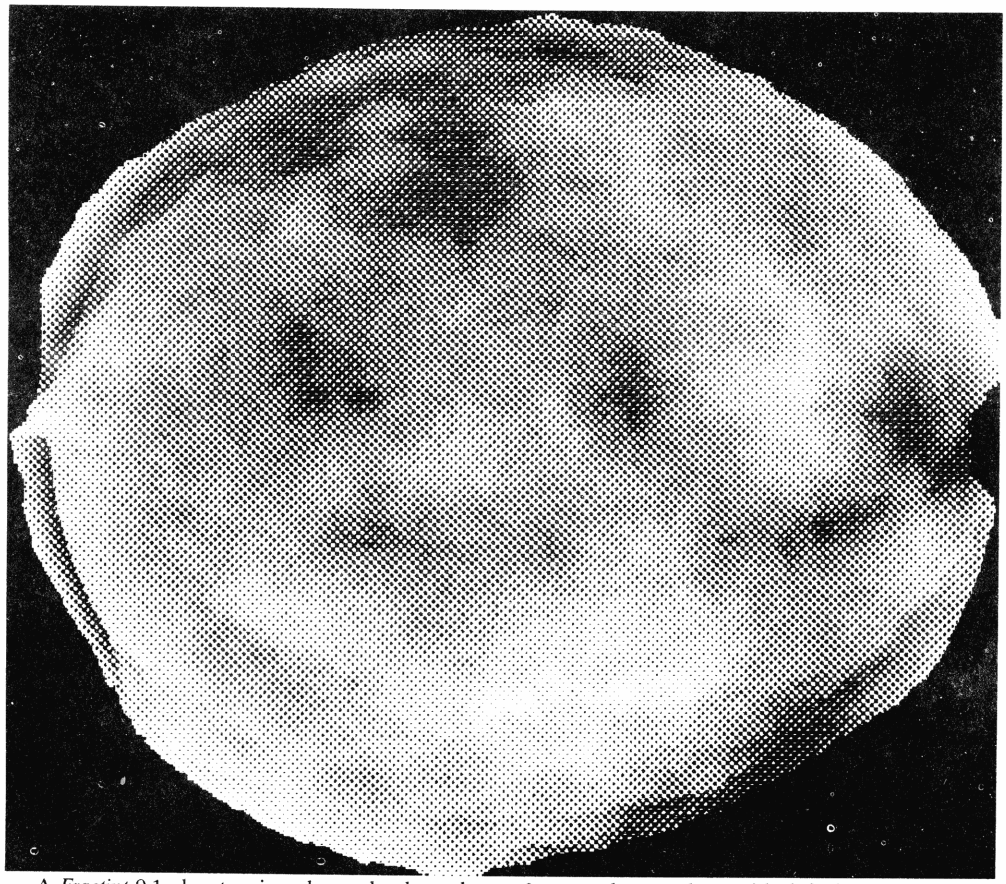
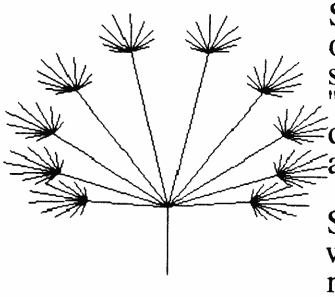
Fractal Report



A *Fractint* 9.1 planet, using plasmacloud roughness .3 mapped to a sphere with default parameters.

No 9



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Volume 2 no 9: First published May 1990. ISSN applied for.

Martin's Mappings

by Paul Gailiunas

Martin's mapping algorithm was given in an article in *Scientific American*, and reprinted in *The Armchair Universe* by A.K.Dewdney. It is given there as:

```
input num
input a,b,c
x ← 0
y ← 0
for i ← 1 to num
    plot (x,y)
    xx ← y - sign(x) × [abs(b × x - c)] ^ 0.50
    yy ← a - x
    x ← xx
    y ← yy
```

The **abs** function is obviously there to avoid square roots of negative numbers, and it looks as though the **sign(x)** term is just to get back the information lost by **abs**.

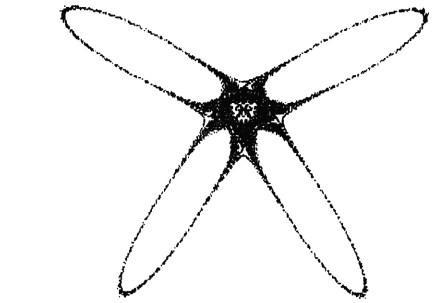
It turns out that this algorithm can be changed in apparently drastic ways without losing the character of the fractal images it generates. At first I thought that the square root term had to be replaced by a function which behaved in a similar way (that its graph had to be curved, concave down, and go through the origin) such as arctan, or log(1+abs( )). In fact just about anything seems to work, although sometimes the useable ranges of *a,b* and *c* are limited. It is even possible to use a linear function, making the mapping affine except for the **sign** term.

The sign term is the key to the whole thing. Without it the algorithm either disappears off to infinity, converges to a point or produces something fairly mundane like a circle. When it is included it makes it possible for the algorithm to jump from one path to another. Rounding errors do the rest.

The images are produced using the linear function, i.e.:

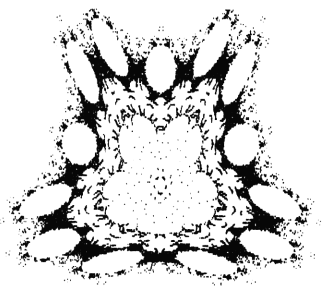
```
input num
input a,b,c

x ← 0
y ← 0
for i ← 1 to num
  plot (x,y)
  xx ← y - sign(x) x (b * x - c )
  yy ← a - x
  x ← xx
  y ← yy
```

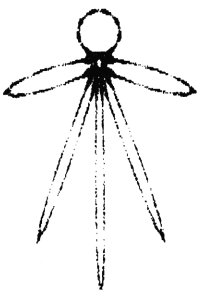


a = 1 b = 0.5 c =-5 mag = 0.5

a = 1 b = 1.27 c =-0.2 mag = 10

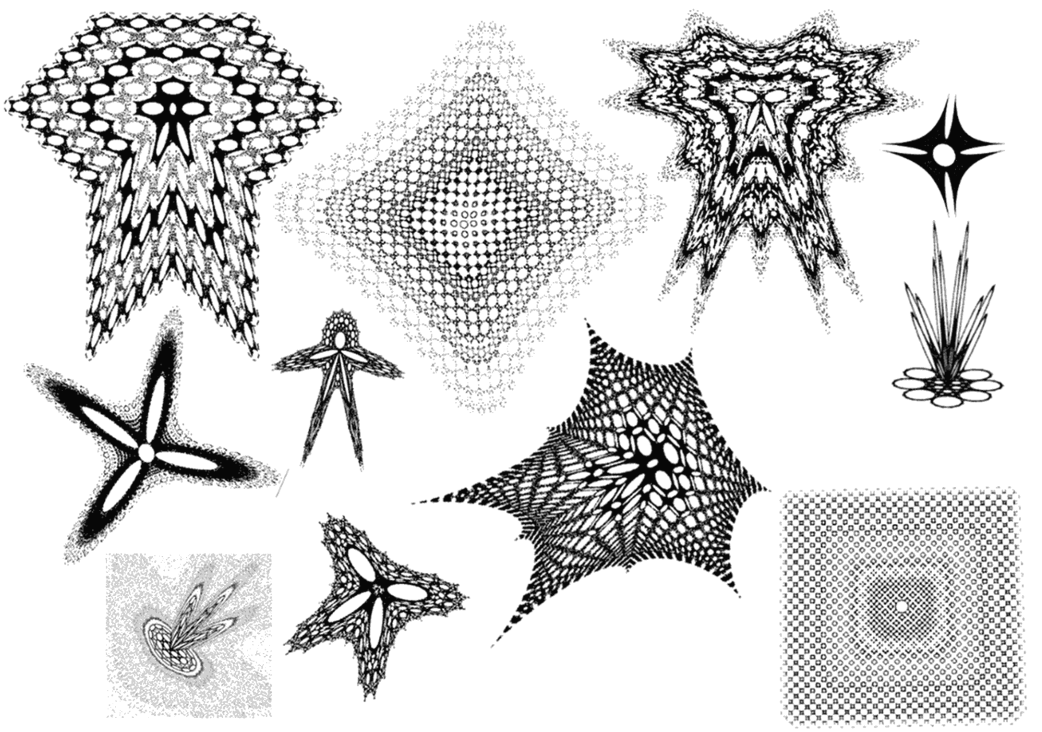


a = 0.7 b =-0.7 c = 2 mag = 3



a =-2 b = 1.5 c =-0.2 mag = 1

2023 update- Magazine scanned 2023 by Stephen Shaw. Here are some images I have produced using this lovely algorithm:



Fractals on the Apple II Series

by J.R. Parkes

Please find enclosed a quick review of the only two Fractal programs for the Apple II series of computers.

At the moment I am attempting to learn TML pascal, and write my own fractal program for the Apple II GS, its hard going.

To this end please can you help by explaining 'distance estimation' as written by Larry Cobb in issue 0 page 14 and how it would be added to Mr Provens GWBASIC program in issue 4 page 12, so that I can see how to implement it.

a) FractalsGS version 1.1 ShareWare.

This program, written in TML pascal, only offers Mandelbrot plots at this time (Julia plots being dimmed (not usable) in the pull down menu). It is written by Steven Disbrow (EGO Systems), copyright 1987 - 1989.

Since there is no contact address, I can't give details of how many bits of precision the maths goto, if he has used the built in Apple SANE unit (Standard Apple Numerics Environment) there is a choice of 32 bit, 64 bit or 80 bit maths. It uses a 320 by 200 screen with 16 colours including black.

As for speed....

	Full Mandelbrot	Zoom view
x Coord	-2	-1.3906
y Coord	-1.25	-4.875 e-1
x Range	2.5	7.10937 e-1
y Range	2.5	9.75 e-1
No Iterations	100	100
Time	4H 39M 24S	7H 35M 25S

As you can see its painfully slow.

b) Fractal Explorer by ECLAT MicroProducts, Miami, Florida.

There are three versions of this program available,

i) Apple II (screen 280 x 191 6 colours including black)

ii) Apple //e,c (screen x 560 by 191 14 colours including black)

iii) Apple II GS (screen 320 x 200 16 colours including black)

The program is sold as an E-Z to use entertaining fractal creation program, drawing both Mandelbrots and Julia sets. It comes with a slide show and eighteen pre drawn pictures which it displays, cycles through the colours, converts into sixteen gray scales and cycles through them again.

The main problems with this program is that you can't find the co ordinates from a completed picture and that you can't enter co ordinates, all pictures are created by positioning a zoom box on an already drawn picture.

The program is written in BASIC with machine code routines for the maths and plotting sections. The number of bits used is adaptive,

it begins with 24 bit signed binary arithmetic, 8 bit integer and 16 bit fractional part, and is increased by 3 bits (to correspond to the times eight zoom box) each time a picture is zoomed, until 64 bits are reached. The maximum number of zooms is 255. The number of iterations is also adaptive, it starts at 32 when the full Mandelbrot is drawn and is increased by 16 for each zoom until the limit of 255 is reached.

While the user can't get to the co ordinate data it is stored in the picture file and is used by the program to work out the various functions when pictures are stopped and then continued or when new pictures are created. There are two points which I have found which slow the program down, it checks after EVERY pixel to see if a key has been pressed and if so will carry out the function which includes stepping the colour palette, exclusive OR palette, colour complement screen pixels or detecting the escape key to jump back to the main menu!

While the new pictures are being drawn it will not save the data until the picture is complete, you can interrupt the program and save the data and then restart the program. As for speed, again it is slow.

Out of interest there are now two ways to increase the speed of the Apple II GS which ticks over at 2.5 MHz, the first was TransWarp GS, an accelerator which runs at 7 MHz, or with new hot of the production line chips at 13 MHz. The other method is by using the Floating Point Engine (a 68881 Co processor) which works likes the intel 80x87 Co processor. All very nice but we are talking about $250 each.

A Brief Note on Time

by John de Rivaz

As so many of the letters I send and receive contain some comment about lack of time for various fractal projects, I thought I'd include a brief note of how a future technology could revolutionise life by control of time. If you think that the very idea of the control of time is the ravings of a lunatic, then I suggest that you read *New Scientist* 28 April 1990 pages 57 – 61 *Wormholes, Time Travel and Quantum Gravity* by Ian Redmount. This suggests theoretical grounds for considering that our universe supports time manipulation. My concept, first published in *The Immortalist* in December 1989, appears below:

It has been said that if anything can be imagined one day it will be done. Something that has been imagined by fantasists and science fiction writers is the time destructor, but most rationalists would regard the concept as nonsense.

A time destructor would be a device that enables the user and everything within his area of influence to move through time slower than the universe as a whole, thus he would be able to get more done than those around him. In a way, tools are time destructors, for example a man with a mechanical digger can move far more dirt than one with a pick and shovel, who can move more than one using only his bare hands. However a true time destructor would be far more than a simple tool. To someone using it, the rest of the universe would appear frozen whilst he caught up with whatever he was doing. H.G. Wells wrote of *The New Accelerator*, being a drug that speeded people up, and a recent *Twilight Zone* story featured a mechanical device.

But is this idea basically impossible? It depends on whether time has one or more dimensions. Some say that there are an infinite number of dimensions (why stop at 4?) If this is the case, then maybe what we regard as time are all those dimensions from four up. If time has more than one dimension, then a time destructor would be possible, as when activated the user would simply be creating more time for himself and the selected task in another dimension.

A more serious difficulty is the energy consideration. It may require very large inputs of energy to operate a time destructor. All ideas for time travel devices, such as the one reported recently in *The Immortalist**, require the movement of astronomical objects through space – hardly projects for the average individual to use in his own home. However these concepts do show that maybe it could be done one way, andif it can be done one way them there is always a chance it can be done another.

A difficulty that has been touched upon by science fiction writers is that anyone using a time destructor would age according to their body time, not the universe's time. Therefore to a bystander although they would appear super efficient and unflustered, they would age quickly. Of course the complete absence of stress (practically all stress is time – related, or at any rate could be relieved by a time destructor) would lengthen body – time lifespan measurably, but nevertheless if they used the device a lot they would age quickly to an observer. However this difficulty is more apparent to our level of technology, as one capable of making a time destructor would most likely have conquered ageing long before.

In a society where time destructors were commonplace, individuals would live in their own universes, connecting to the common time – stream only when they needed further input from others, or to present the results of whatever task they were performing.

This would be in complete contrast to the present world, where devices like the telephone and cell – phone allow others to intrude upon our lives, regardless of whatever we are struggling with at that moment. An interesting corollary to people living in "the time age" would be that if you wanted to contact someone and he was in his own "time – bubble" you wouldn't have to wait for him to come out of it, as he would leave it at the same instant he entered it, according to the main time path. As long as you were on the main time path yourself, then you can contact your friend.

*Similar to proposals in *New Scientist.*

Equation Stability

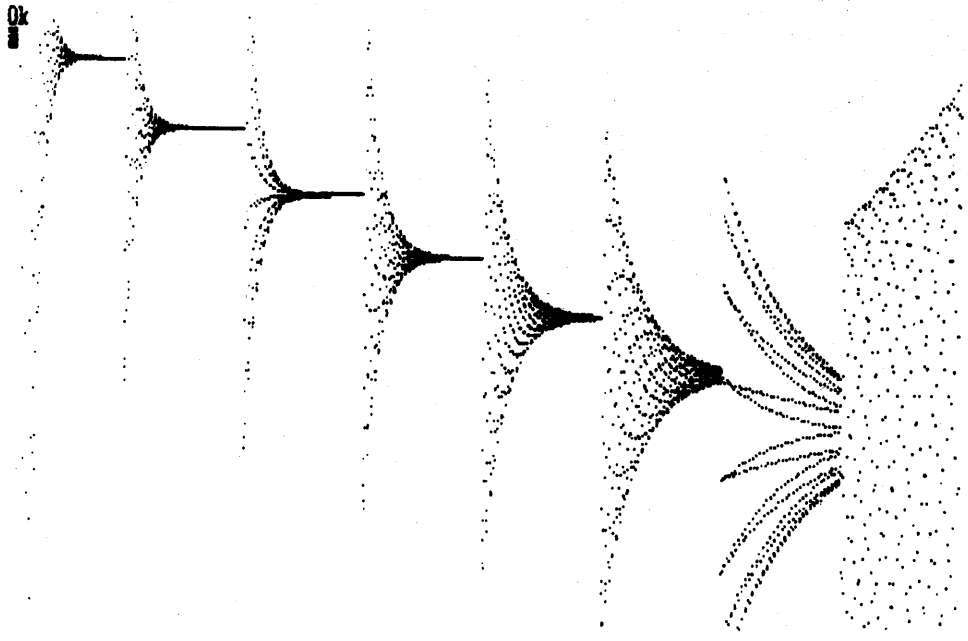
by F.E. Alexander

My investigations into the stability of the two familiar equations: xn=xv*xv-yv*yv+c
and yv=2*xv*yv+d
using 'Lightning Basic' on a PCW, may be of some interest.

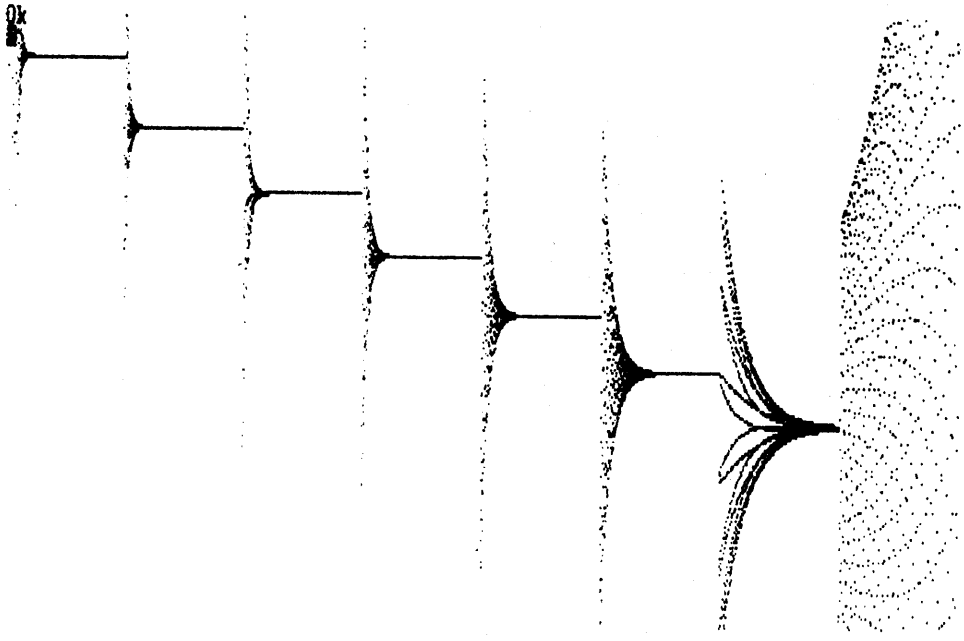
1 (a+b) Show the effect of incrementing c with different numbers of iterations, xn driving the Y axis . The X axis being given a linear incrementation.

2 (a+b) Show the results of similar c incrementation but now driving the X axis with yv.

Both show the increasing instability of the equations within the limits chosen



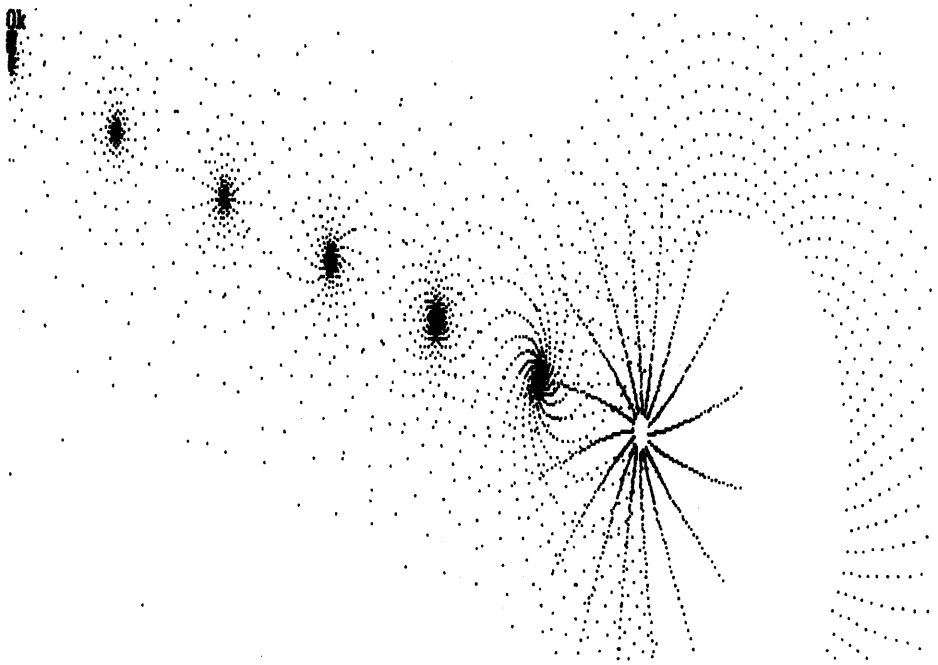
1 (a)
Primary
iteration 6.



1(b)
Primary
Itration 20

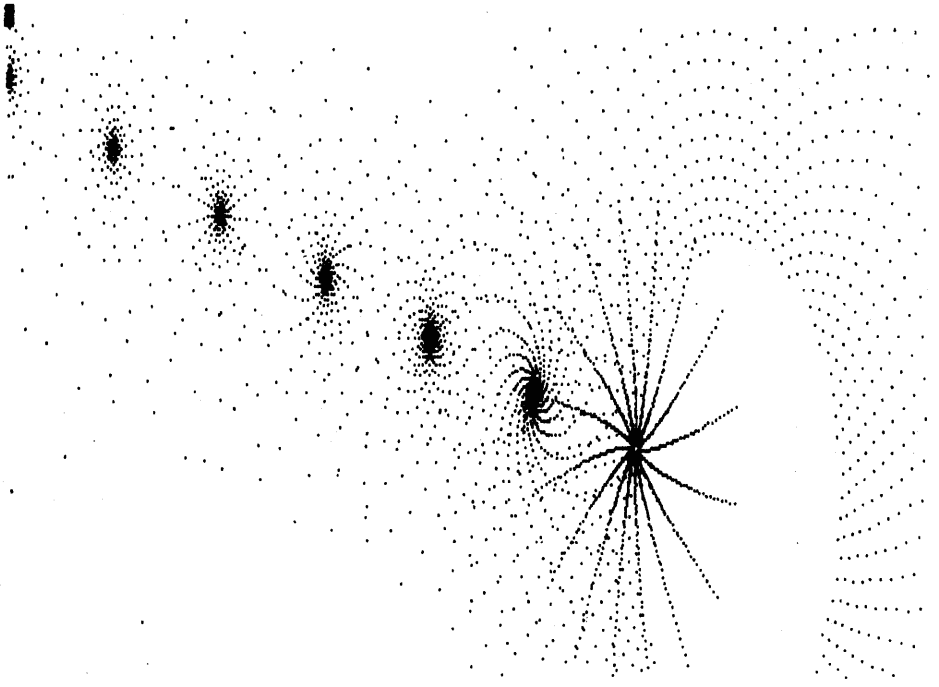
```
LIST 1
10 LEB c:LEB xm:REM (screen clear)
20 x=0:xv=0:yv=0:c=0.277:d=0.015
30 FOR b=1 TO 8:REM (c incrementation)
40 FOR a=1 TO 90:REM(secondary iteration with x incrementation)
50 FOR i=1 TO 6:REM(primary iteration)
60 xn= xv↑2-yv↑2+c
70 yv=2*xv*yv+d
80 xv=xn
90 y=(xn-0.455)*29000:REM (scale screen)
100 IF y<240 AND y>10 THEN LEB p,x,y:REM (printing)
110 NEXT i
120 x=x+1
130 NEXT a
140 c=c+0.0013
150 NEXT b
160 END
```

```
LIST 2
10 LEB c:LEB xm:REM (screen clear)
20 x=0:xv=0:yv=0:c=0.277:d=0.015
30 FOR b=1 TO 8:REM (c incrementation)
40 FOR i=1 TO 900:REM(primary iteration)
50 xn= xv↑2-yv↑2+c
60 yv=2*xv*yv+d
70 xv=xn
80 x=(yv-0.17)*23300:REM (scale screen)
90 y=(xn-0.455)*29000:REM (scale screen)
100 IF y<250 AND y>5 AND x<700 AND x>2 THEN LEB p,x,y:REM (printing)
110 NEXT i
120 c=c+0.0013
130 NEXT b
140 END
```



2(a)

Iteration 400



2(b)
Iteration 900

F. E. Alexander.

NOTHING BUT ZOOMS!

Nothing But Zooms is a video produced by Homer Smith of *Art Matrix* at the Cornell supercomputer facility. It consists of 30 minutes of eleven mind-blowing colorful trips into the Mandelbrot set, which used over $40,000 of supercomputer time to create. The zoom sequences are accompanied by synthesizer music scored explicitly for this video, by turns sprightly, comic, pompous, but always appropriate.
Each of the trips consists of a zoom toward a specific point near the Mandelbrot set.

1. The target of this first zoom sequence is a point near a bud on the zipper in the south crevice between the head and the topknot of the Mandelbrot set (see Amygdala #5, page 2). A yellow prominence becomes the end of a yellow archipelago in the midst of a blue sea. Further expansion reveals a tiny $\mathcal{M}$ surrounded by golden spirals: 8 of them ... 16 ... 32 ... A tiny $\mathcal{M}$-jewel in a golden setting.

2. The target is the extreme tip of the branch near –0.2+1.1i. The zoom is apparently an attempt to elucidate the structure of the extreme tip. Like the effort aimed at –2.0 in *A Journey to the West* (Amygdala #5, page 2) this effort to discover the structure of the singularity at the branch tip is thwarted by a comical and illuminating evasion. The effort to "see" the tip of the branch reveals a twig, angled 30° counterclockwise from the parent branch. In and in we bore: nothing appears but a series of twigs, each expanding to a branch, the next twig merely rotated 30° CCW from the parent, ghostly shrouds of blue being cast off ... On and on until a full circle of futility is achieved. Why go on?

3. The target is on the north arm bud, the left crevice between it and the main body ... a tiny zipper bud on the body ... eyes and a seahorse tail ... in, to the lower left of the eye, center to one of the ants making up a spiral arm, background yellows and blues explode into view ... headed toward the tiny expanding end of a tiny seahorse curl.

4. In toward the utter West, blue left, white right ... toward a midget ... eight white petals. The spike of the midget ... a midget on the spike ... toward an even smaller midget ... vaulted blue and white arches ... an $\mathcal{M}$ surrounded by white rays. Beautiful!

5. A new view of the journey undertaken in #4, showing the details not as colors only, but as elevations on a topographical map, magenta $\mathcal{M}$s appearing as rainclouds floating above the ground, raining down into the heart of an active volcano.

6. Starting at the archipelago of #1, zooming into a golden double spiral — not to its center, but to a structure on one arm, a quadruple spiral expanding from a violin-f, in the center a tiny replica of the outer structure, but an 8-spiral and, inevitably, another tiny $\mathcal{M}$ in the molten crucible's heart.

7. To the strains of a harpsichord, the north crevice between body and head. The main body zipper, bud, eye and seahorse tail ... blue and orange. In toward the eye ... a blot at its center, unresolved at the iteration limits used — an unresolvable singularity. Splendor of seahorse tail and spiral arms.

8. Carnival music accompanies a journey starting at the dual crevice south. A bud on the head ... heads of grama grass like question marks — a faster zoom this time. Buds within buds, each radiating grama heads. In to a double spiral grama head. In and in toward the heart of the spiral ... Off toward one of the sides, ... finally an f with quad arms.

9. Starting with the Big Picture; centered on the south crevice between body and head. In to a sub-sub bud on the bud ... A seahorse tail, blue against pale yellow-green. A tiny tail on the tail, an orange sun below. Tails on tails on tails ...

10. Another crevice, north, between body and head? Moving in toward a bud on the body ... toward a crevice north on the bud ... a hawk's head and upper body ... similar substructure ... sub sub sub ... Elephant trunks ...

> So, Nat'ralists observe, a Flea
> Hath smaller fleas that on him prey;
> And these have smaller fleas to bite 'em,
> And so proceed *ad infinitum.*
> — *Jonathan Swift*

11. Starting once more with the Big Picture. The south crevice between body and head ... a bud in the body zipper, scintillating pale yellows and blues ... a sub-crevice between bud and body ... a seahorse tail ... black blots in the interior of the tail ... a central $\mathcal{M}$ in a shimmering setting.

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Box 219, San Cristobal, NM87564, USA.

Bifurcation Diagrams: A Detailed Look!

John C. Topham

When looking at one dimensional systems I was struck by the suddenness of the onset of chaotic behaviour when the 'growth parameter (r)' increased beyond a certain value. For example, look at figure 1 to see a classic bifucation diagram or doubling scenario of the system: $x_{n+1} = r*x_n*(1 - x_n)$. We see that around approximately 3.57 chaos takes over!

What intrigued me was why this behaviour appeared to be so stable when the value of 'r' was just little less than approximately 3.57 and to be so erratic when 'r' increased slightly beyond 3.57. I thought that the only way to partly resolve this enigma is to take a closer look just at that region.

According to Peitgen and Richter (1), regions of stability, i.e. when 2^n points are plotted, shorten progressively as 'r' increases. They shorten, in fact by a ratio of approximately 4.67:1. In figure 1 you can see that this ratio eventually makes the regions merge into one fuzzy chaotic region i.e. after 3.57. When I drew the more detailed the graph I chose a type of logarithmic scale that mirrored this ratio. Consequently it decreased the step size (the incrementing of 'r') as 'r' increased.

The result is shown in figure 2. Other results are shown subsequent to figure 2. What you see is no longer a chaotic jumble of dots but dots that seem to line up into pathways that oscillate. This oscillation seems at first glance to be chaotic themselves, but on further inspection patterns of symmetry emerge. All the pathways seem to a dance together sometimes completely crossing each other, sometimes only a few of the lines crossing together. Various other synchronised oscillations can also be found.

To make this image easy to inspect I let the equation iterate only twenty times and plotted a further twenty points. Had I let it go on further and let more points be plotted, more pathways would be drawn and these would swamp the image. Of course, a higher resolution pixel system would resolve these pathways.

To further enhance the resolution of the pathways I put a facility into the program to stop the logarithmic step scaling on the x-axis ('r' scale) half way through the drawing of the picture, and let it carry on with a linear scale having a step size the same as the last logarithmic step size. This allowed the last few oscillations to be seen more clearly.

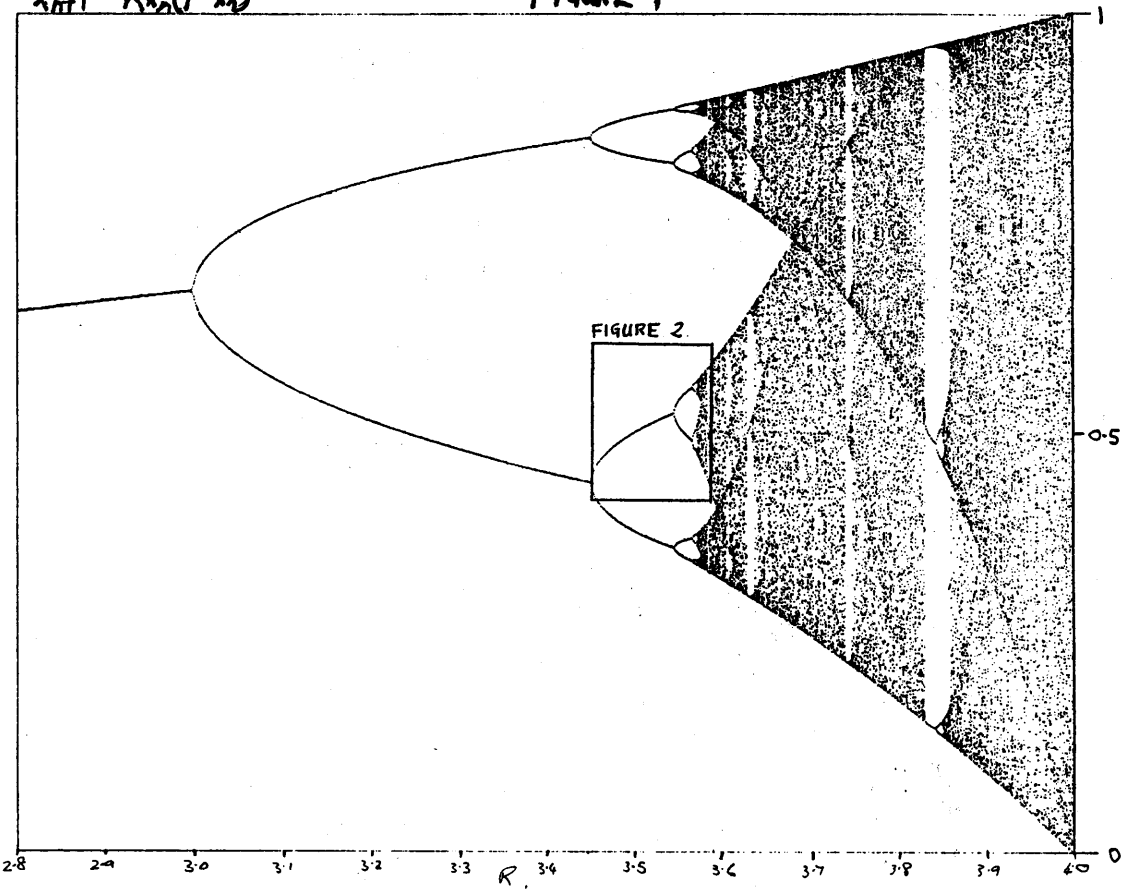
A listing of the program I used is given at the end of this article. It is for the Sinclair QL computer written in Superbasic which is roughly the same as ordinary Basic. If you can read BBC Basic you can read Superbasic. I have kept the peculiarities of some of Superbasic to a minimum.

References:

'The Beauty of Fractals', (H.O. Peitgen, P.H. Richter), Springer-Verlag 1986.

X_{n+1} $RX_n(1-X_n)$

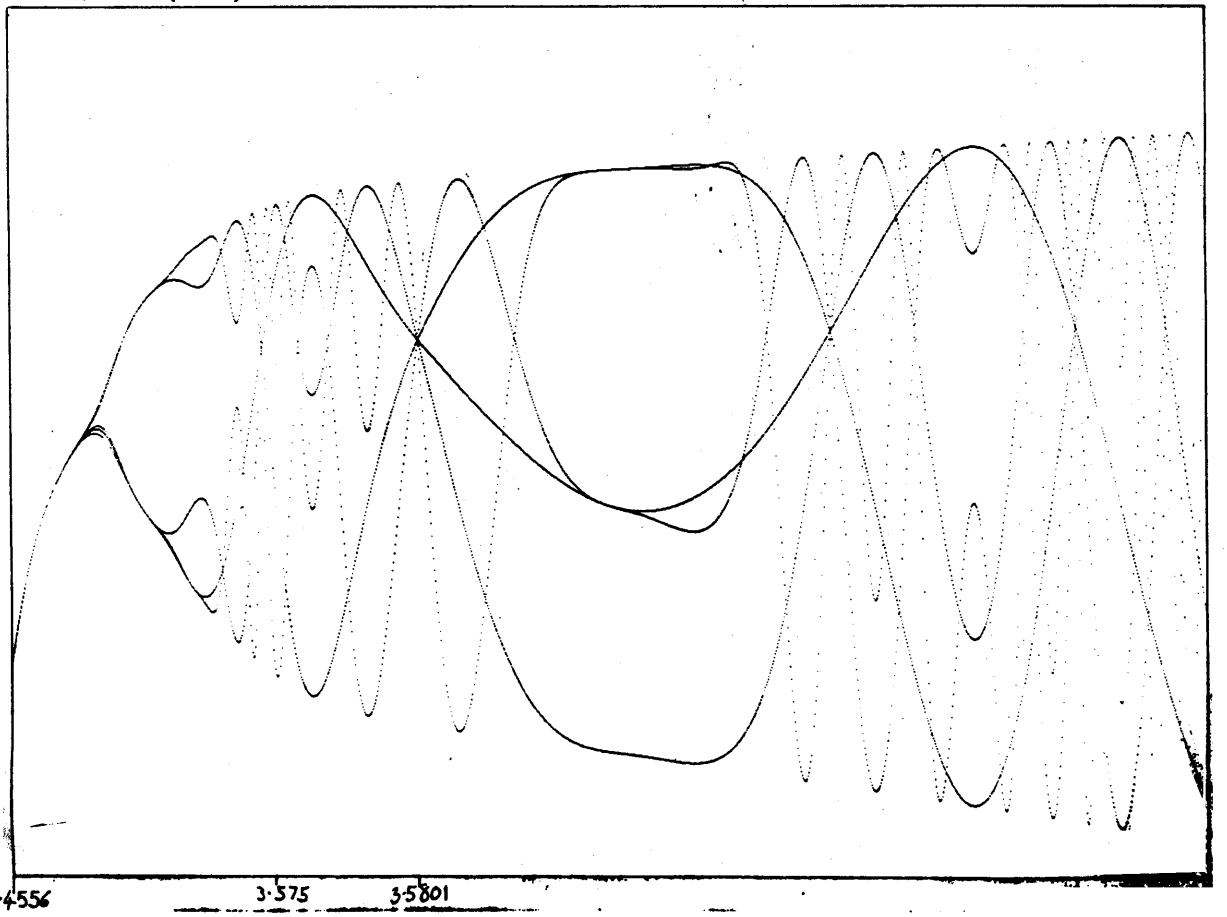
FIGURE 1



$X_{n+1} = RX_n(1-X_n)$

FIGURE 2

K= 1500 : f= 101



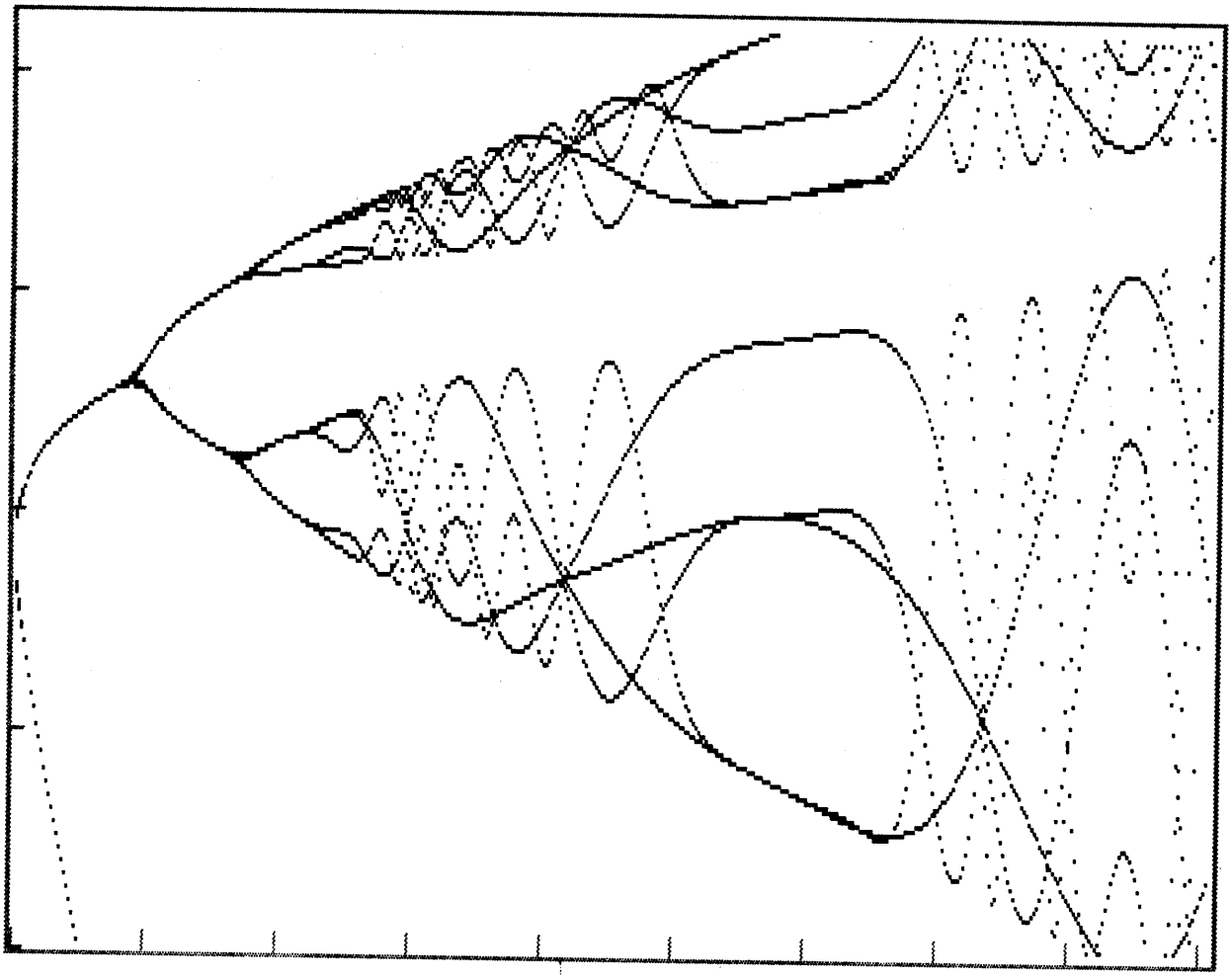


FIGURE 3
========

This is similar to Figure 2. It shows the upper two branches of Figure 1. It starts at 'R' equal to 3 and ends at approximately 3.58. You see ten pathways. It seems that if you plot twenty plots they will be divided evenly across the four branches but intriguing they will divided unevenly across the next set of eight branches. Had further point been plottted more pathways would be revealed and and higher resolution system would be necessary.

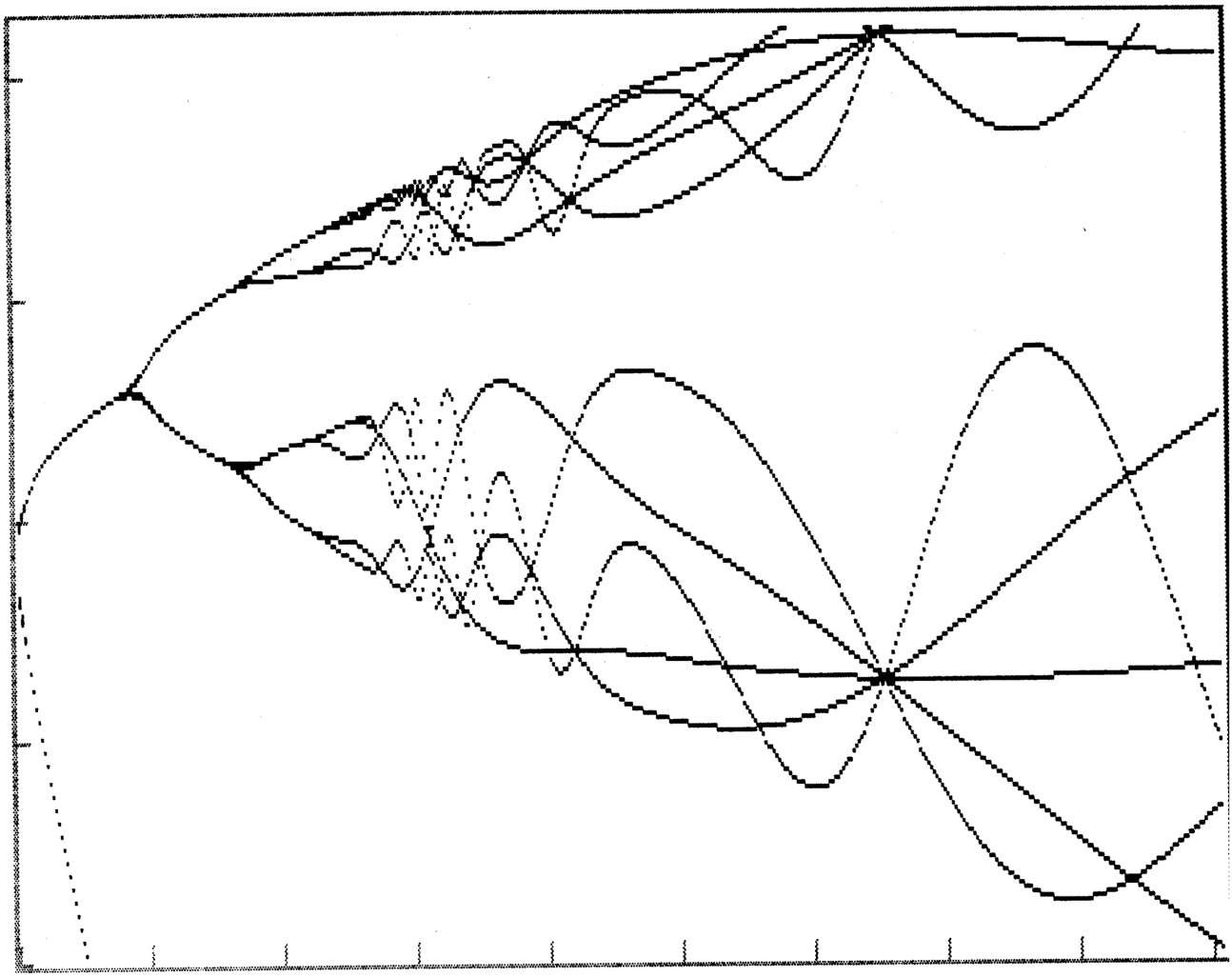


FIGURE 4

This is similar to Figure 3 except it shows the first portion a little more clearly.

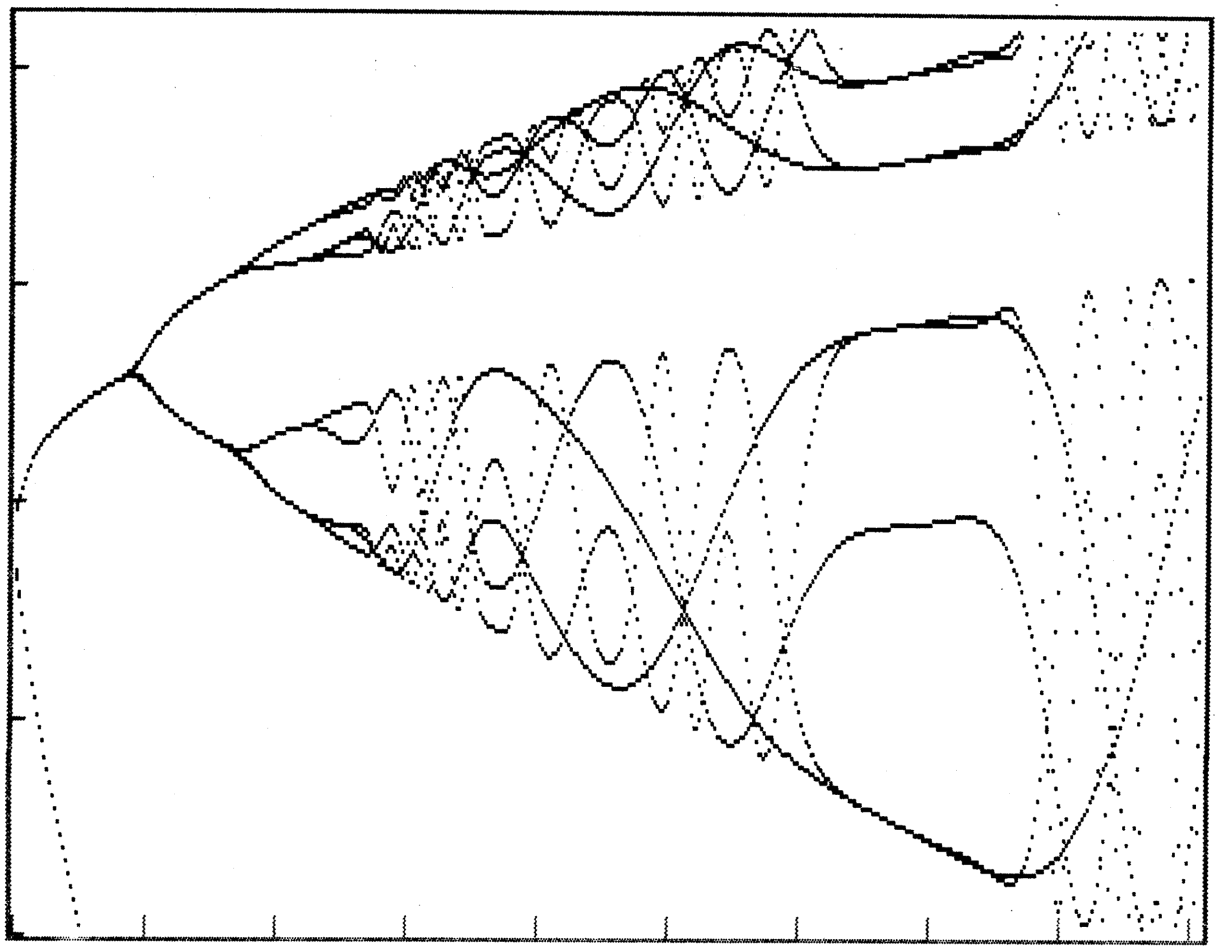


FIGURE 5
========

This is again similar to Figure 3 except instead iterating the equation for 20 times first of all and then plotted 20 points, I iterated the equation for simply 25 times first and then plotted a further 20 points. You see more oscillations before the point where it gathers together into 3 lines. It can be supposed that if more initial iterations took place first, still more oscillations would be packed into the region before it gathers into 3 lines.

It can be further supposed that the 3 line group is the first of the gaps shown in figure 1. A more distinct one is shown at the value of 'r' equal to 3.83 to 3.84.

```
100 REMark    ****      CHAOS EQUATION: X(n+1)=R*Xn*(1-Xn)        ****
110 REMark    **** PERIOD DOUBLING SCENARIO OF ABOVE EQUATION    ****
120 REMark    ****          Using Extended X-Axis Scale          ****
130 REMark    ****           Written by John C. Topham           ****
140 :
150 REMark    ****                 Various inputs                ****
160 REMark    ****  I used; iter=40:thres=20:s=4.63:lin=210      ****
170 :
180  MODE 4:CLS:CLS£0
190  DIM a$(10),b$(10),s$(10)
200 :
210  AT 5,5:INPUT"Number of iterations: ";a$
220  IF a$='':STOP:END IF
230  iter=a$
240 :
250  AT 8,5:INPUT'Threshold number:   ';b$
260  thres=b$
270 :
280  AT 12,5:INPUT 'scale factor = ';s$
290  s=s$
300 :
310  AT 14,5:INPUT 'linearisation point(0-454)= ';lin
320 :
330 :
340 REMark    ****       Initialising other constants           ****
350 :
360 INIT
370 :
380 REMark    ****            Loop incrementing 'R'             ****
390 :
400  REPeat loopI
410  R_change
420  IF f*50>454:dump_pic:GO TO 190: END IF
430  ITERATION_SE0
440  IF flag=1:flag=0:dump_pic:AT£0,2,0:PRINT£0,'Stop.....   ':PAUSE:AT£0,2,0:PR
INT£0,'                ':GO TO 190:END IF
450  END REPeat loopI
460 :
470 REMark ****   Equation Iterating and Plotting Procedure   ****
480 REMark ****   Including Vertical Scaling for QL Screen    ****
490  :
500 DEFine PROCedure ITERATION_SE0
510 Xn=.5
520 FOR n=0 TO iter
530   :
540   Xm=R*Xn*(1-Xn)
550   :
560   updn=INT((1+(1.25*f))*(1-Xm)*heit-(f*40))+50
570   IF updn<3 OR updn>211:GO TO 610:END IF
580   :
590   IF n>thres:BLOCK 1,1,f*50,updn,7
600   :
610   IF KEYROW(1)=8:flag=1:EXIT n:END IF
620   :
630   Xn=Xm
640   :
650 END FOR n
660 END DEFine
670 :
```


2023 note: It was common at this time for UK printers to be set to print a £ symbol instead of a # symbol.

```
680 REMark ****      Intialising Procedure For  QL Screen      ****
690 :
700 DEFine PROCedure INIT
710 WINDOW 512,256,0,0:PAPER 0:PAPER£0,0:INK£0,7:CLS£0:CLS
720 INK 5:WINDOW 460,216,32,16:BORDER 1,5
730 FOR i=0 TO 9:BLOCK 1,5,i*50,209,5:END FOR i
740 FOR j=0 TO 4:BLOCK 5,1,0,213-j*50,5:END FOR j
750 INK 7
760 :
770 heit=214:              f=0:q=0
780 a=-.4556/(s-1)    :b=3.4556-a
790 flag=0               :flag1=0
800 :
810 END DEFine
820 :
830 REMark ****      Scaling X-Axis (Incrementing 'R')        ****
840 :
850 DEFine PROCedure R_change
860 :
870 IF f*50>lin:flag1=1:END IF
880 IF flag1=1:R=R+t:GO TO 940:END IF
890 q=s^(-(f-1))
900 pr=R
910 R=b+a*q
920 t=R-pr
930 :
940 f=f+2E-2
950 END DEFine
960 :
970 REMark  ****       Trump Card System Used On QL            ****
980 REMark  ****       To Dump Picture On to Printer           ****
990 :
1000 DEFine PROCedure dump_pic
1010   AT£0,2,0:PRINT£0,'Dump or Go?':DIM er$(5):er$=INKEY$(-1)
1020     IF er$='d':AT£0,2,0:PRINT£0,'Dumping....':SDP_SET 1,3,1:SDUMP£1:END IF
1030     IF er$='g':RETurn :END IF
1040     IF er$='n':stop_SEQ:END IF
1050  GO TO 1010
1060 END DEFine
1070 :
1080 REMark ****                  END                          ****
```

Has this detail been observed before? Can you or any of your readers tell me if there has been any such research done on this? Since the orginal equation was used to model population growth it would be interesting to see if the results I seem to have found could be applied to that model.

PROGRAM TO GENERATE LAND SURFACES

Philip Hickin

I read with interest the article by Mark Datko on Faking Planets (1) and this reminded me of some reference to planet generation in 'The Science of Fractal Images' (2). After some experimenting I settled on the following conditions:

1. Represent the piece of land by a two dimensional array,
2. Generate 'faults' at random positions across the land,
3. Make all the land on one side of the fault line either rise or fall by one unit,
4. Continue this process until a suitable landscape is produced.

Program 1 shows how these conditions were implemented in GWBASIC. The array representing the land was dimensioned 130 by 130 and has the name MAP%(X,Y). The final data in MAP% was saved on disk for further analysis but if this is not required leave out lines 50, 260 and 390.

Lines 100 to 190 and the subroutine, lines 1000 to 1060, generate the required surface. To generate a fault line I used the fact that if a straight line graph has a gradient, G, and passes through a point x_1, y_1 then the equation of that line is:

$$y = G * (x - x_1) + y_1$$

In line 140 a random gradient in the range -13 to +13 (this range was chosen arbitrarily) is generated. The line of this gradient is then made to pass through a point on one of the four edges chosen at random (lines 165 to 180). Also the displacement, either up or down is chosen (line 160). The subroutine (lines 1000 to 1060) then adds this displacement to the section below the fault line.

On my machine, an Apricot F1, each iteration takes about 4.5 minutes.

Lines 200 to 280 find the maximum and minimum levels. The maximum and minimum are used to define the 'sea level' and various contour levels. My machine has four colours; black, red, blue and white numbered from 0 to 3. Blue, of course, was used for all areas below sea level. Lines 400 to 500 plot out the map on the screen. The command on line 480 draws a 'pixel' with sides of unit length and fills it in (**B**ox **F**ill) with the designated colour.

Although the program took a long time to run, about 18 hours for 250 iterations, the results show remarkably lifelike coastlines. Unfortunately I am unable to print them out.

Program 2 provides a pseudo perspective view of the map by drawing each row of the array starting from the back and working forwards.

The next problem is to try and translate the map onto a sphere but I think this will have to wait a while.

References

1. Faking Planets, Mark Datko, Fractal Report Issue 3
2. The Science of Fractal Images, Heinz-Otto Peitgen & Dietmar Saupe

```
10 CLS                                                    £ = #
20 LINE(0,255)-(639,240),0,BF
30 RANDOMIZE TIMER
40 DIM MAP%(130,130)
50 OPEN "MAP3.DAT" FOR OUTPUT AS £1
100 'produce 250 fault lines
110 FOR ITERATION = 1 TO 250
120   LOCATE 1,1:PRINT ITERATION
130   IF RND < .5 THEN X=1:Y=0 ELSE X=0:Y=1
140   GRADIENT = (RND - .5)*13
150   COORD1 = INT(RND*131)
160   IF RND < .5 THEN DISPLACEMENT% = 1 ELSE DISPLACEMENT% = -1
165   IF RND < .5 THEN COORD2 = 0 ELSE COORD2 = 130
170   IF X=1 THEN COL1% = COORD1:ROW1% = COORD2:GOSUB 1010
180   IF Y=1 THEN COL1% = COORD2: ROW1% = COORD1: GOSUB 1010
190 NEXT ITERATION
200 'find max and min displacements
210 MIN = 1000000!: MAX = -1000000!
220 FOR ROW =0 TO 130
230   FOR COL = 0 TO 130
240     IF MAP%(ROW,COL) > MAX THEN MAX = MAP%(ROW,COL)
250     IF MAP%(ROW,COL) < MIN THEN MIN = MAP%(ROW,COL)
260     PRINT£1 ,MAP%(ROW,COL)
270   NEXT COL
280 NEXT ROW
290 SEALEVEL = (MAX - MIN)/3 + MIN
300 HILLLEVEL = (MAX - SEALEVEL)/3 + SEALEVEL
310 MOUNTAINLEVEL = (2*(MAX - SEALEVEL)/3) + SEALEVEL
390 CLOSE £1
400 'plot results
410 WINDOW(0,0)-(130,130)
420 CLS
430 FOR ROW = 0 TO 130
440   FOR COL = 0 TO 130
450     IF MAP%(ROW,COL) <= SEALEVEL THEN COLOUR = 2
460     IF MAP%(ROW,COL) > SEALEVEL AND MAP%(ROW,COL) <= HILLLEVEL
          THEN COLOUR = 1
465     IF MAP%(ROW,COL) > HILLLEVEL AND MAP%(ROW,COL) <= MOUNTAINLEVEL
          THEN COLOUR = 3
470     IF MAP%(ROW,COL) > MOUNTAINLEVEL THEN COLOUR = 0
480     LINE (COL,ROW)-(COL + 1,ROW + 1),COLOUR,BF
490   NEXT COL
500 NEXT ROW
510 END
1000 'SUBROUTINE plot random line and add displacement
1010   FOR COL% = 0 TO 130
1020     FOR ROW% = 0 TO 130
1030       IF ROW% < GRADIENT*(COL% - COL1%) + ROW1%
             THEN MAP%(ROW%,COL%) = MAP%(ROW%,COL%) + DISPLACEMENT%
1040     NEXT ROW%
1050   NEXT COL%
1060 RETURN
```

Program 1

```
10 CLS
20 LINE (0,255)-(639,240),0,BF
30 DIM MAP%(130,130),PAINTFORM$(66),LINEFORM%(66)
40 INPUT"Enter height above ground ",VIEWHEIGHT
50 INPUT"Distance from nearest point ",VIEWDISTANCE
60 OPEN "map3.dat" FOR INPUT AS £1
70 MIN = 1000000!: MAX = -1000000!
80 FOR ROW% = 0 TO 130
90   FOR COL% = 0 TO 130
100     INPUT£1 ,MAP%(ROW%,COL%)
110     IF MAP%(ROW%,COL%) > MAX THEN MAX = MAP%(ROW%,COL%)
120     IF MAP%(ROW%,COL%) < MIN THEN MIN = MAP%(ROW%,COL%)
130   NEXT COL%
140 NEXT ROW%
150 CLOSE £1
160 SEALEVEL = (MAX - MIN)/3 + MIN
170 MAXHEIGHT = MAX - SEALEVEL
180 WINDOWHEIGHT = 130/(VIEWDISTANCE + 130)*(VIEWHEIGHT - MAXHEIGHT) + MAXHEIGHT
190 WINDOW (-10,-10)-(140,WINDOWHEIGHT + 10)
200 CLS
210 FOR ROW% = 130 TO 0 STEP -2
220   COLOUR1 = 3: COLOUR2 = 3: COLOUR3 = 3
230   GOSUB 1010 'draw panel and paint in white
240   COLOUR1 = 1: COLOUR2 = 0: COLOUR3 = 2
250   GOSUB 1010 'draw panel and paint black
260 NEXT ROW%
263 PRINT"Viewing height is ";VIEWHEIGHT," and distance ";VIEWDISTANCE;" ";
270 END
1000 'SUBROUTINE draw panel and paint
1010   LEVEL = ROW%/(VIEWDISTANCE + ROW%)
1020   LEVEL = ROW%/(VIEWDISTANCE + ROW%)
1030   SCREENSEA = LEVEL*(VIEWHEIGHT - SEALEVEL) + SEALEVEL
1040   PSET(0,SCREENSEA - 3),COLOUR1
1050   X = -1
1060   FOR COL% = 0 TO 130
1070     HEIGHT = MAP%(ROW%,COL%) - SEALEVEL
1080     HEIGHT = LEVEL*(VIEWHEIGHT - (HEIGHT + SEALEVEL)) + (HEIGHT + SEALEVEL)
1090     IF HEIGHT < SCREENSEA THEN HEIGHT = SCREENSEA
1110     LINE -(COL%,HEIGHT),COLOUR1
1120   NEXT COL%
1130   LINE -(130, SCREENSEA - 3),COLOUR1
1140   LINE -(0,SCREENSEA - 3),COLOUR1
1150   PAINT (65,SCREENSEA - 1),COLOUR2,COLOUR1
1160   LINE (0,SCREENSEA)-(130,SCREENSEA - 3),COLOUR3,BF
1170 RETURN
```

Program 2

2023 note:
At this time UK printers were often set to print a £ symbol in place of a # symbol.

ADVERT

Amiga Fractal Announcement

ADVERT

Fractal Software Services

A series of Public Domain and Shareware fractal related software disks for the Amiga. I have a very large collection of PD/Shareware fractal software, which I am currently arranging onto disks. This is just a fraction of the material I have.

Mandelpicts:(John Shortle) A sideshow of Mandelbrot 3.00 images.

Mandelbrots:(Michael Todorovic) A sideshow of MandelVroom images.

Mandel Gallery 1 & 2 (Under construction)(Cadé Roux) The Mandelbrot Gallery, a two disk set, the first containing a sideshow of eleven interlaced images, the second containing thirteen sample images demonstrating each program in the review contained on the disks.

FractalSample1: MandelMountains V1.1 (Mathias Ortmann), EHBPlasma 1.f(Roger Uizun), Chaos (Richie Bielak), FracGen 1.23(Doug Houck) Mandelmountains uses the CPM method to produce extremely smooth 3 – D plots of the Set. EHBPlasma produces plasma clouds in 64 colours. Chaos produces Hénnon Maps. FracGen is a versatile fractal generator. This disk has a wide variety of programs since it is the first disk.

FractalSample2: Mandelbrot Set Explorer (Thomas Wilcox) This is the original generator for the Amiga. It has very good palette control, which makes for spectacular pictures.

FractalSample 3 & 4:(Under construction): MandelVroom 2.0 (Kevin Clague) These two disks contain everything you need for a full MandelVroom system, source and lots of images for you to play around with. MandelVroom is the most polished Amiga Mandelbrot program in existence, and supports all kinds of features (88020/881, all modes except 4096 colour mode, multitasking, zooming, panning.)

FractalSample5:(Under construction) CPM (Lars Clausen), DEM (Lars Clausen) MandelShow 1.1 (Nic Shulver), Morell CPM is a good 3 – D generator, which has shadows. DEM produces excellent black and white images. MandelShow 1.1 is a standard generator with basic features. This disk will contain a lot more material.

Ordering:

(Cheques/checks payable to Cade Roux)
The disks will all be £2.50/$4.00 each (postage included).

Free services:

1. For a blank disk and postage to the amount of original mailing (UK/US stamps, outside of UK or US no postage required), I will send the requested disk.
2. For a disk containing freely distributable PD or shareware (hereinafter called full disks) I will customise any software I have onto a disk. Please write for a £2/$3 catalogue disk or free printout of the software lists (SASE required).
3. For two full disks, I will send three disks, two of which can be customised.
4. Fractal report readers: FractalSample1 special offer for £2/$3.

Interested in a disk based newsletter? I am starting an Amiga fractal newsletter/magazine of images and programs as well as articles. This will be PD, so all contributions should be allowed to be distributed as part of the newsletter. Anything remotely related to Amiga fractal experimentation is welcome as are reviews of relevant commercial packages, animated sequences and anything fractal. Current plans are for a three disk set at £5/$8, or less if possible. All Feedback to me,

Cade Roux

UK	USA
Gonville & Caius College, Cambridge CB2 1TA	Box 3 COMSCEUR FPO NY 09553 – 2000

The first disk of my Mandelbrot Gallery is now complete, but since I last wrote to you, I have come into possession of many more programs, so it may take longer than I expected to finish the second disk off, which will contain an image from each program. The number of programs covered by the review is now thirteen, about ten of which are really important offerings. Unfortunately, I have given up on having it published in hardcopy by anyone, since it is now more than ten pages long. There is, however, an accompanying comparison chart, which will only be about three pages long (I am working to shorten it), which may just be suitable.

Because of the phenomenon of a large amount of Amiga software which is getting bigger and better by the day, I have decided to start some sort of exchange amongst Amiga users. I feel there are enough Amiga users interested in fractals and related topics to support a disk-based exchange of pictures and programs as well as the odd article. All this is laid out in the release announcement enclosed. I have also enclosed a little bit of artwork which I put together using MandelMountains V1.1 by Mathias Ortmann, and then touched up in Deluxe Paint III. It does not do justice to the original images calculated using the Continuous Potential Method.

I am very interested in making a short (it will have to be!) animated zoom sequence in 3D, and would be glad of any advice from readers. The project in mind will use the CPM method and the viewpoint will be allowed to shift, so that one could actually travel round the Set always looking at some point within the Set or at a moving point. This is very ambitious, I know, but 10 seconds is all I am hoping for (150 or 300 frames at 15 or 30 frames a second).

I have ordered a commercial program, FractalPro, which generates 4096 color images and animated zoom/pan sequences, which is supposed to be spectacular. I shall write a (short!!) review for Fractal Report when I get it.

All my services outlined in the release announcement are only for freely redistributable PD/Shareware, and I will not deal politely with anyone who sends me something which does not expressly state that it is redistributable.

I am very curious about the importance of the Euclidean circle in the standard algorithms used to generate images, and if an ellipse was used as the boundary for the iterated point (with one focus at the origin and one between the origin and ±2 depending on which Mandelbrot you are using [left- or right-handed]), how would the image be different. I imagine this makes it harder for points which are more 'towards' the major axis. Do you know anything about this, or do any of the readers of Fractal Report?

Issue 8 was excellent, and looking at the editorial, I see that you are buying a VGA-video converter. I was recently reading the AmigaWorld Desktop Video and Animation Special Issue (brag brag), and a lot of readers had questions about recording individual frames. I quote from the magazine:

"In single-frame recording, the accuracy of your video recorder is very critical. Unfortunately, no industrial VTRs are capable of 100% accuracy. If you are serious about single framing, the Sony 9850 3/4-inch edit/recorder with time code is currently the lowest-cost alternative (approximately $7000). Your animation program should be able to send a signal through its message port when it has completed rendering an image. That signal is received by controller software, which then signals the VTR to record the graphic for a specific number of frames."

I figure the best way to put the animated sequence on tape is to take a BIG hard disk and play them all back as fast as you can while recording in real time, or take that old useless Cray out from under your bed and set it to work. Good luck, and I will probably buy a PAL Amiga system just so that I can get an animated fractal sequence on the Fractal Report Video.

ADVERT

Editorial

Fractal Report – The Video

I have had a few letters expressing interest in this project. However whether I myself am going to find the time to make any videos I don't know. Undoubtedly some of you will, and indeed one of you already has. This will certainly be a long term project, but if the results are pleasing enough could prove very worthwhile. Larry Cobb once pointed out that if you add together all the computing power of readers' computers you'd get something approaching a supercomputer, so theoretically it would seem that we could put together something of value given the time.

Oxford University student Cade Roux in a letter published in this issue points out that single frame video recording may not be as easy as it sounds, but I do know that time lapse camcorders exist, and it may be possible to connect an external signal into one of those. Also time lapse monochrome video recorders exist for surveillance purposes, and sometimes appear on the surplus market for about £80. They use 0.5" reel tapes, and a tape that plays in one hour can be recorded over 48 hours, giving a substantial speed up. I am only sorry I never snapped up the one I saw advertised, because I haven't seen one since. However they do exist!

Fractal Music

After an initial dearth, we seem to have come across a few examples. This time we are offering a cassette and compact disk, and an order form is enclosed. The disks will be ordered from America as required, so unless you are really desperate for a CD, I would recommend the cassette. Surface mail shipments form America are notoriously slow as those of you waiting for *Nothing But Zooms* videos will know. The audio cassettes should be available as soon as initial demand is known, as they are produced by our local firm who are very quick and efficient. However the fact that the musicians have taken the trouble to make a CD, which is very expensive, indicate that they feel sure of their product.

We also know of a local pop group, with both male and female lead singers and various instrumentalists, who have adopted the Mandelbrot Set as their icon. However they have no computer and aren't practical fractal enthusiasts, although some of their instrumental music does appear to have the "same but different" fractal quality. Karen feels that although the music is good *Fractal Report* readers won't be interested, but I may offer a cassette at a later date if no further computer generated music appears. Certainly if your preference is for rock music you may well prefer their cassettes to our previous offerings. (Do not confuse this with the above offer – the pop cassette isn't on offer this time.)

Call For Articles

At the moment our article file is almost empty, so new articles are sought for issue 10. To remind contributors, the ideal size is two A4 pages camera ready, including some lines of BASIC that describe the basic process being discussed. Please bear in mind economy of space. Past events have revealed that mistakes can emerge even during paste – ups, so the only way of being sure it goes in exactly as you want it is to send it in a suitable form! There is no need for menus and frills in BASIC . In addition if contributors are using PCs, the text on a 5.25" (only) disk would be appreciated as it would enable me to laser print it.

A 3.5" debâcle

A number of people have sent me 3.5" disks. In order to accommodate readers who didn't read my previous editorial about not my having a 3.5" drive and who continue to send these disks I recently bought a drive which broke my controller. In view of the aggravation of this, I have decided not to install a 3.5" drive, until I have more time, and therefore cannot accept these disks. Many thanks to all those who kindly send me programs on these disks, but I am afraid that I cannot use them.

Announcements

New Newsletter

Mr Andy Lunness has sent us issue 1 of his newsletter *Chaos and Complex Cartography.* Its motto is *Eadem mutata resurgo* – "I shall arise the same though changed". (More suited to a cryonics society, I should have thought! *Tempus Hostilis Est* would be a good motto for *Fractal Report*, judging from the number of letters I receive and send detailing ambitious projects abandoned through lack of time.) UK subscriptions to 6 issues of *Chaos and Complex Cartography* cost £7, and the overseas cost is £11. (Cheques to "C&CC") They hope to get six issues out each year, but ask readers to be patient if this time schedule is not adhered to. Subscriptions last for six issues regardless of when they appear. He says that he doesn't aim to rival *Fractal Report* but to compliment it with articles on the more theoretical side of chaos and fractals. Computer programs as such won't be published, but algorithms will be given. These are relatively easy to transfer into computer programs if you have a structured BASIC like the QL's Superbasic, or the PC's Turbobasic. Those of your familiar with *The Science of Fractal Images* will know the format these algorithms take. Of course they have the advantage that they are not machine specific, but the disadvantage that there is no absolute check that they work!

Issue 1 has three main articles. The first is an introductory article by Mr Lunness which introduces the reader to the terminology and presents some simple but interesting examples. The second is a review of James Gleik's *Chaos – the Making of a New Science* and the third an article on drawing fractals from Newton's Method for solving cubic equations. Not mentioned in the contents list there is also a tutorial on the mathematics of complex numbers, and a mathematical proof of the symmetry of the Mandelbrot Set. The newsletter is the same size as *Fractal Report*, and all the articles are retyped so as to be in the same typeface. This is nice to look at, but runs the risk of causing extra errors to creep in, particularly when mathematical equations are given. Also it is highly consumptive of editorial time that may be better applied elsewhere.

At the printing of the first issue Mr Lunness only had ten supporters, so those of you wanting a more theoretical and mathematical approach may well find his newsletter worth encouraging as a compliment to your *Fractal Report* subscription. I can't see it lasting very long unless it is supported better than this.

With regards to his article on de Moivré's theorem, he says that it will work for any positive or negative integer. He also states "It is also valid for fractional powers. However the result maps itself onto a Reimann surface, not the complex plane. Rendering this surface onto a plane is a complicated affair which I cannot do, hence the discontinuities. It is also possible to have a complex

power. However the maths is very complicated and the basis for a future article when I can simplify it a bit."

Fractint

Last issue I lamented the problems at *Personal Computer World* with *Fractint*, a PC shareware fractal program. Mr Adam Case has very generously offered to copy his shareware Fractint 9.1 free to anyone who sends him a blank 5.25" or 3.5" PC disk formatted to low density (ie 360k 5.25" or 720K 3.5") together with return postage. Send disks and postage to Mr Adam Case, 109, Ferry Road, Hullbridge, Hockley, Essex, SS5 6EL. A similar offer has been received from Jo Gedrych, of Rose low, Whimple Road, Broadclyst, Devon EX5 3BX, only he will fill two 3.5" 720K disks with (presumably a longer version of) the program and documentation, or he will supply disks at cost. A number of people also offered to provide the program for a copying fee, but it seemed pointless printing this in view of the above.

I have now tried Fractint, and can assure readers that it is well worth getting. The reviews it has been getting in magazines like *Personal Computer World* are well justified. However you just have to use it as given, it is an .exe file written in a mixture of C and assembler. Although it covers many areas, Mandelbrots, Julias, Lambdas, Newtons, planets and landscapes to name but few, there will always be room for the new programs covered in *Fractal Report*. For example, in version 9.1, higher powered Mandelbrots and Julias were not covered.

Major New Fractal Book

Dr Clifford Pickover has come up with another of his very generous offers to *Fractal Report* readers. He has written a colour illustrated book totalling no less than 400 pages entitled *Computers, Pattern, Chaos, and Beauty,* packed with recipes and algorithms for producing images. Martin Gardner the *Scientific American* computer columnist, said that Dr Pickover has produced a truly stunning survey of the manifold consequences of Chaos and Fractals. Paul Hoffman of *Discover Magazine* says "Dr Pickover takes the reader on a stimulating odyssey through the world of computer graphics, a world that surprisingly involves the Shroud of Turin, snowflakes, and the genes that cause Cancer."

Dr Pickover has offered to answer any queries implementing the programs in the book, but he asks that queries are sent to *Fractal Report* and then sent on to him in a bundle. The reason given is that he doesn't want lots of correspondence arriving at his workplace. I know that we have published his address in his announcements before, so please do enter into the spirit of this. We will probably mail enquiries on a monthly basis, so do not expect any quick response, and it may well be that Dr Pickover will want to analyze the commonest queries so that he can formulate a general reply for an appendix for a future printing of the book. So I would ask readers to be patient.

The book will be available in the UK from Alan Sutton Publishing, Phoenix Mill, Far Thrupp, Stroud, Glos GL5 2BU, for a special pre – publication price to *Fractal Report* readers of £21.50 delivered. This includes £1.50 postage and compares favourably with a publication price of £25. The books measures 246mm by 172mm and has 400 pages with 200 black and white illustrations and 8 pages of colour illustrations. However, to obtain this special price, please mention *Fractal Report* and also please post your order to arrive BEFORE the publication date of 28 June 1990. Those ordering after publication from booksellers may like to quote the ISBN which is 0 862 99 792 5.

US readers are asked to write to Mr Garrett Kiely, St. Martin's Press, 175, Fifth Avenue, New York, NY10010, USA. He will accept credit card orders, and the book costs about $35 with carriage. (At the time of writing the exact price with carriage is not known).

I also understand that *Fractal Report* will be mentioned in this book. This will give an enormous boost to our readership both in the UK and abroad. It will result in an increasing range of material being offered as articles, and should benefit everyone concerned.

As far as I am aware, this book is the first book that is similar in content to *Fractal Report* inasmuch as practical information is given. It is a must for anyone interested in getting these patterns to appear on their own computer screens as opposed to reading what other people have done, without a clue as to how to do it themselves.

A Canadian Fractal Enthusiast Comments

Mr Jon McLaren offers a £25 reward to anyone who can give him the code (for his PC with 8087) that will generate the image on page 57 of the December 1986 *Scientific American.* He also offers source code in 8087 microsoft assembler and BASIC that computes Mandelbrot and Julia sets using only the 8087 registers, and a Landscape program that runs on EGA or VGA that he believes is superior to the one published in *Fractal Report.* He expressed his support of *Fractal Report* authors who concisely explain the maths used and then gives executable code that shows how the maths is converted into BASIC. He cites particularly *Ikeda Map* and *Coloured IFS Tilings* as being good examples of this. He hopes that we will get plenty of articles from post graduate students, and that we will be printing code that enables people to get true 3D images of fractal objects. He suspects that it would be no big deal for such a student to supply us with a "light source z – buffer algorithm". Mr McLaren is certainly keen. He tells me he drove 140 miles just for a copy of *Generation and Display of Geometric Fractals in 3 – D* by Alan Norton, only to be disappointed by the lack of code or enough detailed information to enable him to write it. He also told me how he spent on 'phone calls more than the price for which *Dynamical Systems and Fractals* is marketed in order to obtain a copy. His address is 4384 Bennett Road, Burlington, Ontario, Canada L7L 1Y7.

Certainly I do think it would be useful to have a program module into which one can input x, y, z, and colour which will draw an image illuminated from point x1,y1,z1 with colour(s) c1...cn and be viewed from point vx,vy,vz and have hidden line removal. The module should have universal application, unlike the Mandelbrot and Julia routines that I and others have been working on which rely on plotting particular points first. My suspicions are that such a program will require huge areas of RAM and be particularly unwieldy on PC systems. Hopefully there is some way around this. Such a module could be implemented for a number of different machines and be used by *Fractal Report* authors and readers for different fractals.

Fractal Novel

A science fiction novel based on fractals will be appearing at Christmas from Gollancz and Bantam Books. It features the *Titanic* and the Mandelbrot Set. I cannot wait to find out the connection!

I will publish further details as soon as I am given the go – ahead to do so, but as there is a worst case three month delay between receipt of information and publication in *Fractal Report* many of you who are science fiction enthusiasts may find out before I publish anyway. The main purpose of this note is to save you all wasting stamps writing to tell me about it!