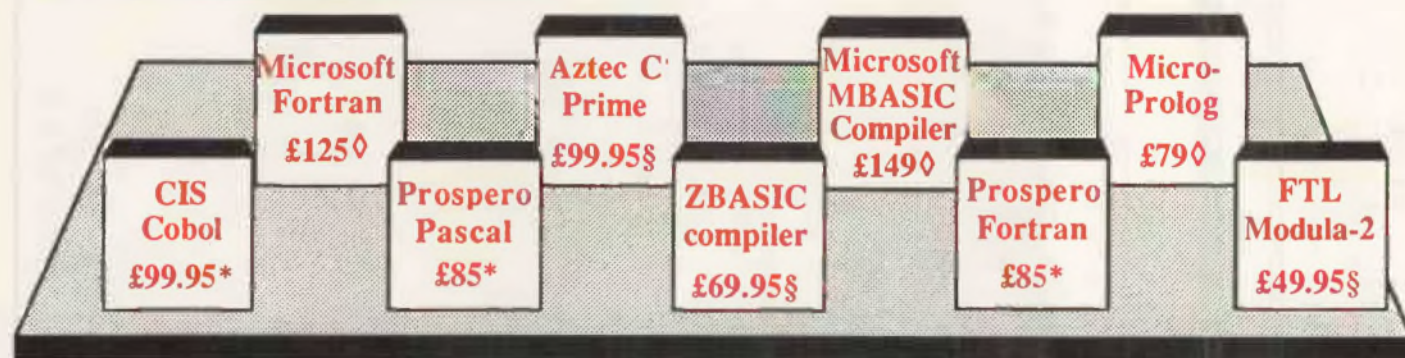
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Factsheet Focus

The following is an extract from our factsheet on BASIC compilers available on CP/M-80 computers. Firstly, the PCW benchmark timings and then some facts about each compiler in turn.

Test	ZBASIC	MBASIC	CBASIC	Mallard
1	0.8	0.4	0.2	7.1
2	1.0	0.4	0.3	30.6
3	6.9	66.0	22.0	100.0
4	6.7	25.0	20.0	96.1
5	6.8	26.8	20.1	104.9
6	9.8	28.6	21.7	170.7
7	11.6	35.0	27.7	270.9
8	100.3	72.1	374.1	35.4

Note: Benchmark 8 was done with a loop of 1000 rather than 10000. Mallard BASIC is an interpreter and its timings are shown for reference. The variables used as loop counters were declared as integer in all cases.

ZBASIC is a fully interactive compiler which allows you to type in and test your program exactly as you would with a standard BASIC interpreter. Typing *RUN* compiles and runs the code in memory and various options exist to save the compiled code to disc to be used as a stand-alone program. Overall, ZBASIC is easily the fastest compiler in our list. The syntax required and keywords present are very similar to those used in Microsoft BASIC, so converting existing programs is not very much of an effort. ZBASIC is also available for the IBM PC and the Macintosh, at the same price. The Amstrad version of the ZBASIC compiler incorporates firmware graphics routines for the CPC464, CPC664 and CPC6128 machines.

MBASIC is Microsoft's BASIC compiler and is available here on any CP/M machine for a new, lower price. MBASIC is one of the oldest BASIC systems around and its syntax is so widely recognised and imitated that it is near enough the *standard* BASIC. The package includes the entire Macro-80 assembler system, incorporating the M80 macro assembler, the L80 linker and loader and the LIB80 object module librarian.

CBASIC is Digital Research's popular 'Commercial BASIC' compiler and comes complete with GSX graphics. Good value.

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BASIC LANGUAGE

ZBASIC is new to us and performs well at a very good price. We have some new libraries and utilities also.

BASIC INTERPRETERS

BetterBASIC	PC-DOS	£195
Professional BASIC	PC-DOS	£ 99
Microsoft MS-BASIC	MS-DOS	£245
MEGABASIC	MS-DOS	£265

Dig.Res. CBASIC	CP/M-86	£290
MEGABASIC	CP/M-86	£265
MEGABASIC	MP/M-86	£365

Dig.Res. CBASIC	CP/M-80	£130
Microsoft MBASIC	CP/M-80	£110
BBC BASIC	Z80+CP/M-80	£ 95

BASIC COMPILERS

Microsoft QuickBASIC	PC-DOS	£ 75
Softaid MBASIC	PC-DOS	£ 60
ZBASIC	MS-DOS	£ 75
Alcor Multi-Basic	MS-DOS	£ 95
Microsoft MS-BASIC	MS-DOS	£285
MS Business Basic	MS-DOS	£325
Dig.Res. CBASIC	MS-DOS	£390

Dig.Res. CBASIC	CP/M-86	£390
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Microsoft MBASIC	CP/M-80	£185
Dig.Res. CBASIC	CP/M-80	£435
ZBASIC	Z80+CP/M-80	£ 75
Softaid MBASIC	Z80+CP/M-80	£ 65
Alcor Multi-Basic	Z80+CP/M-80	£ 95

LIBRARIES & UTILITIES

Database

CADSAM (source code)	MS-DOS	£135
Btrieve	MS-BASIC + MS-DOS	£225
Btrieve/N	MS-BASIC + MS-DOS	£485
Multikey	MS-BASIC + MS-DOS	£145

CADSAM (source code)	CP/M-80	£135
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Graphics

Multi-Halo	MS-BASIC + MS-DOS	£130
GSS Kernel	PC-DOS	£225
GSS MS-BASIC BINDING	PC-DOS	£110

Tuning & Debugging

Bitatools Dev.System	PC-DOS	£110
Figureflow Tuning Kit	PC-DOS	£ 43
Active Trace	MS-DOS	£ 85

Active Trace	CP/M-80	£ 85
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FORTRAN COMPILERS

New version from Lahey will ensure its superiority for the present. Microsoft on CP/M-80 is down in price.

Lahey F77L v2.00	MS-DOS	£395
RM/FORTRAN 77	MS-DOS	£450
DR FORTRAN 77	MS-DOS	£290
MS-FORTRAN V3.31	MS-DOS	£250
Pro Fortran v2.1	MS-DOS	£220

Pro Fortran v2.1	CP/M-86	£220
DR FORTRAN 77	CP/M-86	£290

MS Fortran-80	CP/M-80	£150
Pro Fortran V1.25	CP/M-80	£220
Nevada Fortran	CP/M-80	£ 35

Pro Fortran 77	ATARI 520ST	£120
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We have Fortran Graphics Libraries and Scientific Subroutines in stock.

PASCAL LANGUAGE

Two notable new products, the Pecan UCSD Pascal, and our first Pascal Interpreter, called ALICE.

PASCAL INTERPRETERS

ALICE Pascal Intrprtr.	PC-DOS	£ 80
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PASCAL COMPILERS

Pro-Pascal v2.14	MS-DOS	£220
MS-Pascal V3.3	MS-DOS	£225
MS-Pascal V3.2	MS-DOS	£ 95
SBB Personal Pascal	MS-DOS	£150
SBB Professional	MS-DOS	£335
Pascal MT+86	MS-DOS	£335
Turbo-Pascal	MS-DOS & PC-DOS	£ 49
Practical Pascal	PC-DOS	£145
UCSD Pascal (Pecan)	PC-DOS	£ 65

Pro-Pascal v2.14	CP/M-86	£220
Pascal MT+86	CP/M-86	£335
Turbo-Pascal	CP/M-86	£ 49

Pascal MT+ v5.6	CP/M-80	£ 99
Pascal MT+ v5.6.1	CP/M-80	£290
Pro-Pascal v2.18	CP/M-80	£220
Turbo-Pascal	CP/M-80	£ 49

UCSD Pascal (Pecan)	ATARI 520ST	£ 65
UCSD Pascal (Pecan)	APPLE II	£ 65

We have many Pascal Libraries. Enquire

PASCAL LIBRARIES

New products for use with Turbo Pascal keep coming, otherwise fairly quiet.

TURBO PASCAL LIBRARIES

Blaise Power Tools	PC-DOS	£ 75
Blaise Turbo Asynch	PC-DOS	£ 75
Paragon Supertools	PC-DOS	£ 45
Turbopower Utilities	PC-DOS	£ 75
Turbo Gameworks	PC-DOS	£ 49
MetaWINDOWS	PC-DOS	£ 49
Turbo Graphix Toolbox	PC-DOS	£ 39
Turbo Editor Toolbox	PC-DOS	£ 49
Turbo Database	CP/M & MS-DOS	£ 39
Turbo Tutor	CP/M & MS-DOS	£ 25

GENERAL PASCAL LIBRARIES

Blaise Tools (s'ce)(MS)	PC-DOS	£ 95
Blaise Tools 2 (s'ce)	PC-DOS	£ 75
Blaise Asynch (s'ce MS)	PC-DOS	£145
Btrieve (MS,SBB)	PC-DOS	£245
MetaWINDOWS (MS)	PC-DOS	£120
Multi-Halo (MS)	PC-DOS	£165
Blaise View Mngn. (MS)	PC-DOS	£205
Source extra		£135

Shark database (Propas)	MS-DOS	£250
Prospect Graphics (Pro)	MS-DOS	£ 70
Panel (Screen)	(MS) MS-DOS	£225

Shark database (Propas)	CP/M-86	£250
Prospect Graphics (Pro)	CP/M-86	£ 70

Shark database (Propas)	CP/M-80	£150
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The excellent XTC Editor comes with MS-Pascal source code @ £ 70

PRICES & DELIVERY

Prices do not include VAT or other local taxes but do include delivery in UK and Europe. Please check prices at time of order, ads are prepared some weeks before publication.

For other products in our range see our other page in this issue or ask us to send you a complete price list.

MODULA-2 COMPILERS

The Logitech range has been reprinted and repackaged. Every Atari programmer should consider the TDI Modula-2.

Interface M2-SDS	PC-DOS	£ 75
Interface M2-SDS-XP	PC-DOS	£185
Modula 2/86 BLS v2.0	PC-DOS	£ 95
Modula 2/86 BLS/8087	PC-DOS	£135
Modula 2/86 BLS/512K	PC-DOS	£180
Volition Mod.2	PC-DOS	£410
Modula Corp.PC Mod.2	PC-DOS	£120

Modula 2/86	CP/M-86	£410
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Volition Mod.2	APPLE II	£195
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Hochstrasser Mod.2	Z80/CP/M-80	£145
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TDI Modula-2	ATARI 520ST	£ 75
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MacModula-2	MACINTOSH	£125
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Library source is available with some compilers. Please enquire about other utilities available.

PROLOG LANGUAGE

New to our catalogue are Chalcedony Prolog V & V-Plus. Arity continues to establish a professional reputation.

PROLOG INTERPRETERS

Arity Standard	PC-DOS	£ 85
Arity Prolog v4.0	PC-DOS	£310

Chalcedony Prolog V	MS-DOS	£ 65
Chalcedony Prolog V-Plus	MS-DOS	£ 90
Micro-PROLOG Professnl.	MS-DOS	£265
Micro-PROLOG v3.1	MS-DOS	£150
PROLOG-86 v2.01	MS-DOS	£115
PROLOG-1 v2.2	MS-DOS	£299
ADA Educ.Prolog	MS-DOS	£ 45
ADA ES Prolog	MS-DOS	£ 55
ADA VMI Prolog	MS-DOS	£ 85
ADA VML Prolog	MS-DOS	£165

Micro-PROLOG V3.1	CP/M-86	£150
Prolog-1 V2.2	CP/M-86	£299

Micro-PROLOG V3.1	CP/M-80	£ 75
Prolog-1 V2.2	CP/M-80	£225

PROLOG COMPILERS

Arity Intrprtr+Compiler	PC-DOS	£685
Prolog-2 Compiler	PC-DOS	£1995

PROLOG LIBRARIES

Arity Exprt.Sys.Package	PC-DOS	£260
Arity SQL Develop.Pack.	PC-DOS	£260
Arity Screen Dsgn.Tools	PC-DOS	£ 49
Arity File Interchg.	PC-DOS	£ 49
APES Expt.Sys for micro-PROLOG		£150

ADA COMPILERS

The Janus C pack gives an entry to ADA which everyone can afford. Augusta is for budding compiler writers.

JANUS/Ada C-Pack	MS-DOS	£ 75
JANUS/Ada D-Pack	MS-DOS	£ 860
JANUS/Ada S-Pack	MS-DOS	£1275

Augusta (Source)	CP/M-80	£ 75
JANUS/Ada C-Pack	CP/M-80	£ 130
JANUS/Ada D-Pack	CP/M-80	£ 260
Supersoft Ada	CP/M-80	£ 250

Sheer Kahn . . . The peace of summertime London was disturbed recently when Philippe Kahn, larger-than-life founder of cheap software pioneer Borland International, crashed through the city with his usual delicacy and tact — that is, with none of those desirable qualities at all.

Kahn was in town to meet customers, distributors and the press with the news that Borland was set to open up a UK subsidiary, go public over here on the Unlisted Securities Market, and bull its way into the European market with some new products.

All of which sounds like good commercial sense, and is the kind of message that we are used to hearing from button-down Ivy Leaguers in sharp suits, wheeled out by US corporations to speak in tongues containing phrases like 'maximising bottom-line productivity' and 'leveraging power-user potential'. Mr Kahn, though, is in a quite different non-ivy league and sometimes seems to be playing a completely different game with a rulebook written by himself. And that's despite having a glowing profile in, of all non-Kahn-style papers, *The Sunday Telegraph*.

In a hotel room crammed with Compaqs, boxes of software opened and scattered on every surface, and a dozen empty litre bottles of Perrier, Kahn prowled around looking very,

very big and very, very tired. And sprawled in an armchair with his eyes constantly drooping as though his local gravity was different from ours, he laid out his philosophy of the software world.

On Turbo Prolog, the follow-up to the Turbo Pascal phenomenon: 'For our next language we could have done C, we could have done Modula, we could even have done an assembler. But we thought the users needed a surprise, something to expand their imaginations.'

On artificial intelligence: 'Everybody talks about it but nobody does it, like sex I guess. People wanna build expert systems, to program them like they write a spreadsheet. Spreadsheets are programming tools too.'

On Sidekick, his pop-up utility package: 'The beauty of Sidekick is the notepad — we managed to figure out a way of getting people to buy a second word processor.'

On pop-up programs in general: 'There are limits to what you can cram in RAM. There's no point in having an 80 or 90k program sitting in memory when you only use it every three days.'

On marketing: 'It's like war, with several generals fighting it out. There are various tactics you can use, techniques like guerilla warfare, flank attacks and circling manoeuvres. And the army with the most troops doesn't win all the time.'

On PC users: 'There are 50

per cent who don't like the machine they're using. There are another 50 per cent who are interested and want to know more, and of those, 10 per cent get to be real hackers. That 10 per cent are the people who everyone goes to for advice, the gatekeepers for the rest of the users. And if you can convince them you've got a good product, they will pass the word.'

On future products: 'Graphics and communications are two areas that are not very satisfying right now. If you've used any graphics or comms products, you'll know what I mean.'

And on Borland strategy: 'We're only going to produce non-useful things from now on. But people will buy them anyway.'

With that, Kahn's eyelids drooped further and he doubtless began dreaming of \$25 million sales, \$8 million profit, and lots of new shareholders with money to burn.

Just so logo . . . In the US, companies have vice presidents like a dog has fleas. The VP catering is involved in a knock-down-drag-em-out battle for supremacy with the VP human and coffee resources. The VP of marketing communications only speaks to the VP of public and commercial relations with a loaded gun in his hand. And the VP of comfort station perquisites does his best to sabotage the VP toilet tissue procurement.

This explains the growth of desk-top publishing and presentation graphics in that great nation, where the massed ranks of VPs — yes-men and noddors to a sharkskin-suited man — carry out their office warfare with reports, projections and optimistic statistical summaries aimed at the ignoramuses at chief executive officer level.

Imagine, then, the scene at heavy-metal database producer Micro Data Base Systems Inc. For in its corporate HQ, dominating the skyline from its prestigious address at PO Box 248 in booming Lafayette, Indiana, the VPs have been having a typical fracas.

It is all to do with the company's corporate logo, the face it puts before the world, rather than the more important VP matters like

who gets stainless-steel wastebins and swiss-cheese plants in their open-plan empires. Imagine the VP of corporate logos, feeling the pressure from the VP of graphic design and advertising. Feel the tension as the VP of handout production vies with the VP of promotional materials. Thrill to the dilemma of F Charles Redfern, a mere manager of advertising of public relations, setting one faction off against another as he aims for the pinnacle of VP status.

The results are now in. The old logo featured the letters MDSB, written in circles in a diamond formation — and the exciting new logo features the letters mdsb, daringly transferred to lower case, with four circles in a diamond formation about it. And now a slogan has been added, after deep discussions with the VP of text design and sizing, saying 'The Knowledge Management Company'.

Or to put it in the words of F Charles: 'Our new logo is a clean, simple design. It symbolises the unification of all our products and services into one corporate umbrella.'

Let's hope the VP of umbrellas has been placated for the absence of his symbol from the new logo. Perhaps he has been given a stainless-steel wastebin. **Waterhead's revenge . . .** well really. It was tempting fate to extract the waste product from International Resource Development last month. The waterhead sanctuary has responded with an in-depth analysis of what effect the video phone will have on the world.

Can it be that people will have false clothes handy for when the phone rings in the bath? Will it stop us making faces at the receiver when someone makes a complete gonzo statement?

No. According to IRD, the main result of videophones will be to kill the video dating market.

Why pay money, IRD argues, to see your prospective dates at some agency's video parlour when you can see everyone you speak to on the phone? Well yes, but surely that means ringing up prospective partners at random, having a quick shufti, and then asking them out. Who knows, you might even manage a bit of heavy breathing.

END



The three smiling faces here are celebrating the award of the title 'Corvus Dealer of the Year' to Keen Computers, made by Vistec Business Systems. On the right is Vistec's Corvus supremo George Gubas; on the left is Keen's system manager Nigel Underwood; and in the middle is . . . well, an anonymous bit of cheesecake wheeled in for the occasion and not even mentioned in the caption helpfully attached to the photograph. The Sexist Distributor of the Year award goes to Vistec.

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