Issue No.2

TATUNG

Einstein NEWS

THE NEWSPAPER FOR EINSTEIN USERS

MAY 1986

Data Protection Act

By the time you read this, or shortly thereafter, it will be a requirement of anyone holding personal data on computer to be registered.
The scope of the act is quite deep but briefly, the way it will effect any Einstein Users is as follows.

Should you be keeping data on such things as members of a club, you would be required by law to register the fact. There are exemptions to this such as payroll, pensions, names and addresses only used for distribution purposes.

My advice is, if you store data on private individuals, contact your local Citizens Advice Bureau for further information.

David M. Bell, A.I.D.P.M.
Software Manager
May 11th 1986 Official Deadline - ED.

"DISK NO SECTOR" ERROR MESSAGE

Correction in Einstein News Issue 1 December, 1985, page 6.
Problem Page. Answer to question 1.

To put the current DOS on a disc, insert you system master disk.
Type MOS and press the enter key.
Type R 8ØØØ 99FF
Remove system disk and replace with desired destination disk.
Type W 8ØØØ 99FF

(note spaces after R 8000 99FF and W 8000 99FF)

Special note:
Do **not** use this procedure on any commercially protected disk or one that Auto Loads. It will corrupt the disk and make any guarantee void. An **example** of this type of disk is the Konami and Games disk.

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VISA Access

NEW 80 COLUMN WORD PROCESSOR LAUNCHED

SCREENSOFT in conjunction with Fydler Microprogramming of Torquay have launched a new 80 column Word Processor for the Einstein Microcomputer. To be sold under the title of "SCREENSCRIPT", the versatile word processor will offer features normally found in products costing twice the price of its £29.95 tag.

The program has been designed for the user who requires a powerful word processor without the complexity associated with better products of this kind. Screenscript will offer full functions such as Word Wrap, Justification, Centering, Scrolling while working on the WYSIWYG (What you see is what you get) principle, with full 'on-screen' editing.

Full use of the function keys has been incorporated in the program for SAVE, RENAME DOCUMENT, SEARCH, PAGE BREAK, REFORMAT, CONDENSED PRINT, EXTENDED PRINT, EMPHASISED PRINT etc and a 'HELP' page may be called at a keystroke.

Unlike many other Word Processors Fydler Microprogramming has built in the facility of integration for Screenscript. Two utilities to follow soon after the launch of the Word Processor will be "SCREENMAIL" a complete mailing module and "SCREENBASE" a Database to enable information to be integrated with the Word Processor.

The products are available now and further information can be obtained from Screens Distribution on 09274 20664 or Fydler Microprogramming on 0803 214102.

The winner of the **"WIN £500 CASH"** cash competition in the last issue was MR J.SURREY of Galleywood Road, Chelmsford Essex whose selection of Einstein features in order of importance was "**b-g-a-e-f-h**" and the caption "My Einstein is the best computer because **it is extremely good value for the range of facilities that are offered**" was judged the best. Runner up was MR C.HORNEY of Wallis Avenue, Lincoln whose caption "**Relatively speaking he is more practical than theoretical**" earned him a deserving second place.
Well done both entrants!!

THE ARTICLES PUBLISHED IN EINSTEIN NEWS DO NOT NECESSARILY REFLECT THE VIEWS OR OPINIONS OF THE EDITOR OR PUBLISHERS

How to stop buying software

We've taken a completely new look at the software needs of small to medium sized businesses.

The result is Personal Assistant – a quite superb suite of six modules to cover the most often-needed functions. It's on a sensible scale, so you're not paying for vast complexity that you'll never need.

Personal Assistant's six modules are:-

Wordmate _____ All the functions of a word processor without the aggravations – word wrap, justification, centering, text manipulation, scrolling and so on. It's so friendly that even people who hate word processors like it, and it integrates fully with Datamate and Mailmate.

Billmate _____ Create invoices with this attractive and easy-to-use module. Calculate VAT, discounts and so on, and print onto plain paper with most types of printer.

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Now available for:- **TATUNG EINSTEIN AMSTRAD PCW 8256 AMSTRAD CPC 6128 ... AND MOST CP/M MACHINES, SHORTLY ON MSDOS**

Datamate _____ An astonishingly versatile database. Our fundamental rethink of database concepts means it operates very quickly despite its simplicity in use. Datamate gives you full screen configuration, multiple pages and field lines, help page, five search methods, sort and update – among a host of other features.

Mailmate _____ Build your own mailing system, which will personally address a Wordmate-generated letter to some or all of your business contacts.

Appointmate _____ A fully computerised diary, enabling you to book cancel, amend and search for appointments – instantly.

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£94.95 Access

incl. VAT

Available from your FMP dealer, or direct from:

Fydler Microprogramming Limited, Panderic, Braddons Hill Rd West, Torquay TQ1 1BG
Tel. (0803) 214102

NORTHERN COMMS PACKAGE.!

Many users of the Einstein computer have a need or would certainly like to experience, communications with other machines and remote data bases.

Shortly after the launch of the computer we at Northern Communications, took a long hard look at the bewildering array of modems and software to see what could be done for the Einstein.

We very quickly learned that the casual user, who knows nothing about modems and databases is very much, on his own! All too often it's a case of, Caveat Emptor (Buyer Beware)

Modems and software come in two categories, cheap and expensive, there is often little assistance available to get going and vital parts like connection leads etc are not supplied.

Being a Mail Ordering Organisation, dedicated solely to the Einstein we set out to put together a complete package, in partnership with a manufacturer, that would include everything necessary to get the system working, right from opening the box.

After consulting several suppliers of modems we finally chose Pace Electronics Ltd., not only because they were sympathetic to our plight but also they offered a top quality product at a reasonable price, with back-up support.
It has all of the features found in more expensive units, in a type approved, simple to use form.

Like the computer itself, their modem is capable of being upgraded, to keep pace with changing needs. They can offer sophisticated options, such as Direct Dial and Auto Answer which can be added when needed.

Not everyone wishes to take out an immediate subscription to Prestel or Telecom Gold but they do want to use their modems.
With this in mind we developed our own basic comms software, on 3" Disc, called somewhat aptly, "Pacer".
This allows users to get going quickly and is packaged with the modem, plus interferance wiring etc.
NB: Modem plugs in series with new style telephone jacking system, no extra BT socket required.

All this is now packaged, with the modem, at an all inclusive starter price, together with details of, "interesting" telephone numbers to ring. - It really can be fascinating !!!!!!!!!!

A number of these special packages are already in the field and we are greatly encouraged by user feedback.

Certainly, the one-box, no more heartache approach has been very well received!

We believe that the future development of Einstein computing depends very much on its ability to communicate with other users and we feel sure that this specialist package shows the way, for both home and commercial users.

EDITORIAL
EINSTEIN NEWS

"WE HAVE RECENTLY RECEIVED ISSUE 1 OF EINSTEIN NEWS...
I SHOULD BE GLAD TO KNOW HOW I CAN CONTINUE TO BE SENT FUTURE ISSUES....." (B'HAM)
"...WOULD YOU PLEASE SEND ME DETAILS OF HOW TO SUBSCRIBE TO E.N." (HANTS)
"RECEIVED ISSUE 1 OF EINSTEIN NEWS....PLEASE SUPPLY FURTHER DETAILS OF SUBSCRIPTIONS...." (N.YORKS)
"TATUNG NEWS NO1 - I THINK IT WAS A SUPERB PUBLICATION AND HOPE YOU WILL REPEAT IT AGAIN....." (MERSEYSIDE)

And so the letters went on - very encouraging for a 1st issue rather hastily put together!! Please continue to write and let us know **WHAT YOU WANT** from the E.N. We'll even publish your letters in future issues!!

Future issues will contain "small ads" if you want to sell/exchange/swop equipment also if you are into communications a special section for Mailbox numbers only (want to contact the Editor! - try MBX on Prestel 927420664 -)

In fact if you have something to say about Einsteins let the "E.N·" know.

This issue is full of exciting reading and competition too, have a go, who knows you may even win !!

ADVERTISE IN EINSTEIN NEWS FREE !!!

Equipment to sell
Equipment to buy
Pen-Pal wanted
Games to exchange

Whatever you wish to buy or sell write your advertisement carefully on a post card and send to Classified Section, Einstein News, 6 Main Avenue, Moor Park, Northwood, Middlesex for **FREE** insertion in the next edition. MBX Nos PLEASE IF YOU WANT TO BE CONTACTED ON PRESTEL !

DROP US A LINE!

Have you got a small program for other Einstein Users.
Got some News to share.
Want to have a moan.
Want technical advise.

Then drop us a line to The Editor, Einstein News, 6 Main Avenue, Moor Park, Northwood, Middlesex for inclusion in the next edition.

★★★STOP PRESS★★★

AVON EINSTEIN USER GROUP

The A.E.U.C. are primarily interested in Einstein Users who reside in or around the Avon Area. Full details of the group and membership form can be obtained by sending a stamped, addressed envelope to the address below.
The Secretary,
Avon Einstein User Group,
74, Great Hayles Road, Crowndale Estate,
Whitchurch,
Bristol BS14 0SJ
Avon.

★★★ MORE A WAY OF LIFE ★★★

Agnes and Alistair Ward retired early from the medical and academic worlds and four years ago they started their own business, Peach Computers Ltd 0475 673766. They specialise in writing low cost business software for the Tatung Einstein computer. Here they describe their very attractive life style and a few of the many friends they have made.

We are really very lucky in living and working in one of the most beautiful parts of the United Kingdom. Our study windows look out across some ten miles of water to the snow capped peaks of Arran. And recently we have had blue skies as a perfect background to the ocean swells rolling in from the Atlantic. We have a wide range of birds - some passing through from the Arctic and others with us all year like the gannets and eiderducks and the wild swans. Not to mention the seal that patrols our part of the coast living well on rich diet of salmon and sea trout. An ancient sea cliff lies behind us and when stone age man lived here the waves surged over what is now our home and garden area. The cliff is a sanctuary for wild animals and with towering trees forming an attractive woodland area which is full of snow drops at present and just ready to burst into the golden yellow of wild daffodils. The wood folk include dear foxes owls and a wild mob of small birds who are good judges of when our fruit trees and bushes are ready.

Our home is also our workplace and it is difficult to imagine a better environment for writing computer software. Nowadays as well as our standard Peach Pack we are more and more being asked to write customised business programs for special applications. We are anything but isolated and get calls and letters from all over the world. And there is really something very attractive and nice in the contrast between our natural surroundings and the very advanced computer technology in which we deal. We write for different machines but the Einstein is our favourite. There is simply nothing to beat it. It is so well made so thoroughly reliable and with its Crystal Research system software it is so pleasant to use. We are really quite surprised ourselves at the scale and variety of the tasks which the Einstein can take on. We recently finished a program called Club which allows records to be kept for up to 10000 members. The search facility will find a record by name or by code number in about 30 seconds. The other facilities include selective print out of groups which is convenient for jogging the memories of folk who have forgotten to renew their subscriptions. We have not yet advertised Club but already several users have bought it and seem pleased. An earlier version of Club brought a delightful postcard from Paris - it seems that the user had gained so much extra time that she had flown over to Paris for the weekend and wrote us the postcard while sipping wine in a Paris cafe.

We never know what the post will bring - last week we received a request from a user with a life style very like our own. He lives on a boat on the South coast and has a vast library of 30000 items which forms the basis of his successful business. He needs to build up a data base with details of each item and where the item is. At first we were a little bit taken aback by the request but the more we looked into the problem the more it seemed viable using the Einstein. It means very large set of data discs but as each record is connected only with a small number of other nearby records there is really no requirement for a hard disc with all of its expense and vulnerability. In fact the data will be safer spread over the small discs and any one of the records can again be accessed and used within less than a minute which is really quite fast for his purposes.

We seem to be learning more and more about different types of businesses. We recently completed a new program called Barsales which brought us into intimate contact with a wide range of liquours and whiskies and a host of other drinks. To write our customised software each user has to explain in detail just what his problem is. Its all very interesting and a lot of fun for us. One of our Einstein users has a night club in London with roulette tables cabaret and four bars. He uses Club and Barsales with great effect and we are moving on to do his accounts.

Our charges are quite low - £25 for a customised program no matter how long or short a time it takes us to write it. Of course by this time we have a huge collection of our own software and we usually only have to join parts together which does not take us very long - hence the low price. Our standard Peach Pack is popular and again the price is low at £30 for the complete set of 10 really practical business programs all on the one disc.

The financial rewards of our work are quite adequate for our needs but perhaps the greatest rewards are the many friends we are making among our users who seem to be very grateful for the trouble we go to in getting the software right for their particular needs. At times we are somewhat overwhelmed by their response. One of our users a hairdresser who needed a customised program for handling invoices for some 2000 boys at one of the largest colleges was so pleased he sent us a huge bouquet of flowers. Another user a teacher sent us a beautiful plant, another sent us a huge box of chocolates. To our utter amazement a business man with a large high quality gift store sent us an extremely valuable barometer as a Xmas gift. To say that we are overwhelmed by all this is putting it mildly. So much for the rugged tough business world. Our experience has been that there are very nice people out there who are grateful for assistance in getting the best out of their Einstein.

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SOFTWARE

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E2 Printer Cover £7.95
Covers to match available for most printers please ring for details!

Speech Synthesizer - Einstein *SPEAKS!* (Disc based) £44.95
At last! What you have been waiting for! *Exclusive to ourselves!*

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FULL KEYBOARD UNIT	£24.95
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ADVANCE ORDERS NOW TAKEN FOR SPECTRUM EMULATOR
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Special Offer to Club Members!!!

OFFER 1 Purchase T.P. 100 printer & get free printer dust cover + ½ price printer cable (normally £14.95) or ½ price 2K Buffer (normally £15)

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OFFER 3 Purchase 80 col card & get 2 x free blank discs.

OFFER 4 Purchase Tasword & Tasprint together for £31.40 (save £3.50)

OFFER 5 Tatung Integrated Business Packages £25 each (normally £39.95 each) or £99.95 for all 5! (SALES/PURCHASE/INVOICING/STOCK/MAILING)

OFFER 6 DISCO DAN - OH MUMMY - CHUCKIE EGG - £9.95 each or all 3 for £24.95

OFFER 7 Save £2 when you order E1 Einstein Dust cover normally £13.95 together with E2 Printer cover normally £7.95 £19.90

OFFER 8 Einstein Hardware Manual £24.95 Order No. EH1

OFFER 9 3" Blank Discs (normally £4.90 each)
Box of 10 £44.00. Save £5.00 (order as 10)

OFFER 10 Wordstar Professional 80 col: only £275.00 A saving of £183.54
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* Offers apply to members only. * Allow up to 28 days delivery. * Software exchanged if found faulty or defective on receipt. * Membership numbers must be given to qualify for special offers.

UNITED KINGDOM EINSTEIN USER GROUP (UKEUG)

We are a group made up of people like you (Einstein Users) who have come together to help and support the Einstein.

We produce a monthly Newsletter of which extracts have been reproduced below. For further details contact us at the following address.

KEITH STOKES
Hillcroft
Codmore Hill
Pulborough
West Sussex
RH20 1BQ

WDPRO versus TASWORD
by
ROBIN DURANT

I run a small business, and use a word Processor for Letters, Statements, Invoices and other documents, and have tried both WDPRO and TASWORD and have made the following observations:-

First of all, may I mention WORDSTAR, which is, in my opinion, the only one suitable for the larger business, where there is a person, specially employed to carry out the job of letter writing etc. My concern is with the type of business where the Proprietor does most of the jobs, or where the number of times the Word Processor is used during the week is few.

TASWORD

I found this very easy to use, for, what you see on the screen is the same as the written letter will be. The program customisation is useful, as you can set it up to suit your own business requirements. There are options as to the style of print, should you require them,from LECTURA to COMPACTA, providing you have a Tatung TP80 Printer, and there are two Help pages, should you forget the commands etc.

The major disadvantages I found were first, that it is only a maximum of 64 characters per line, where an A4 sheet of paper takes 80, and second, that it has no PROMPT code. Otherwise it is a reasonably priced, sophisticated program.

WDPRO

This program is based on entering your text with codes, prefixed with a 'blob', using the ESC Key. Once you have learned these codes, it is very easy to write, but not so easy to see what you have written, as the way the text is displayed is not the way it will be printed. However, there is a command SETV, which will display your text in the correct manner, if you wish, or you can space the text in a way that can be more easily read.

WDPRO allows you to configure it to the features of your own Printer and lists 6 major manufacturers. It also allows you to set it at 40 or 80 column.

Another nice feature is the ability to program the 8 Function Keys on the Einstein (16 with shift), to each of the commands, this saves time when operating.

The one feature which requires consideration is the PROMPT code. This enables you to enter a short text from the keyboard into the output while printing, i.e. if one letter is being sent to many people, then the PROMPT will ask "Name", "Address", which you will enter. It also is very useful if using the Processor for Statements or Invoices etc. which differ each time. I know that other programs enable you to alter the variables, but this one reminds you what the alterations are.

The variations in Script style are restricted to Double Width and Emphasised on this program, but others can be obtained by use of other codes.

CONCLUSION

There are, of course, many more facilities on each of the programs, which I have not mentioned, but I have tried to name the main points which would be important to the small businessman who may not be interested in the finer attributes of a program, but more in the effectiveness and simplicity of it, related to his own requirements.

I feel that, if only standard Reports or Letters are required then, the TASWORD for around £20:00 is for you, but if you are going to use it for other uses, such as non-standard Letters or Invoices etc., then it is going to cost you around £58:00 for the WDPRO.

PS

I have had trouble in getting the Centreing Code, Blob C, to work. If you are also having the same problem, try the following:-

Blob C, (text), Blob M, Blob C-.

That is, putting the M Code before the cancelling C Code.

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EINSTEIN DUST COVERS

In response to customer enquiries we have encouraged a specialist maker to produce for us matching Dust Covers for both the Einstein Computer and the TP100 & TP80 complimentary printers.

They are made of a special anti-static, lightweight nylon type fabric, which is both tough and durable.

The covers are manufactured in a pastel Grey colour with edges piped in Red.

The effect is very pleasing and we are especially pleased with the contoured styling of the cover, that follows the lines of the monitor and keyboard. (It's not box shaped!)
Allowance has been made on both covers for wiring, at the rear of the machines and of course the 80 column adaptor unit.

Since making the original items we have received enquiries for matching covers for alternative printers.
Some of these are now standard items but there is no problem in producing to order, provided that we have the model number and its basic dimensions.
You'd be amazed what we are asked to cover!

There is now also a computer-only cover available for those without monitors.

For more details see our advertisement, Front Page in this issue.

COMMUNICATIONS

The rapidly growing interest in communications being shown by home computer owners, is akin to the rapid growth in Amateur Radio enthusiasts which has been taking place since about 1980. The idea of communication with some far off computer or person holds a strange fascination, and once experienced, will be a source of pleasure and interest for evermore. However, getting there can be fraught with heartache, particularly for the relative novice, so here are a few things to be wary of when considering the purchase of some communications equipment. First, what will you need? You will need a MODEM, which is the device which allows the Computer to link to the Phone, a Cable, to connect the computer to the modem, and some SOFTWARE, to allow the computer to interpret what is coming into it from the MODEM. If you wish to use PRESTEL then the MODEM must be capable of accepting 1200 Bauds Receive and 75 Bauds Transmit, a standard adopted by PRESTEL, and now being taken up by a lot of Bulletin Boards. If your MODEM does not have a 1200/75 Split Baud Rate option, then no communication with PRESTEL will be possible. The second requirement is for a suitable piece of software, and as far as we Einstein Users are concerned, that means just one thing, Communications with Viewdata from KUMA.If your hope is to use your Einstein as a TELEX machine, or as a means of accessing bulletin boards, then you will need to set the MODEM for 300/300 half Duplex (this simply means that communication is ONE WAY AT A TIME, unlike the telephone where each party can talk at the same time (FULL DUPLEX).Software for such applications is more widely available, and for those who do not have a sophisticated requirement, then PETER AMEY's Hackers Delight, again from KUMA, is a very good buy.
For those who wish to prepare text OFF LINE and then send it via an Electronic Mail Box service like One-to-One, the software package called INTEXT from the Business Computer Centre in Telford, is a must. Although this package is around the £115.00 mark, it does all that is required of a sophisticated Comms package, and indeed with this package, you could replace the office Telex machine quite confidently. Subscribing to an electronic mail box service, like One-to-One, is an ideal way of cutting down on Telex Charges and indeed on postal charges, since all electronic mail is sent and retrieved free of charge, with the user paying only for ON LINE time, and this cheap. Full details of this electronic mail service is available from Dr. Mike Bayliss at The Business Computer Centre (see their advert in this issue).

PRINTERS

Over the past few years, the number of people who have added a PRINTER to their home computers has grown enormously, and yet people still get caught out by the "fast operators" who sell totally unsuitable printers to the poor novice. The biggest mistake to make, is choosing a SERIAL printer instead of a Centronics Printer. Not that there is anything wrong with SERIAL printers, they work well. The problem is that nearly ALL of the software written for the Einstein requires the use of a printer with a CENTRONICS interface, so those cheap offers of printers with RS232 (Serial) interfaces, are to be guarded against. The next biggest question which the user must ask is
DO I REQUIRE FULL LETTER QUALITY?
If the answer is a definite YES, then a DAISYWHEEL printer is the only true solution. The price to be paid is that of speed, since most daisywheel printers are slow (around 16 to 20 characters per Second (CPS)), but they do give a superb "typewriter" look to the documents which they produce. If the answer is "maybe" or "sometimes", then the better choice would be a Dot Matrix printer with a Near Letter Quality (NLQ) option. These can be purchased quite reasonably now, and offer a good compromise to the person who wants Letter Quality sometimes, but speed most times. The extra advantage of a Dot Matrix, apart from speed, is that other print types, such as condensed and enlarged letters, together with Subscript and Superscript, are available. A third option, for those requiring a cheap printer for use at home, is the Thermal Printer. These produce their letters almost silently, by allowing hot wires to react with a heat sensitive paper (usually provided on a roll). The quality of the print is usually good, but the width of the roll paper is normally only about eight inches or less, so as a business tool, they are not so attractive.

COMPETITION
★★★ TATUNG EINSTEIN ★★★

THIS NAME COULD WIN YOU
A 2" T.V. !!!

ALL YOU HAVE TO DO IS TO MAKE AS MANY WORDS OF THREE LETTERS OR MORE FROM THE WORDS "TATUNG EINSTEIN". WRITE DOWN AS MANY WORDS AS YOU CAN EXCLUDING FOREIGN WORDS AND ABBREVIATIONS AND SEND IN YOUR ENTRY TO ARRIVE BEFORE MAY 31ST NEXT. REMEMBER TO COMPLETE THE CAPTION BELOW TOO!

IN THE EVENT OF TWO OR MORE PERSONS HAVING THE SAME NUMBER OF WORDS THE WINNER WILL BE DECIDED UPON THE ANSWER TO THE BEST SLOGAN IN THE QUESTION "I LIKE THE EINSTEIN BECAUSE ....." IN NO MORE THAN 20 WORDS. SEND ENTRY TO THE EDITOR, EINSTEIN NEWS, MAIN AVENUE, MOOR PARK, NORTHWOOD, MIDDX HA6 2HJ.

THE DECISION WILL BE FINAL AND NO CORRESPONDENCE WILL BE ENTERED INTO. WINNER WILL BE NOTIFIED BY JUNE 30TH 1986.

THE PANTHER MULTI-MODE PRINTER FROM DATAC

The *PANTHER* utilises the latest technology to provide quality print copy and durability. State-of-the-art engineering and light weight construction make the *PANTHER* ideal for personal and small business use. The sophisticated microprocessor-based electronics ensures versatile and reliable performance. High resolution Bit Image graphics and razor-sharp charcter printing that set high standards in accuracy and quality make the *PANTHER* today's most exciting news in matrix printers.

FEATURES

- ☆ Friction feed & tractor feed - handles cut sheets, roll paper or sprocket paper.
- ☆ 1152 Byte input buffer for efficient data transfer & complete line of high resolution graphics.
- ☆ Precision print head utilises special wires for sharp quality printing & durability.
- ☆ Compact cartridge type ribbon designed for long & easy replacement.
- ☆ Bi-directional logic-seeking carriage.
- ☆ Versatile character printing modes.
- ☆ Graphics modes - Bit Image including high resolution & 1:1 aspect ratio.

CHARACTER PRINTING MODES:

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PATTERNS OF CHAOS

by Peter Moon

THE MANDELBROT SET

"The Mandelbrot set broods in silent complexity at the centre of a vast sheet of numbers called the complex plane. When a certain operation is applied repeatedly to the numbers, the ones outside the set flee to infinity. The numbers inside remain to drift or dance about. Close to the boundary minutely choreographed wanderings mark the one onset of instability. Here is an infinite regress of detail that astonishes us with its variety, its complexity and its strange beauty"

So wrote A.K. Dewdney, and I can find no better words to describe this structured marvel, discovered only a few years ago by mathematician Benoit Mandelbrot.

To keep it short, it is a fact that some non-linear iterative processes are unstable for certain numerical values, and in the region of instability, chaos is manifested. By "non-linear" I mean functions whose graphs are not straight lines, such as powers of x. By "iterative" I mean a process in which a number is calculated from x, and the result is fed back as the new value of x in the same process, and so on repeatedly.

Mathematicians have a habit of borrowing ordinary everyday words like root, map, set, domain, prime and so forth, and using them with very special and precisely defined meanings. Chaos is a precise mathematical term applied to irregular behaviour generated by a deterministic (and therefore calculable) process, as distinct from a truly random and unpredictable process such as the decay of radioactive nuclei. Chaos has an irregular, subtle but ordered structure which may be displayed by suitable mappings. In fact mapping in what mathematicians call the complex plane turns out to be the best way to display and visualise the patterns of instability and chaos.

IMAGINARY AND COMPLEX NUMBERS

This brings us to the awkward number represented by i, the square root of -1. At this point you may well feel like turning to Space Invaders as more manageable and entertaining, but bear with me for half a page and I guarantee you'll find nothing incomprehensible about complex numbers.

The numbers we use in everyday life - real numbers - are single entities (like hats) such as 3.14159, -7, or 29. A complex number is made of two parts (like a pair of trousers). By convention, the first part is called the real component, and the other bit, the imaginary component, is just a multiplier for our daunting but useful friend i. Thus two complex numbers might be $-3+4i$ and $2-3i$.

The rules of complex arithmetic are simple. To add two complex numbers, just add the real and imaginary parts separately. Thus $-3+4i$ plus $2-3i$ is $-1+i$.

Multiplication is no harder. Remembering school algebra:

$$(-3+4i)\,(2-3i) = -6+8i+9i-12i^2 = -6-i-12i^2$$

As the awkward i is -1 it unfortunately squares to give -1, so the complex product becomes $-6-i(-12)$ or simply $6-i$.

We can express the size of a complex number as the square root of the of the sum of the squares of the two parts; in this case $36-(-1)$ or 37, which is near enough 6.082.

Painless, wasn't it? Now you know enough about complex arithmetic to write your own computer programmes.

THE MANDELBROT SET

If we take a complex number Z (consisting of course of a real part RZ and an imaginary part IZ), square it, and add a complex constant C (RC+IC), we obtain another complex number. If we put this back into the formula as the new value of Z and go on doing this (iteration) a great many times, one of two things will happen. Either its size will get very large, or it will dot about but still remain at some moderate value. Numbers which do not go screaming off to infinity under this iterative treatment belong to the Mandelbrot set. The best way to visualise them is to plot them on a graph, their real parts on the x-axis and the imaginary parts on the y-axis. This is all that is meant by a "mapping in the complex plane".

PROGRAMMING

Now we are in a position to generate a 2-dimensional picture of the Mandelbrot set on the Einstein. The steps are as follows:

1. Consider a square window on the screen with side 2.5 units long having its south-west corner located at $x=-2$, $y=1.25$. Assuming we have 192x192 pixels in this window, calculate the co-ordinates of each pixel and use each pair of co-ordinates as the real and imaginary parts of a complex constant C to be used in the next step.
2. For every constant in turn, start with $Z=0$ (that is, $0+0i$) and apply the process $Z=Z^2+C$, in other words square Z and and add C using the rules of complex arithmetic.
3. Take the result as the new value of Z and repeat step (2).
4. Do this 100 times, and if at any stage the size of Z (RZ + IZ) exceeds 2, stop iterating and plot the corresponding pixel the same colour as the background. Any complex number which gets this big is guaranteed to be on its way to infinity, so waste no more computer time on it. If Z survives 100 iterations, colour the coresponding pixel white.
5. Repeat (2) to (4) for every value of C, ie for every pixel in the window.

A programme in BBCBASIC is given below. If you are using a colour monitor you have 192, not 768, pixels to play with. If all the pixels required the full 100 iterations the programme would go through lines 230-290 3.7 million times, and the BASIC interpreter takes 11.5 hours to wade through this.

The programme can be speeded up by using fewer pixels, iterating less than 100 times, using a language which is compiled rather than interpreted (such as FORTRAN), or using machine code for the frequently executed lines.

The definition of the picture can be improved, if you have a dot matrix printer capable of bit image mode, by plotting a dot or a blank for every possible position of a single pin on the print head. If you can command 60 dots per inch across an 8" paper width, and can specify a linefeed of 1/60th of an inch, you have the equivalent of 480x480=230,000 pixels, and the definition is much improved (at the expense of execution time!)

Figure 1 was produced in this way.

WHAT YOU SHOULD GET

The Mandelbrot looks like a squashed bug, covered with warts and excrescences, each wart resembling but not identical with the parent figure. By choosing more restricted windows in the complex plane you can magnify parts of the border, and it turns out that there are warts on the warts and so ad infinitum. For large magnifications it becomes necessary to use double precision arithmetic to avoid the iteration step falsely flying off to infinity because of small repeated rounding errors.

Space does not permit more than a mention of the beautiful effects which can be obtained by assigning graded colours to the pixels representing values of C which are marginally unstable, just outside the Mandelbrot figure. See A.K. Dewdney's excellent article in "Scientific American" (August 1985), and Howard Oakley's programme in PCW (January 1986).

If you're thinking of using the Einstein's colour graphics, be warned in advance that, in spite of what the book implies, you can't colour all the pixels differently.

There is a closely related subject called Julia sets, and the next issue will continue the theme of Patterns of Chaos for this phenomenon.

After playing with Mandelbrot and Julia sets for two months and having only scratched the surface, I still marvel that a formula as simple as $Z=Z^2+C$ can give rise to such intricately complex patterns. Beats a spirograph hollow! (to be cont -ED).

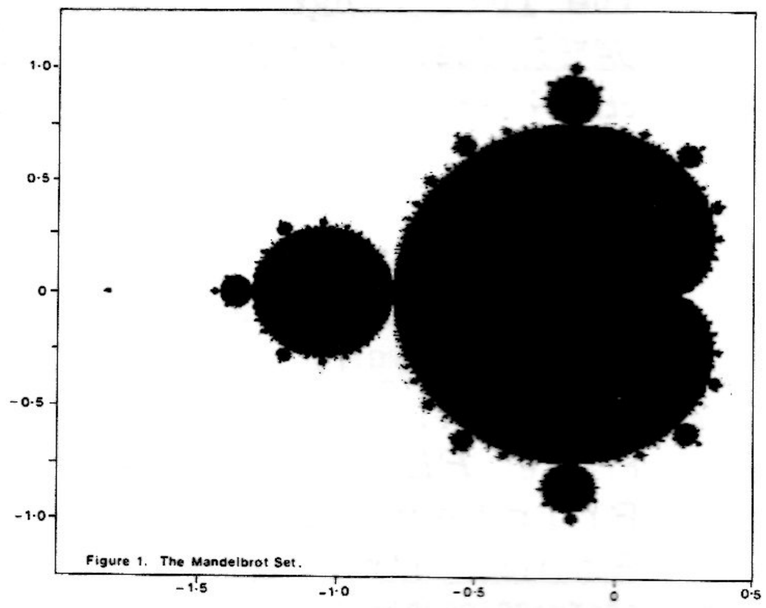

Figure 1. The Mandelbrot Set.

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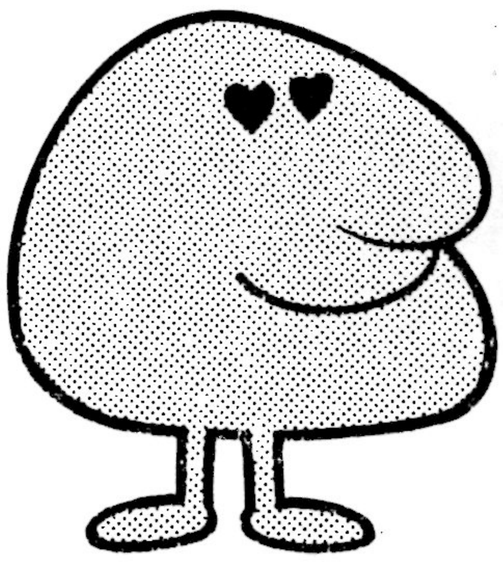

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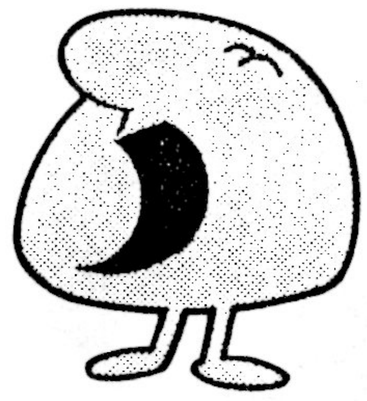

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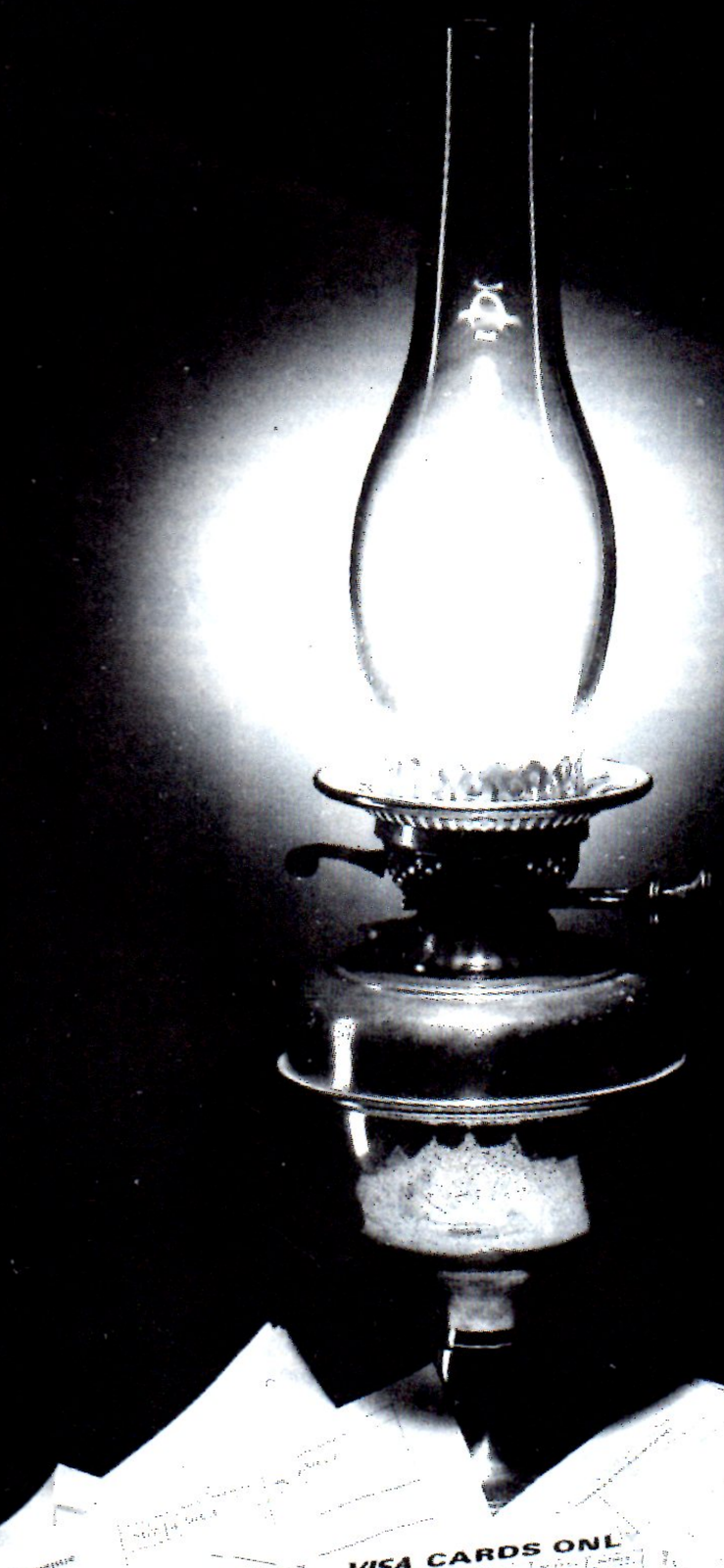

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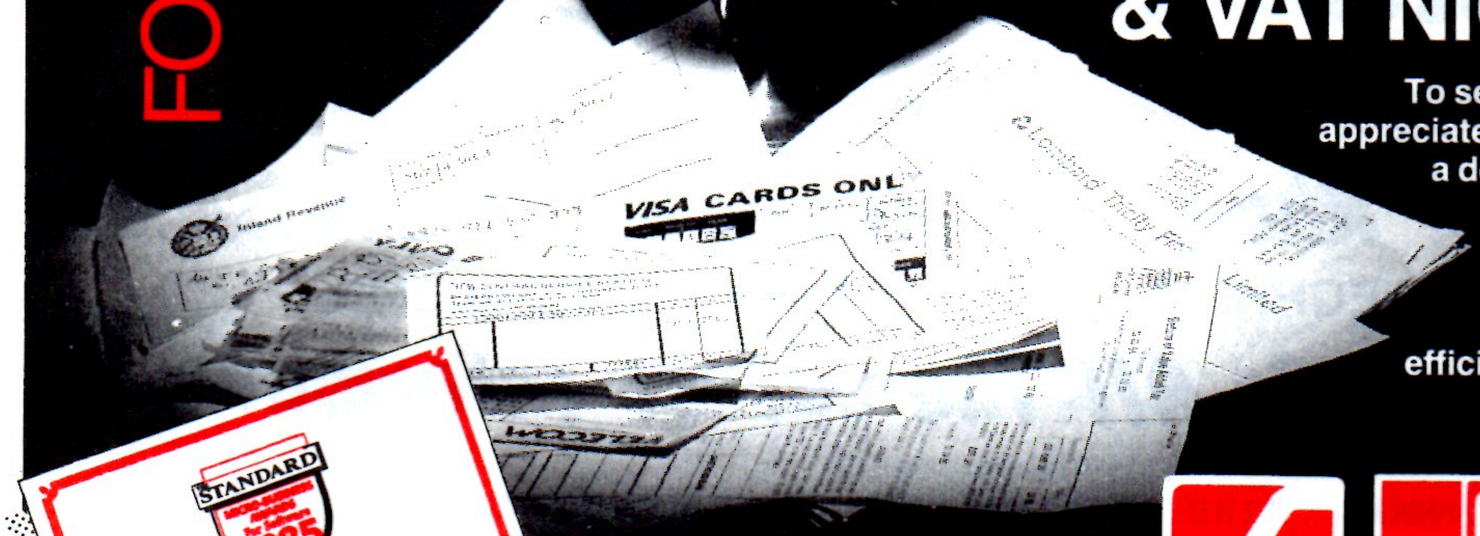

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