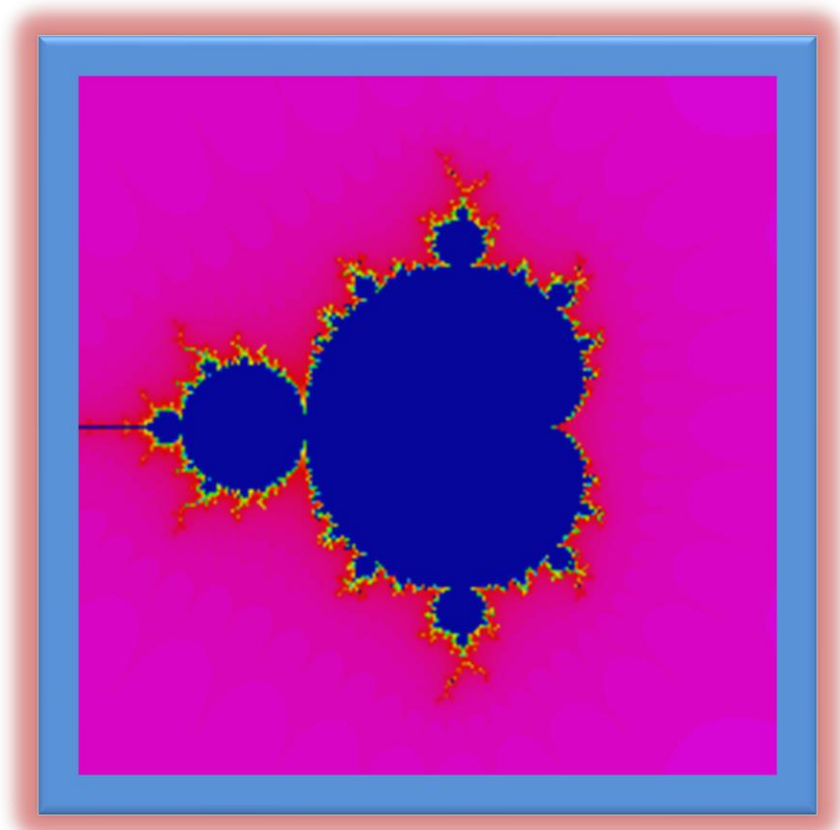


FRACTAL SEQUENCER

USER MANUAL



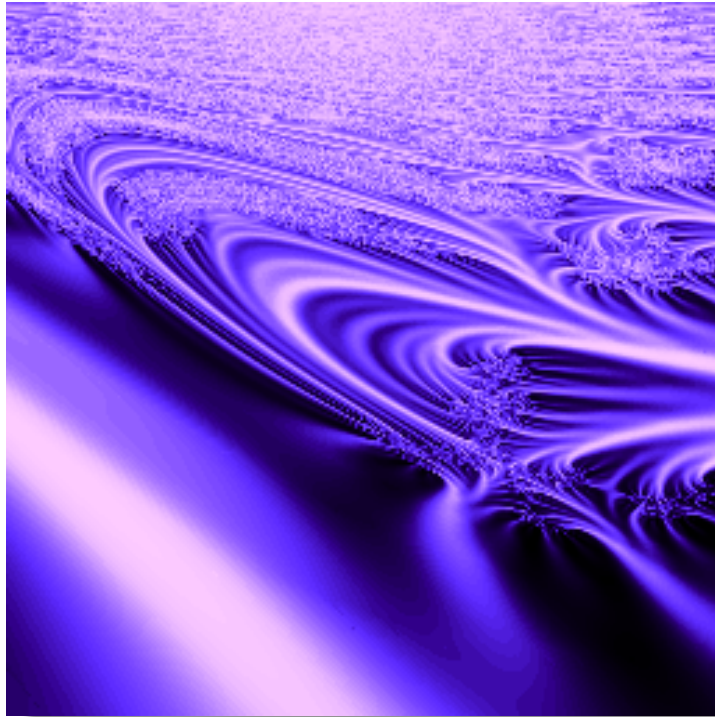
Software Version 4.3.5

Copyright 6th February 2024

By Stuart Pryer

Fractal Sequencer Web Site <http:\\stuartpryer.co.uk>

E-Mail stuartpryer@gmail.com



"A Different Sea"

Looking into the infinite!

Fractals are infinitely complex objects created by simple equations. The equations contain complex numbers, both real and imaginary. Fractals contain no straight edges or curves which can be differentiated. They have the property of self-similarity. That is similar patterns occur at different scales. If you zoom into a fractal you will never reach an end. Detail continues forever. Our limitation in creating them is the finite precision of variables held in a computer's memory.

In the natural world there are fractal like objects like fern leaves, branching trees, snowflakes. But you cannot zoom in forever as you will reach the atomic and quantum world. At the plank length - length has no meaning.

This software enables you to explore the world of Fractals both as images and as musical sequences. The latter can drive via Midi both virtual synths VST's and real midi instruments.

Have fun. The more you experiment the more you will discover.

Stuart Pryer, Cornwall, UK

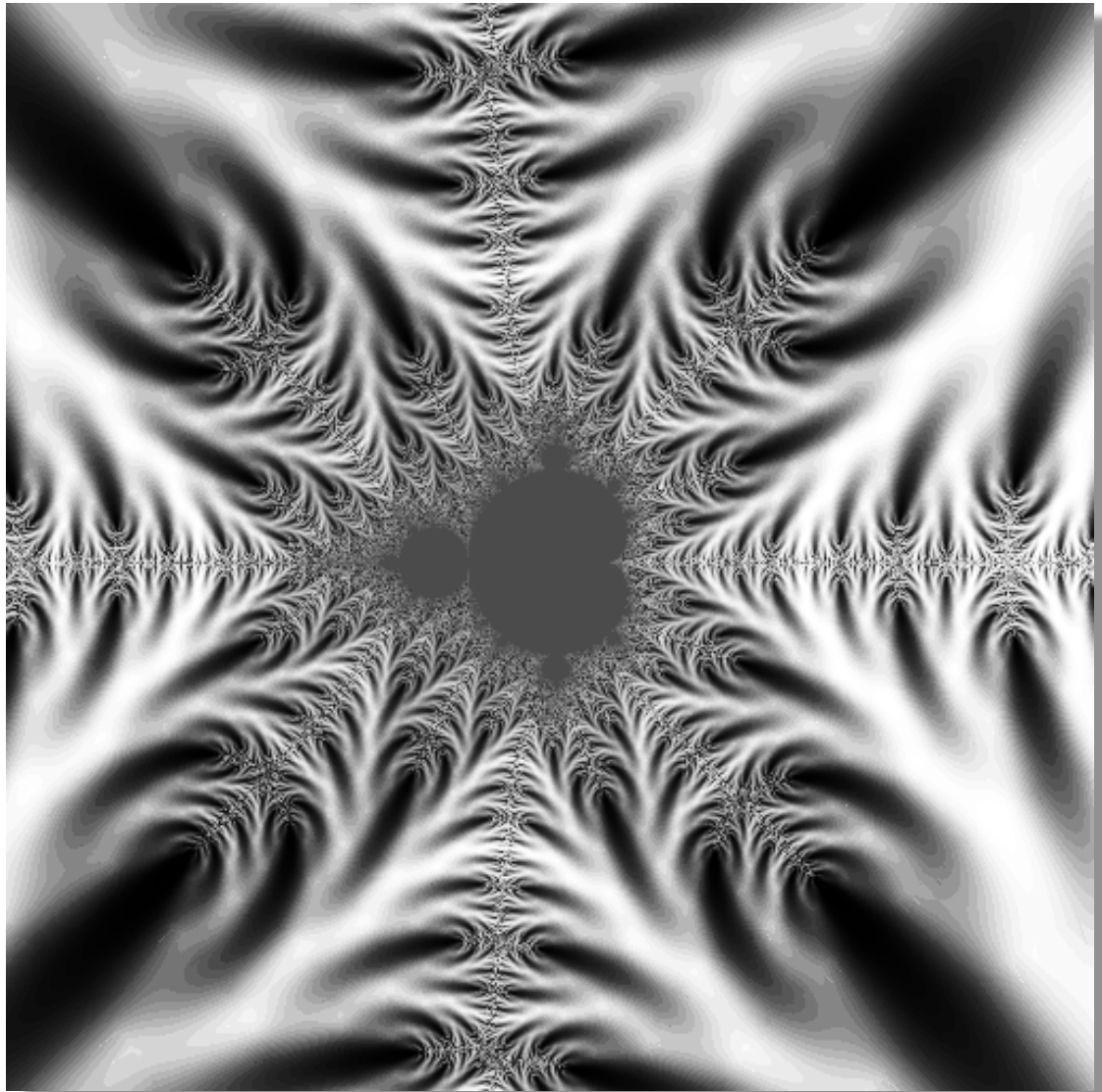
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Thanks to the beta testers ☺



The Mandelbrot set appears an infinite number of times in its own set. It demonstrates 'self-similarity'. This one lies on the spike at x/y coordinates $-1.626, 0$.

INTRODUCTION TO THE FRACTAL SEQUENCER

The Software can used to draw fractals and compose music which sounds amazingly similar to human composition. A great way to inspire new compositions!

CONDITIONS OF USE

License Conditions for Fractal Sequencer Software

1. The license purchaser (licensee) is entitled to install the full software on PC's belonging to them once payment for the license has been received by the author.
2. The licensee shall not give the software to other people, resell it, distribute it, post it on a web site or attempt to decompile it or reverse engineer it.
3. The license is non-transferable.
4. The licensee will be entitled to free updates for future releases of the software for 2 years after the date of purchase. These updates will be posted on the author's web site and the licensee may request to download them when they are ready.
5. The licensee will receive reasonable support from the author to assist them in operating the software.
6. Licensee's may request new features. The author may implement them if they are feasible, and the code does not take too long to write.
7. The licensee is solely responsible for the consequences of use of the software and any damage to equipment or loss of data shall remain their responsibility.

If you accept the license terms, then you may install the software.

I would appreciate any feedback on layout, features, bugs, documentation, or ideas on how to make it better. If you are happy for me to put your thoughts on the software on my website please tell me as it would be useful to prospective purchasers. Feedback and a wish list for additional functions are always welcome, together with suggestions for improving the documentation!

If you need any help at all, please e-mail me.

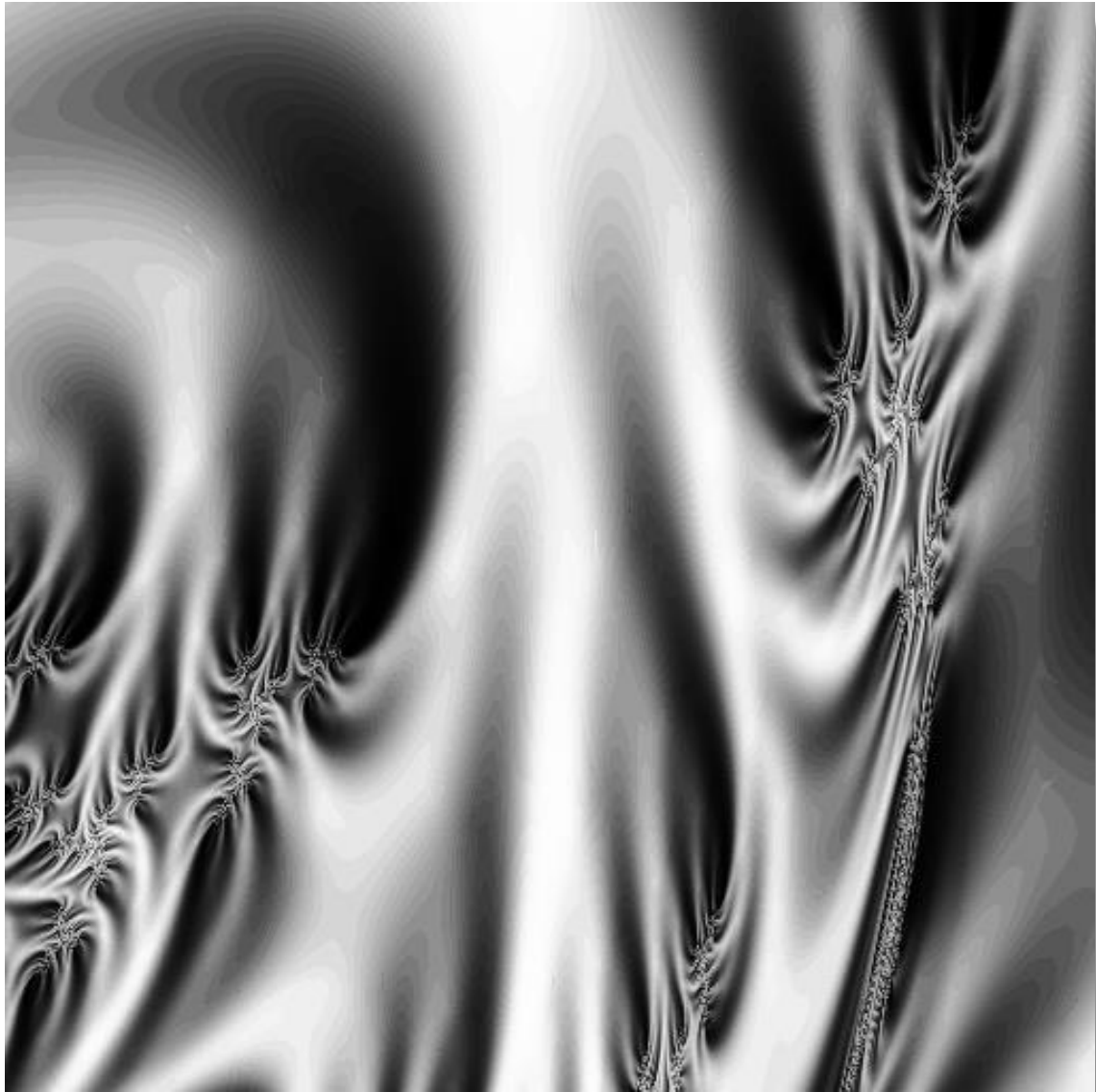
Thank you once again.

Stuart Pryer

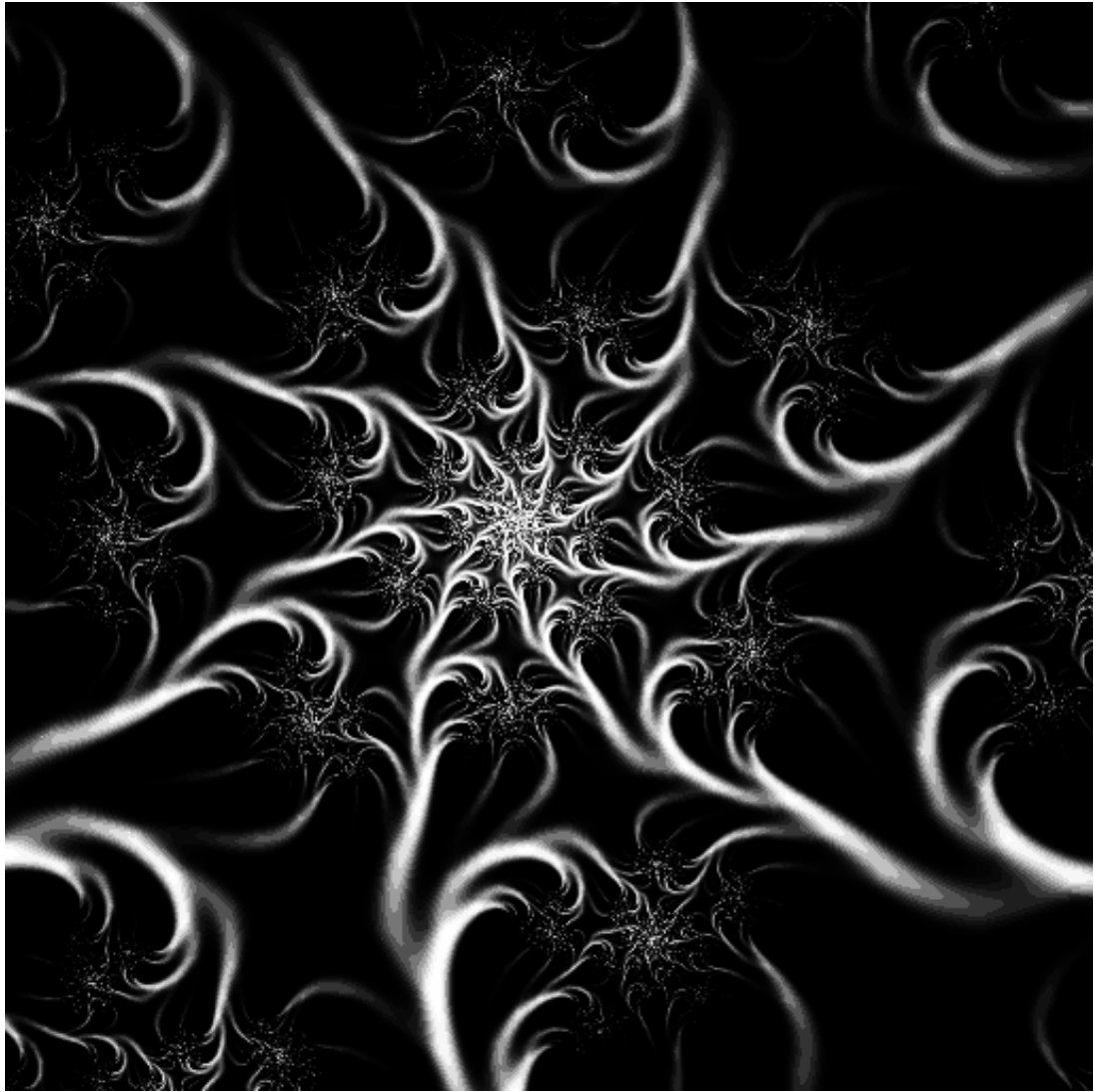
stuartpryer@gmail.com



"Red"



"Three Faces"



"The Vine"

Note. As the program develops, other features will be added. I encourage users to give me feedback and I will endeavour to add new features if requested.

LOADING THE SOFTWARE

NB. To install on Windows log on with administrator rights and run the installer fractal1.msi. The associated setup.exe file ensures the required .net framework is setup and the installation is properly managed.

Note. You can use the software via a Mac if that's your studio computer. See later.

NB. The demo version of this software limits Fractal image size to 256 pixels square and a maximum sequence length of 16 notes. Plus other restrictions on image processing and sequence generation. It is also an earlier version 4.0 with fewer features. Only the Blue2 synth and arpeggiator are supplied.

The software is designed to draw beautiful fractals and assist with musical composition. That is, suggest melodies! The more you experiment it the more you will discover its richness. It is a major update on the modules in the Korg Oasys Companion, Korg Triton Controller and Fractal sequencer version 3 and earlier. It works with just about any midi enabled virtual synthesizer or hardware synth. Get ready to explore the infinite!

1. The PC should be running Windows 7 to 11. 32 or 64 bit. Updated with .net 4.8.0 or higher. Recommended PC spec. Intel Core i3 or higher, 4GB RAM, Screen resolution 1380x780 or higher. Min Spec. Intel Atom processor, 2GB RAM screen resolution 1380x780. The software takes up about 65mb of disk space.
2. It will run on a Mac/Macbook running OSX High Sierra using the excellent software Codeweavers Crossover sold at <https://codeweavers.com>. Set up a windows 10 32 bit bottle Then use the fractal sequencer msi. The IAG driver on a mac provides internal midi routing as standard and Macs don't suffer the problems of routing internal Midi. Mac spec. i3 or higher, 4gb ram or higher, Screen resolution 1280x720 or higher.
3. It may also run on a dual boot system or using a virtualised windows environment such as Parallels but this is not guaranteed.

4. It has been written in the latest version of Microsoft Visual Studio 2022. It is a 32 bit application and will also run on 64 bit systems. Image processing and sequence creation is processor and memory intensive. But the software does runs on my old netbook. A shortcut will be placed on the windows desktop and the start menu.

USER MANUAL

Important. This pdf help file fractal.pdf will be copied to the same folder as the software's exe file during installation. Normally C:\program files.....\fractal.. - do not change the pdfs name. NB. The help file won't work if you name it 'something else' or placed in another folder. You will be able to access it from the program 'Help' Buttons which will automatically open your browsers pdf reader and then open the file. Tool bar tips also appear for some commands,

SETTING UP AND RUNNING

Try the demo and if you like it purchase the software - a link will be provided so you can download it. Run the msi package. The msi installer contains the software, synths and pdf manual. There is a separate executable setup.exe which checks the .net framework on your pc is up to date and the software installation is properly managed. Note. The synths and documentation will be installed in the programme directory.

C:\program files\ for 32 bit operating systems or c:\program files (x86)\ for 64 bit pcs.

NB. Software updates will normally consist of just an updated Fractal.exe file and pdf manual. The latest help file fractal.pdf can be found on my website. These can be downloaded and can be copied into the installation directory overwriting the fractal.exe and fractal.pdf files.

Your PC should be located adjacent to the keyboard. Ideally with the keyboard of the PC at right angles or above the keyboard. As the software is mainly mouse driven, all you really need near the keyboard is a screen and mouse. Connect the two devices using midi cables/usb between the PC's midi port/usb port and the keyboard. USB hubs are not recommended.

Turn on the PC, turn on the keyboard and run the program. When you run the program, configure the midi device by using the '**MIDI**' form. Then set the midi channel of the software (I normally use 0 - this is the default value). Then open the midi port if you are using midi.

Please contact me if you have any problems. NB. A few third-party midi controllers were not written with fully compliant windows midi drivers.

START UP AND WORKFLOW

If you just want to create stunning images then go to the Draw Section.
To start exploring;

1. Click the 'Draw' button on the main form. This draws the Mandelbrot set.
2. Zoom in by selecting a region using you left mouse button
3. Click 'Draw' again
4. Then image process

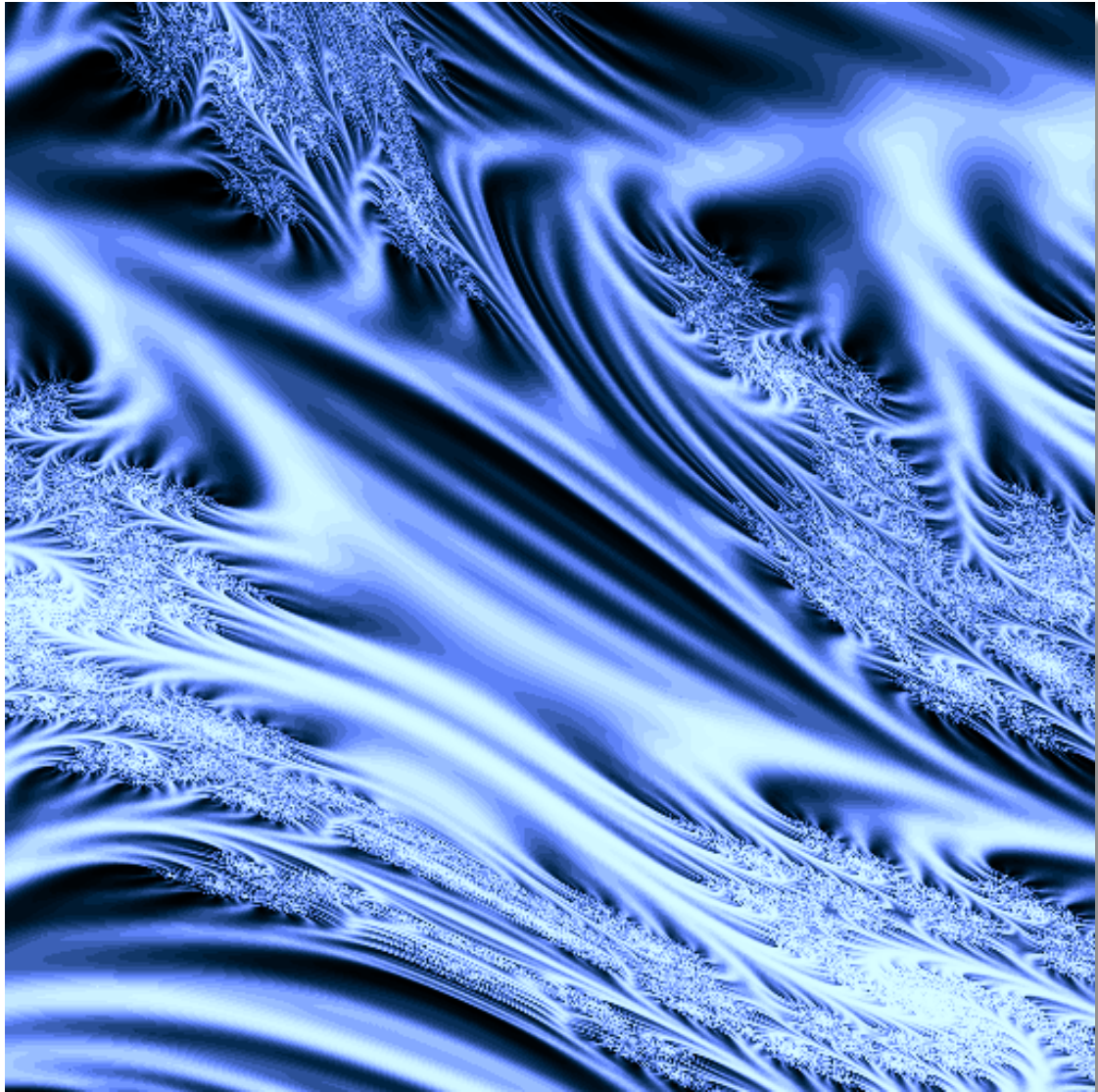
OR

If you want to create musical sequences then set the midi output device using the 'Midi' settings menu on the Midi form and then you can approach it from either:-

- The Main Drawing module - This contains most of the control settings. Just click 'Generate'. For sequence based on the centre of any selection box.

Or

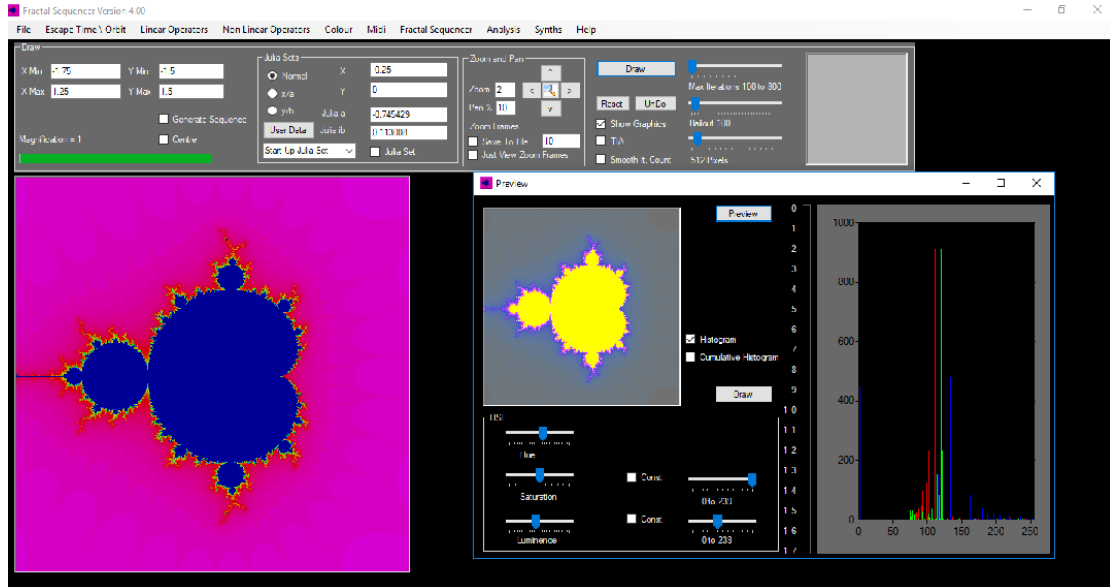
- The main drawing module and Fractal Sequencer Module. The Draw module is fascinating as you can explore the images and then from the image create musical sequences which are processed by the fractal sequencer module. It also has tools to help find sequences. Check the *Generate Sequence* checkbox on the Draw Form, open the midi port and Click on the image. Click again on the image for another sequence.



"Frozen"

Zooming in on the Dendrite Fractal in the plane y/b . TIA and smooth iteration count. Linear Equalisation and RGB colourised. Limit of 550 iterations per pixel and 10^{12} bailout.

THE FRACTAL SEQUENCER - MAIN FORM



The main screen has a menu system at the top. Each menu item is described in detail later.

1. File - opens and closes saved images and settings
2. Linear Operators - Image processing
3. Non Linear Operators - Image Processing
4. Zoom - allows the user to inspect the main image at 2,4,8 X magnification
5. The Colour Menu allows mapping the monochrome image to RGB or HSL Colour spaces and Localised Colouring.
6. Escape Time and Orbit provide an alternative analysis of the fractal
7. The Midi menu allows the user to set up the midi input/output port for the software. This is used to turn on or off the midi in and out ports or if the user wants to change the midi routing. There is also

a two octave keyboard and a 88 note keyboard. Note. to use midi you need to have at least one midi in and one midi out.

8. The Fractal Sequencer menu accesses the main control screen for the sequencer engine.
9. Analysis enables the representation of the sequence variations for a fractal and searches for melodies the user inputs and outputs variations on the melodies.
10. The 'Synths' menu allows access to four separate instruments included with the software. Blue2 synth, Violet Synth, SH 1000 Synth and an Arpeggiator/midi file player/recorder.
11. The Help button accesses my website and the fractal.pdf help file. This is installed automatically with the software in the installation directory. Updates can be downloaded from my website and the pdf file can be overwritten. Please keep the name the same. 'Fractal.pdf'. Many controls have tooltips. Just hover the cursor over the control and the tool tip appears.

MIDI ROUTING

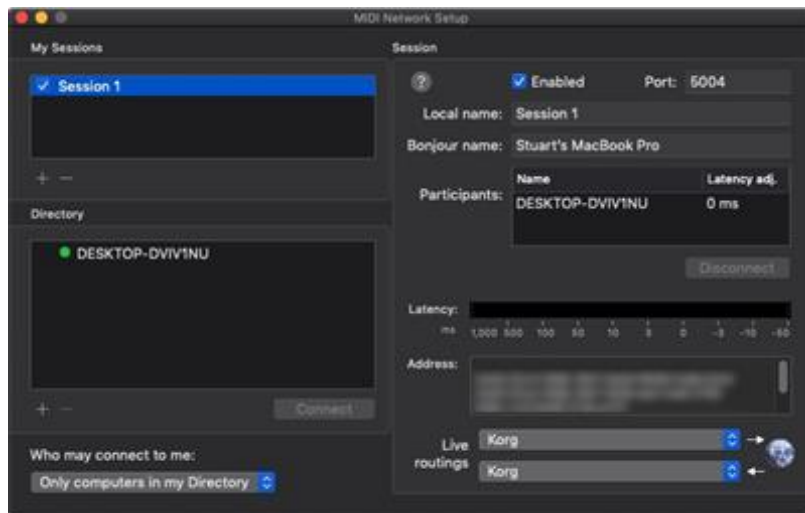
This software generates midi note data for sending to midi instruments can receive midi in. If you want to get up and running quickly and prefer to read the detailed instruction later, then this is what you need to do:-

1. Either - Connect the Midi Keyboard to the PC (midi ports or usb) using leads supplied (midi out on the PC to midi in on the synth and midi in on the PC to midi out on the synth or use usb). I use an external midi interface from the M-Audio Midisport range - a midisport 4x4 - which is excellent. Make sure any usb driver is installed if the interface is not class compliant.
2. Alternatively use virtual instruments and a free virtual midi routing application like midi yoke or loopbe1 to connect see later.
3. Load a sound on the instrument.
4. Set midi channel to 1 on the midi form, open midi out. The set the midi in of you instrument to the same channel.

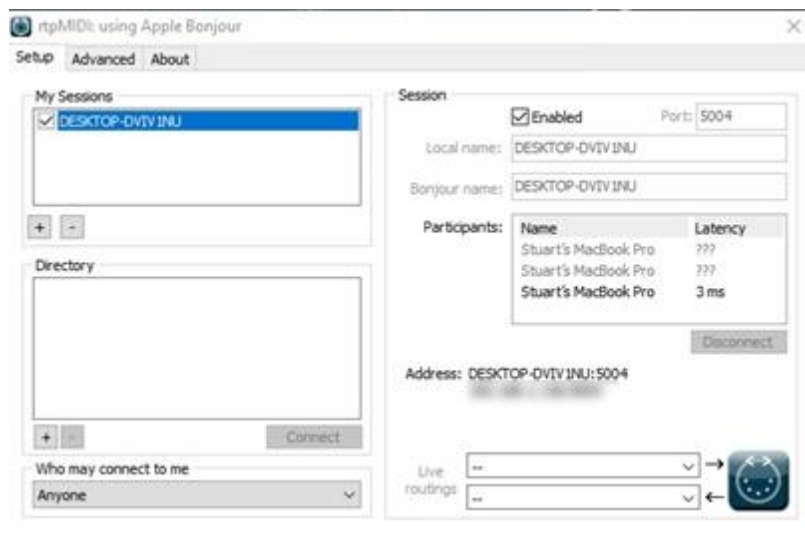
USING FRACTAL SEQUENCER VIA A MAC

You can route Midi data via a Mac using the free rtpMIDI program on a PC. So if your studio computer is a Mac you can run this software on a PC and connect to the Mac as an intermediary then to your instruments/midi interfaces.

Below is the Network Midi screen of the Mac (Studio Computer). Note the input and output ports are set to Korg - in this case my Triton. It is connected via my network connection (wireless or through a network switch) to rtpMidi running on my PC - computer name DESKTOP-DVIV1NU. The latency is 0 to 3ms. The Mac calls it Session1.



Below is my PC screen. rtpMidi is running and is connected to my Macbook. Enable the session by checking the Enabled box on the PC form.



So now a two-way MIDI connection is established between the PC and Mac. On the Fractal Sequencer set midi input/ output to the name of your pc desktop. In my case Desktop-DVIV1NU

So, the Fractal Sequencer on the PC is now connected midi in/midi out through the Mac to the Korg midi port (interface) and the Triton. If you want to control the PC and see the windows desktop on the Mac use Microsoft remote desktop on the Mac too. Get it free from the app store.

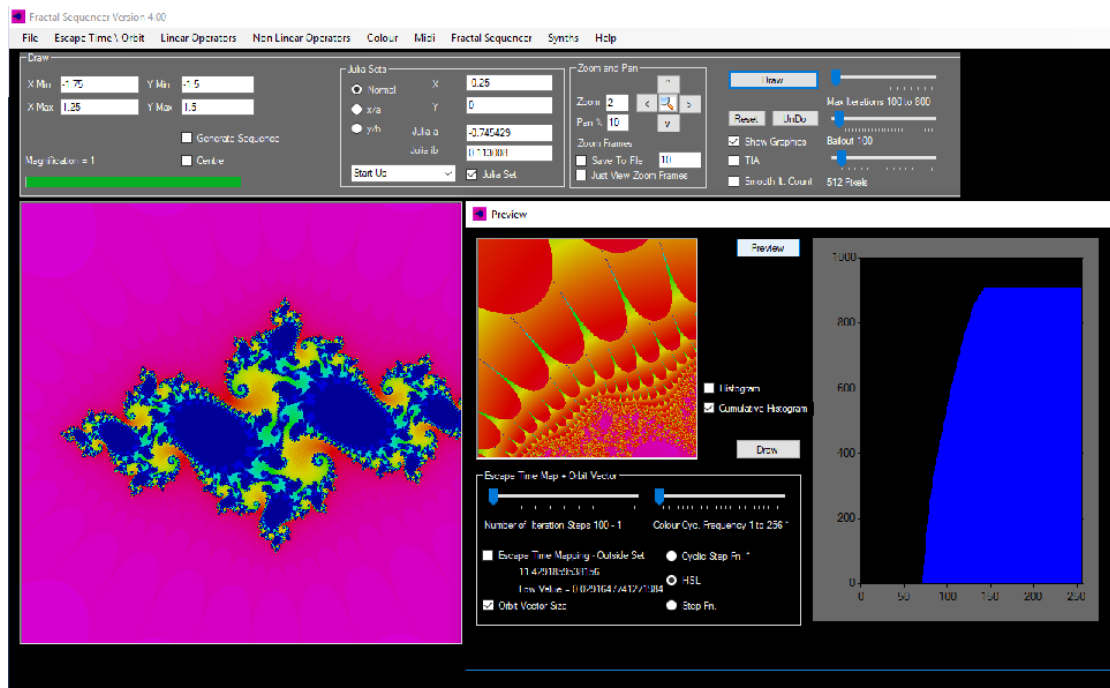
EXITING THE SOFTWARE

To Exit the program click on the 'File, Exit' drop down menu at the top left when the composer form is loaded. The software will close the midi port and sequencer engine will be closed as well. If you are generating an image the calculations will need to complete before you do this unless you force quit windows. Remember to save any image or settings you want to keep before you exit.

FRACTAL IMAGING

The programme has two main drawing components. The Main Form and the Preview form. The Main form enables the user to produce marvellous images of the Mandelbrot Set and Julia sets. It also sends values to the Fractal Sequencer form.

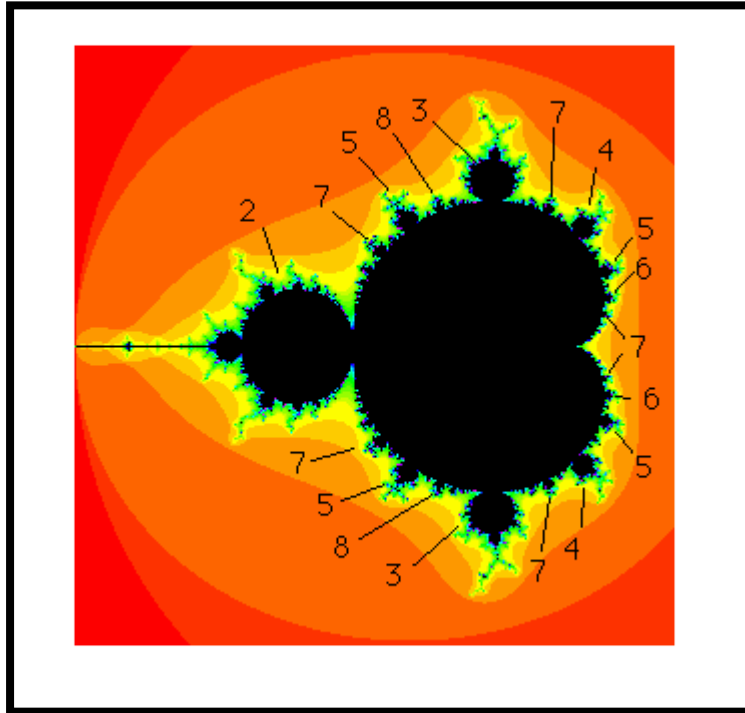
Note the Fractal Sequencer feature section sends midi note data and will work with any midi instrument including the soundcard on a PC.



THE MANDELBROT SET

The Mandelbrot Set depicted in a picture.

$2i$ - Imaginary number Y axis vertical



$-2i$

-2

0

2

Real number X axis ----->

A Stunning representation of the infinitely complex Mandelbrot set - the black area. Numbers refer to periodicity in the primary bulbs discussed in the text below. The set exists in a parametric plane as $F_0 = 0$.

Fractals use simple equations to generate incredible complexity. In the natural world, complexity is independent of scale. So if you use a microscope to zoom into say a leaf, the complexity does not diminish with magnification! There is also self similarity. Patterns which repeat at different scales. This is why Fractals lend themselves to music.

The Mandelbrot set uses a specific equation, $F_{n+1} = (F_n)^2 + C$. This equation generates a new number based upon a previous number in an iterative process. Both F and C are complex numbers of the form $a + ib$. i being the square root of -1 . For certain values of a constant C and 'seed'

F_0 , the number sequence will not exceed certain limits and it will oscillate or 'orbit' around a value. Thus it is possible to generate a sequence of notes using the output from the generator. If the constant value lies between -2 and + 2 the sequence will oscillate around a value. For values over 2 the sequence will diverge to infinity and the point will not form part of the Mandelbrot set. In fact the full Mandelbrot set exists in complex number space and the 'constant' values which do not diverge to infinity lie in a complex pattern (the black area in the picture above) within the bounds of a circle +-2 and +-2i where (i is square root of -1, an imaginary number). This is the Mandelbrot Set. NB. The sequencer engine is designed to allow sequences to be generated even if values are chosen outside the Mandelbrot Set.

So how does it relate to a musical sequencer? Well consider the infinite non divergent series, output from the iteration $F_{n+1}=(F_n)^2 + C$. Where F and C are complex numbers. The series could represent midi note values, note timings and lengths ! Think of each point in the black area as a single sequence. As there are an infinite number of points, there are an infinite number of sequences.

As described above, the sequencer does not produce random notes, but notes which are related to their predecessor and so forth using the Mandelbrot equation. This produces sequences which can be very close to human composition. For a given constant value, a given sequence will result. However, as there are an infinite number of constant values there are an infinite number of sequences. Very slight difference will result in different sequences, so -1.900000 will be different to -1.899999 although the difference will not become apparent until several, if not many, notes (iterations) into the sequence. As the program variables are double precision the user will not run out of sequences in a hurry! Trial and error is the best way to get started, try values for constants between -1.9 and +0.2. Going beyond +-2.0 or +- 2i will result in divergent data. The software will trap this if the values exceed 10^{100} . You can easily select values by dragging a square with the mouse button on the large image of the Mandelbrot set which automatically appears when the Mandelbrot Sequencer is selected.

Constraining the note values to scales will result in some interesting melodies, and remember to allow plenty of notes to enable the sequence to develop properly. The Fractal sequencer can generate 100,000 notes; more could be easily added if users want. Cutting it short can often miss some interesting sequences. Similarly constraining note length and note

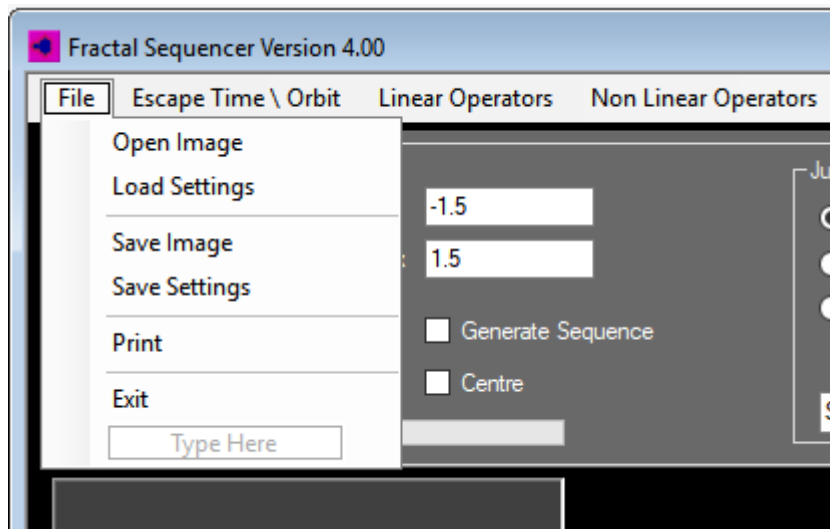
interval can make the music appear more natural. The sequence is saved in an array and the user can choose to play back just a section once the sequence is generated.

Once you've found something interesting, save the settings and use the synth or another midi sequencer to record the sequence permanently in midi. Some sequences result in series which converge or oscillate between values. A constant of -1.9 will not do this but -1.75 will. For very surreal music do not constrain the sequence at all. Pick a pad sound , sit back and listen.. Constants which result in chaotic sequences can often lead to incredible melodies, but remember they may occur just once in a sequence of 50,000 notes !

Tip...Good speakers will enable the very low frequencies to be heard and felt. Also keep the volume at low levels until you are familiar with the sequencer. Im happy to add features if users want them added and its feasible.

To stop the sequence just check 'Stop Sequencer' check box on the Fractal Sequencer form

SAVING AND LOADING IMAGE & SEQUENCE PARAMETERS



1. If you click the 'Save Settings' menu item (click on File Menu at top left), the software's settings file will appear in the text box at the top right of the main form. It will save all the settings as a text file. So if you want to permanently save a sequence just use the 'Save Settings' menu item - and save as a text file (txt).
2. Pressing Load Settings will load all of the settings back from your text file back to the sequencer. This is handy for storage of sequences.
3. Open and save image an image file to your computer and allows it to be opened. Format default 24 bit colour bitmap .bmp
4. You can print any image in the main picture window.
5. The Exit option closes the program. Use this rather than closing down the window with the windows 'X' top right hand corner of the main window. This is so all notes are stopped and the midi port is closed properly.

IMAGINARY NUMBERS AND THE SQUARE ROOT OF -1!

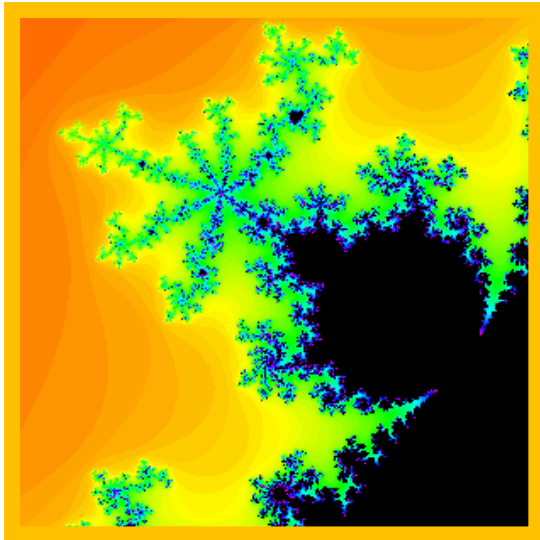
The effect of the value of the 'real number only' constant c with the imaginary number = 0.

$C = -0.65$	Tends to a fixed value
$C = -1.6$	chaotic
$C = -1.75$	period of 3
$C = -1.8$	chaotic near a 3 cycle - intermittent
$C = -1.85$	chaotic
$C = 0.2$	tends to a fixed value

The software also allows the user to specify the real and imaginary part of the complex number. The frames on the right hand part of the Fractal Sequencer settings. This fully represents the Mandelbrot space. Some suggested constants that produce repetitive sequences are shown below:

Real constant	Imaginary constant * i	Periodicity
Note Constant	Note Constant i	
-0.12	+0.75	3
-0.5	+0.56	5
+0.28	+0.54	4
+0.38	+0.333	5
-0.62	+0.43	7
-0.36	+0.62	8
-0.67	+0.34	9
+0.39	+0.22	6

The period means that these constants will result in repetitive values and correspond to the Mandelbrot diagram as these occur at 'Bulbs' on the diagram with the same number of 'antenna' ! These are numbered on the image above. Picking complex numbers in these primary bulbs will result in the periods described above. The two frames headed complex values allow the imaginary part of the constant to be input. Remember, the constant $|c| < 2$ otherwise you will definitely get divergent data although the software will sort this out using routines I have implemented!



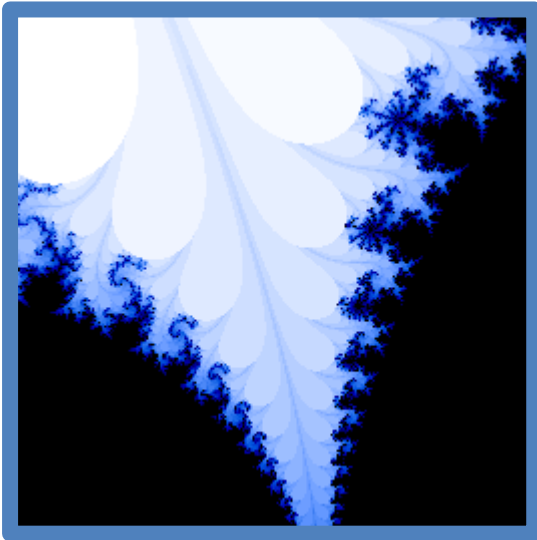
The beauty of an infinitely detailed object. A close up of bulb 7 with an attached antenna comprising 7 radiating extensions - Complex numbers with values in the big black primary bulb to the lower right will yield a periodicity of 7! Constant $c = -0.62 + 0.43i$

The user can also force the generated notes to a scale (Check box 'forces note to scale keyboard') which makes the melodies very 'human'.

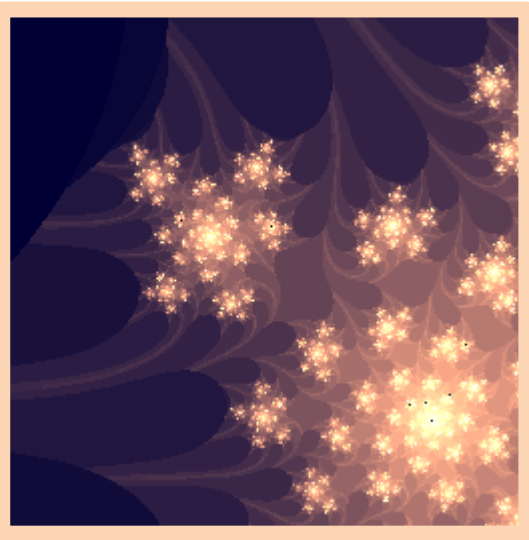
Try experimenting with values and instrument sounds - it is definitely worth the time and effort. What you hear is the audio equivalent of a Mandelbrot set series with note values generated from points in the 2 dimensions of the Mandelbrot plane.

The mapping function (top of sequencer form) determines how values generated by the sequencer (Either Mandelbrot or Julia set) are turned into midi notes in the range 0-127.

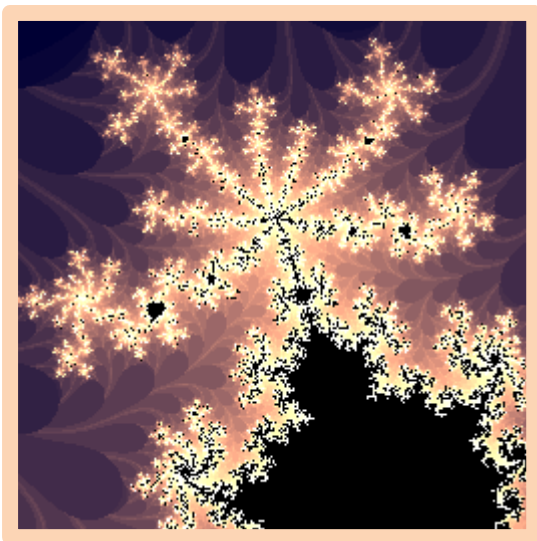
IMAGES



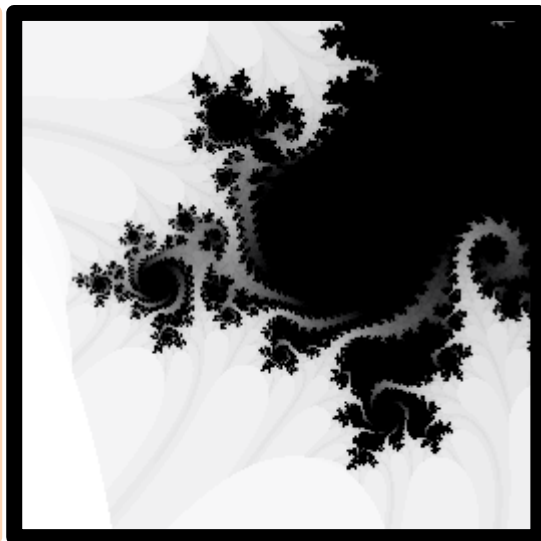
Sea Horse Valley



Julia Set Fatou dust - Star Cluster



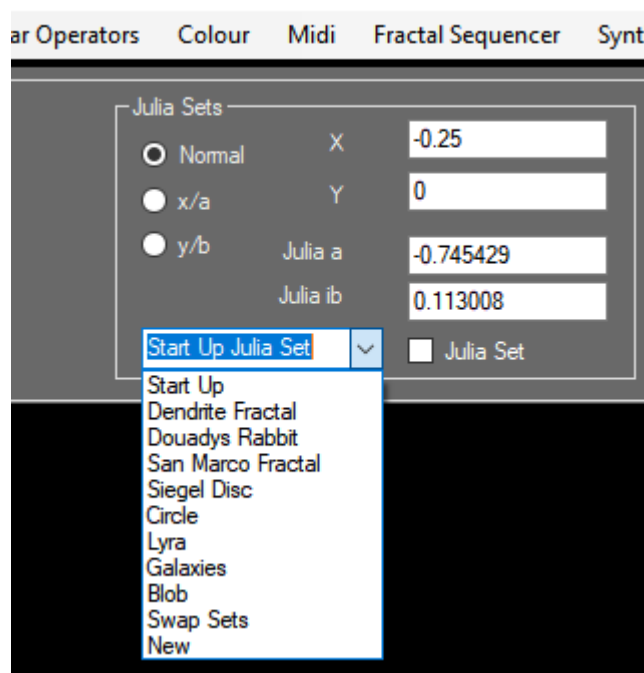
Period 8 Antenna



Julia Set Swirls

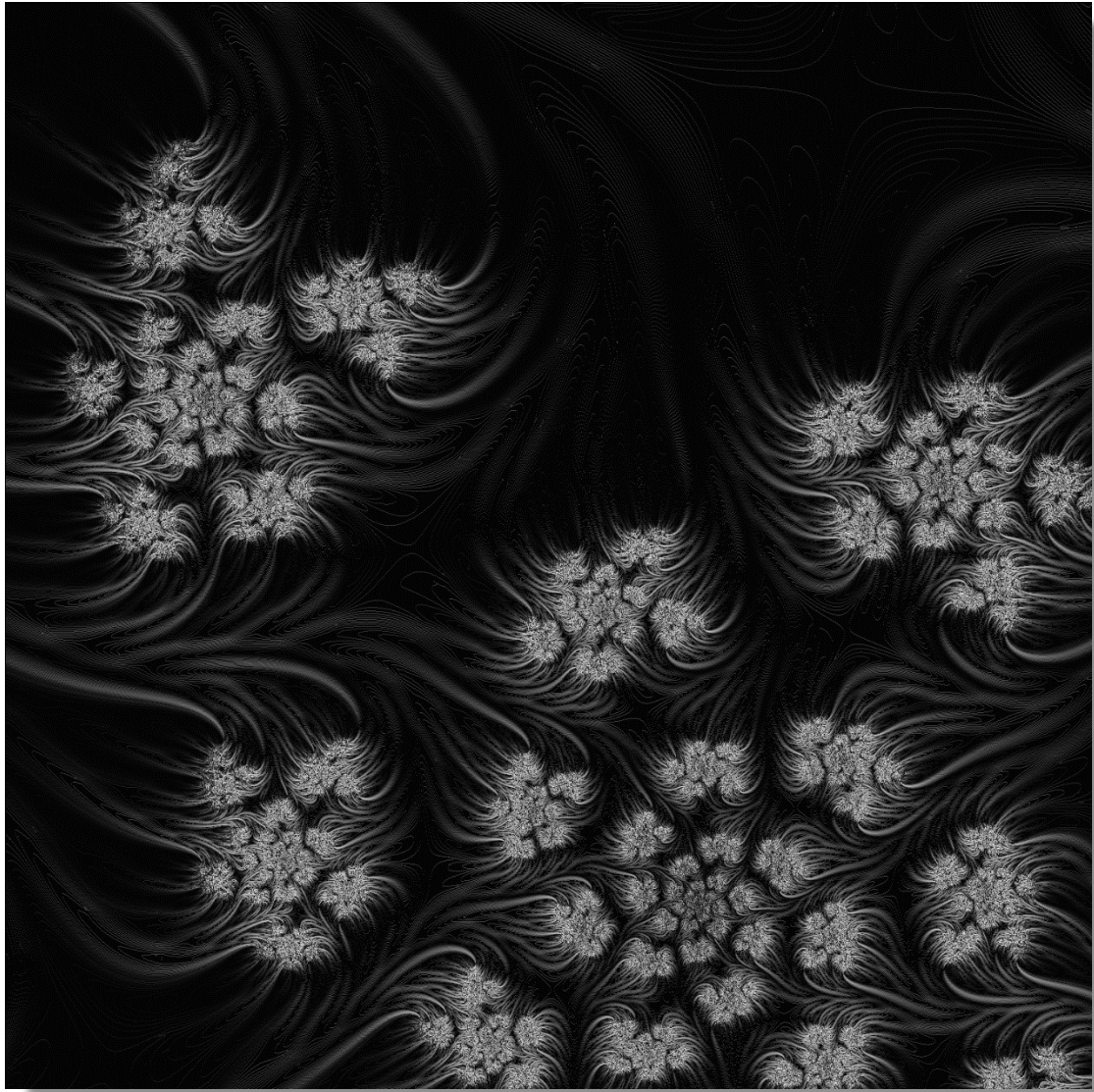
JULIA SET

The other major set is the set in the dynamical plane where starting values of F_0 larger than 0 are used. The Julia Set frame enables the user to specify its use by checking the check boxes - 'Use Julia Set'. Then both the real (a) and (b) imaginary components of F_0 (seed) can be entered in the boxes by the user. Press 'Generate...' button to create the Julia Set for the note series and to start the sequence playing. Keep values in the boxes small (generally less than ± 2 (i)) otherwise divergent data will interrupt the series and will be error trapped by the software.



Note. Clicking the Julia Set check box in the Mandelbrot picture form, changes Julia Set values instead.

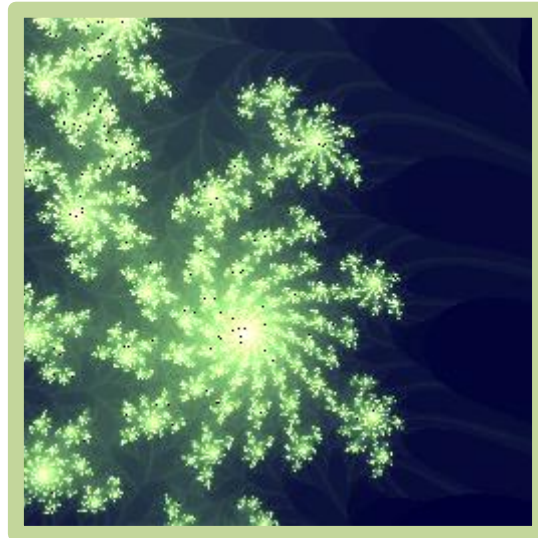
All the settings in the Julia Set frame are used in conjunction with the Real and Imaginary constant boxes for note and note timings. The fascinating thing about Julia sets are that if the series of $F_0 = 0$ does not diverge to infinity, the Julia set will consist of a finite number of connected pieces. If the series does diverge to infinity the Julia Set is a Cantor Set - that is the Julia Set comprises a 'cloud' on unconnected points.



"Strange Flowers"

Notice in this image the 'infinite' detail that is present in the Julia Set.

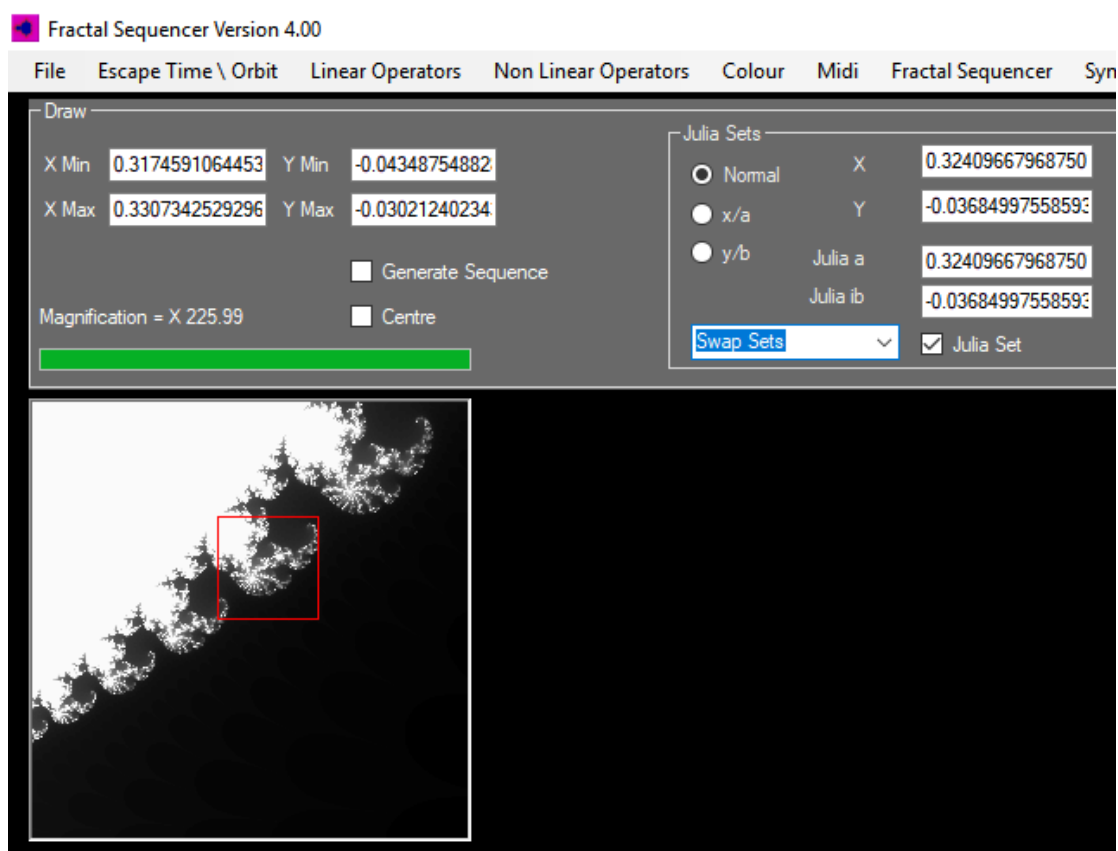
Values of F are real in the horizontal axis and imaginary in the vertical Y axis. Thus F_0 needs to have values in the black area to produce non divergent data. Eg. $F_0 = 0.1 + 0.1i$ would work. A non divergent series (ie. in the black area) will always turn into to a repeating 4 note motif in this area of the Mandelbrot set. Try it out, set the constants and set the middle note radio button so you use a complex note expression. Change the note range to 0 to 127 - random composer form.



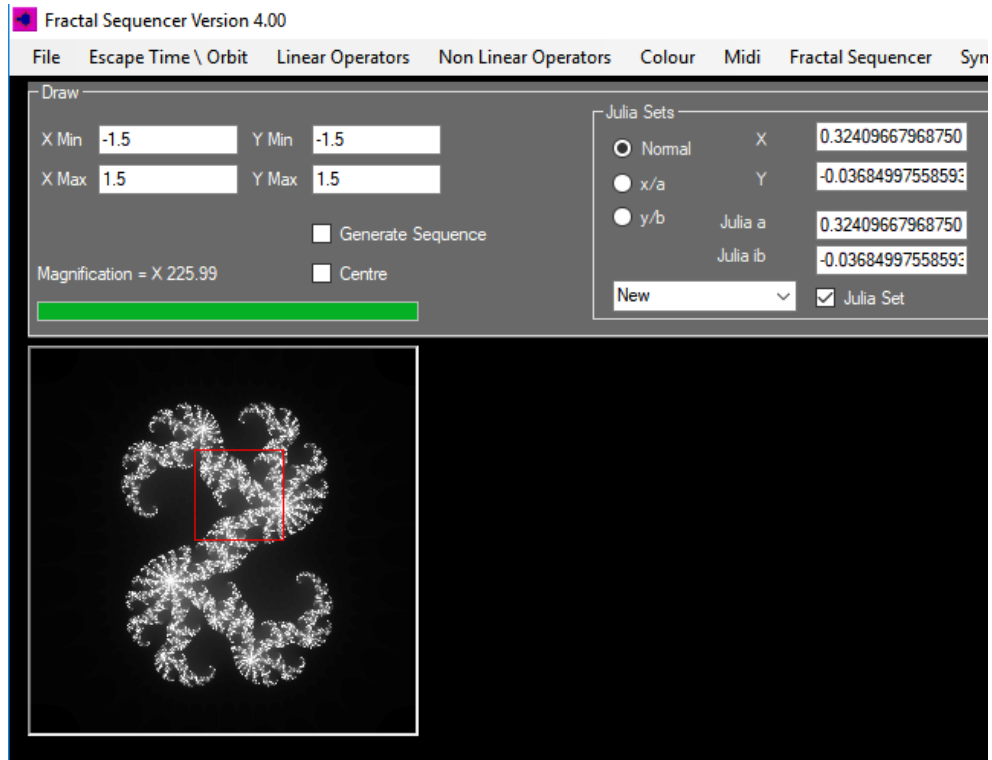
FINDING THE JULIA SET FOR A POINT ON THE MANDELBROT SET

As discussed earlier. For every point on the Mandelbrot set there is an associated Julia Set. Or, every Julia Set produces a point on the Mandelbrot set with $X_0, iY_0 = 0$

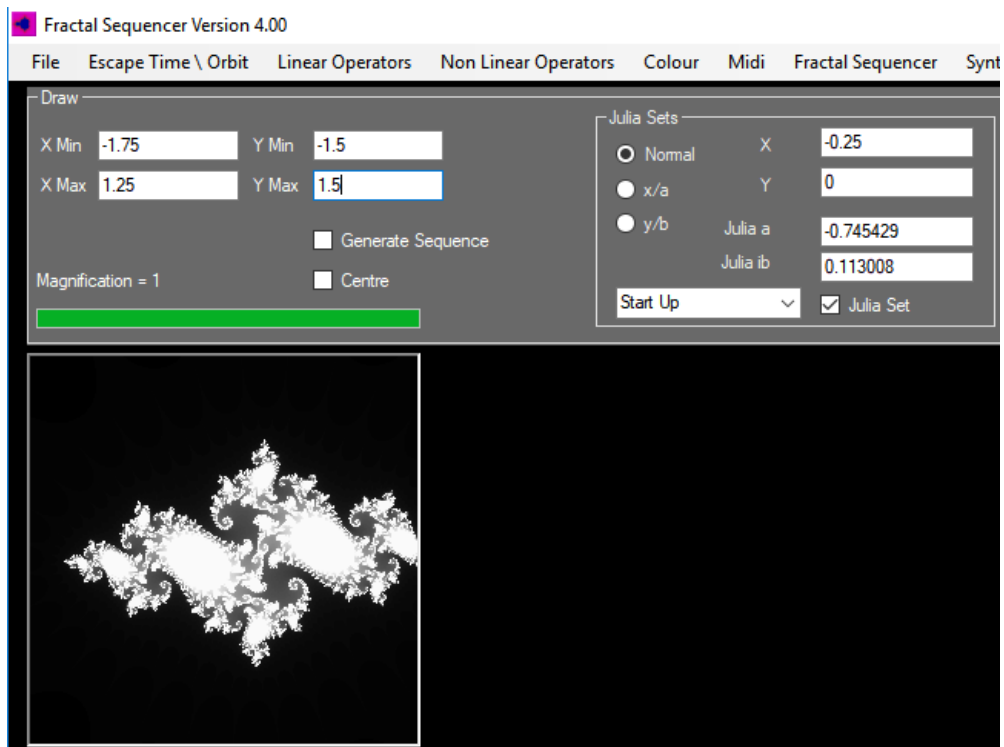
You can easily switch between the 2 sets. In the example below, a region at the boundary of the Mandelbrot set is selected with the left mouse button.

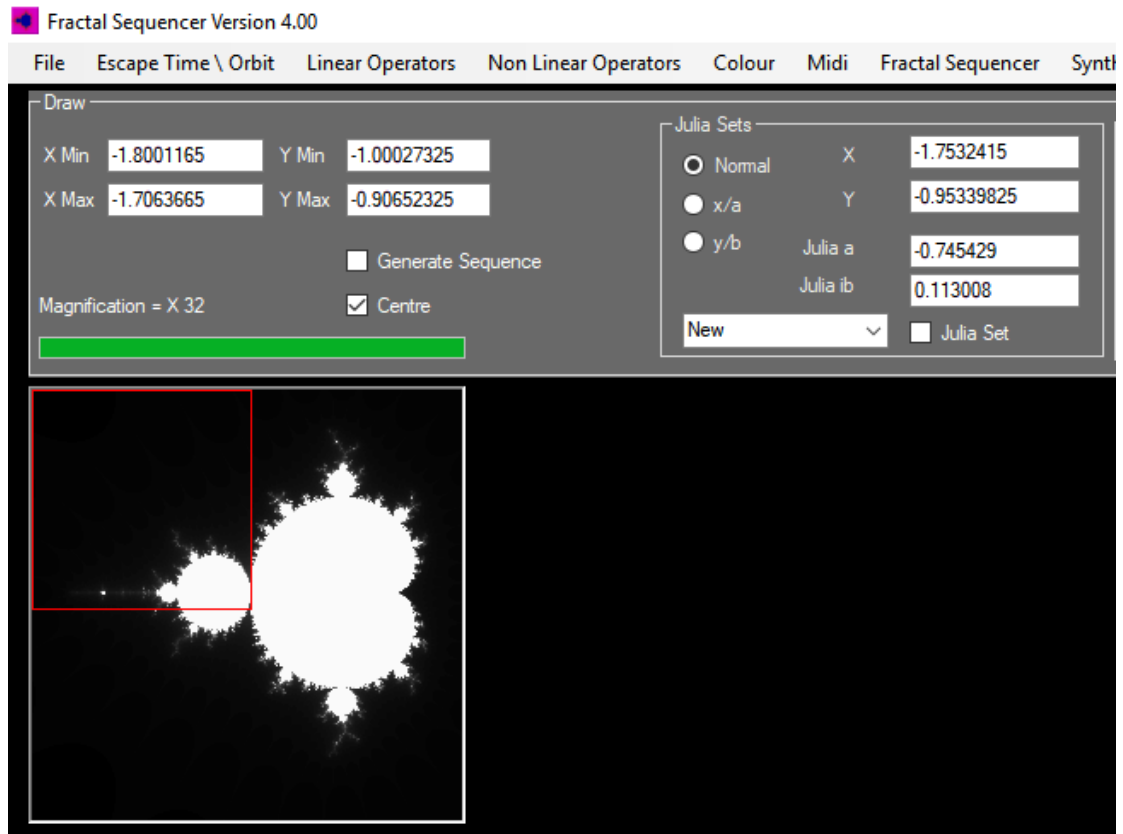


I want to see what the associated Julia set looks like for the region of the Mandelbrot set displayed above with the small square box. Check the Julia Set check box and select 'Swap Sets' from the drop down box. Click Draw. The Julia set is shown below with its a, ib constant value set as the coordinate at the centre of the square box you have drawn previously!



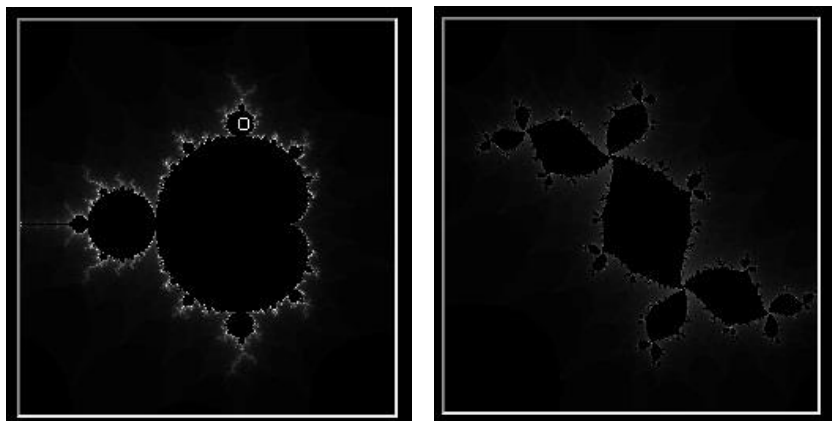
You can work the other way also. If you have a Julia Set, then by unchecking the Julia set box and selecting 'Swap Sets' from the drop down box you can see where on the Mandelbrot set the Julia set lies. Click Draw. You can use the corner of the "Centre" red square to see the precise point.





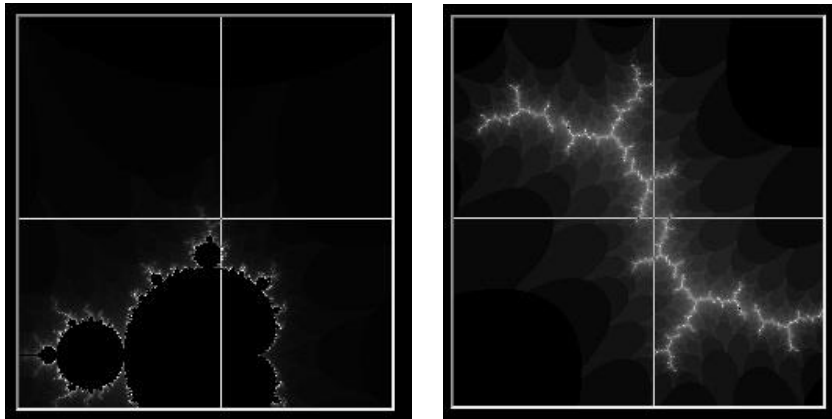
The bottom right corner of the red square shows the position of the start up Julia set.

For the infinite number of points in the Mandelbrot set there are an infinite number of Julia Sets. Try exploring around the boundary of the Mandelbrot bulb. Inside the bulb the Julia sets are connected with solid regions. Outside they are disconnected consisting of discrete points.

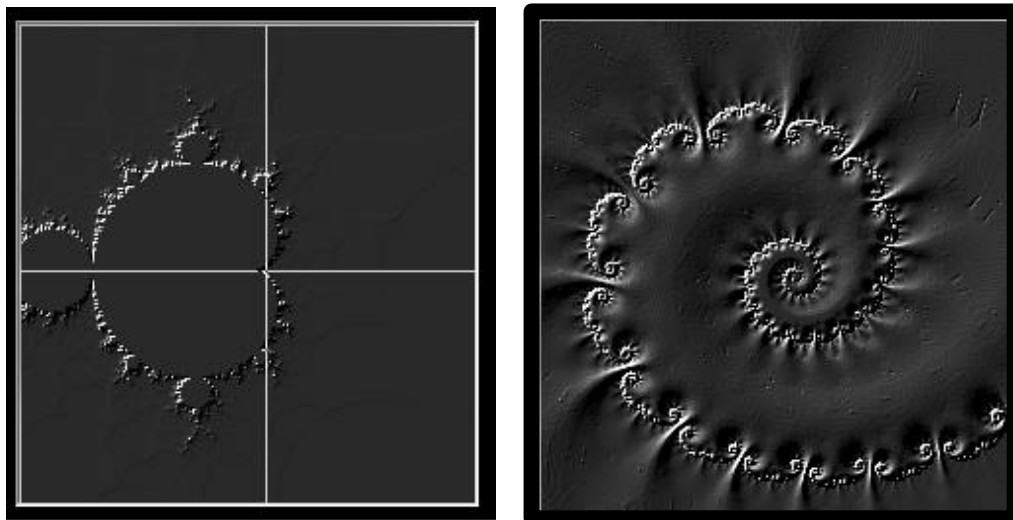


Above right is a Julia set (Douady's Rabbit) from a point inside the top bud of the Mandelbrot set top left. It is connected. Below is a Julia set (Dendrite) from a point above the top bud and outside of the Mandelbrot

set. It is not connected and if you zoom in enough the individual points would not be in contact.



The fun thing is there are an infinite number of Julia sets to explore and draw! See an interesting feature I found below. $a=0.3$, $b=0$.



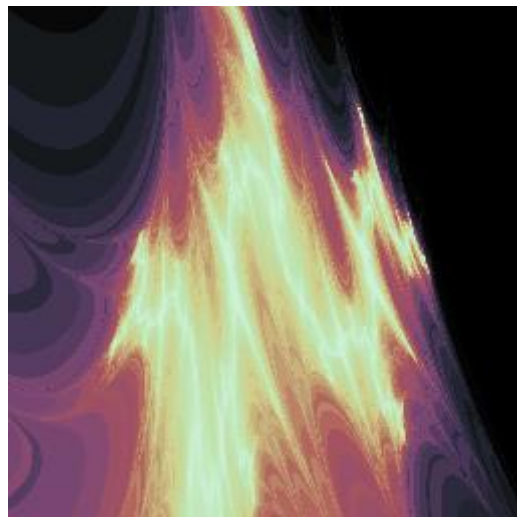
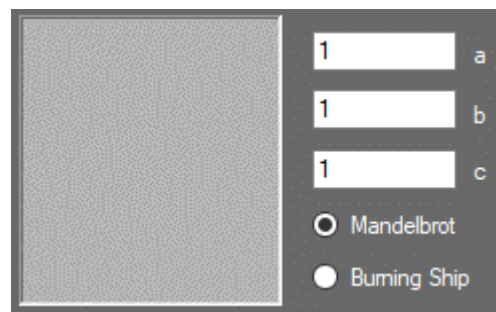
OTHER SETS

The Mandelbrot set is created by a recursive pair of functions.

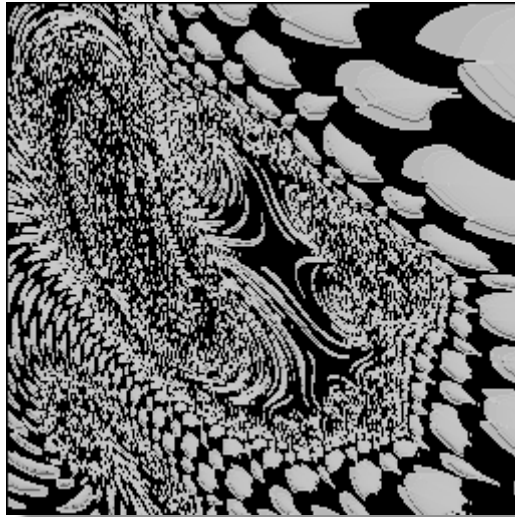
$$\text{NewX} = (\text{CurX} * \text{CurX}) ^ a - (\text{CurY} * \text{CurY}) ^ b + \text{OrigX}$$

$$\text{NewY} = (2 * \text{CurX} * \text{CurY}) * c + \text{OrigY}$$

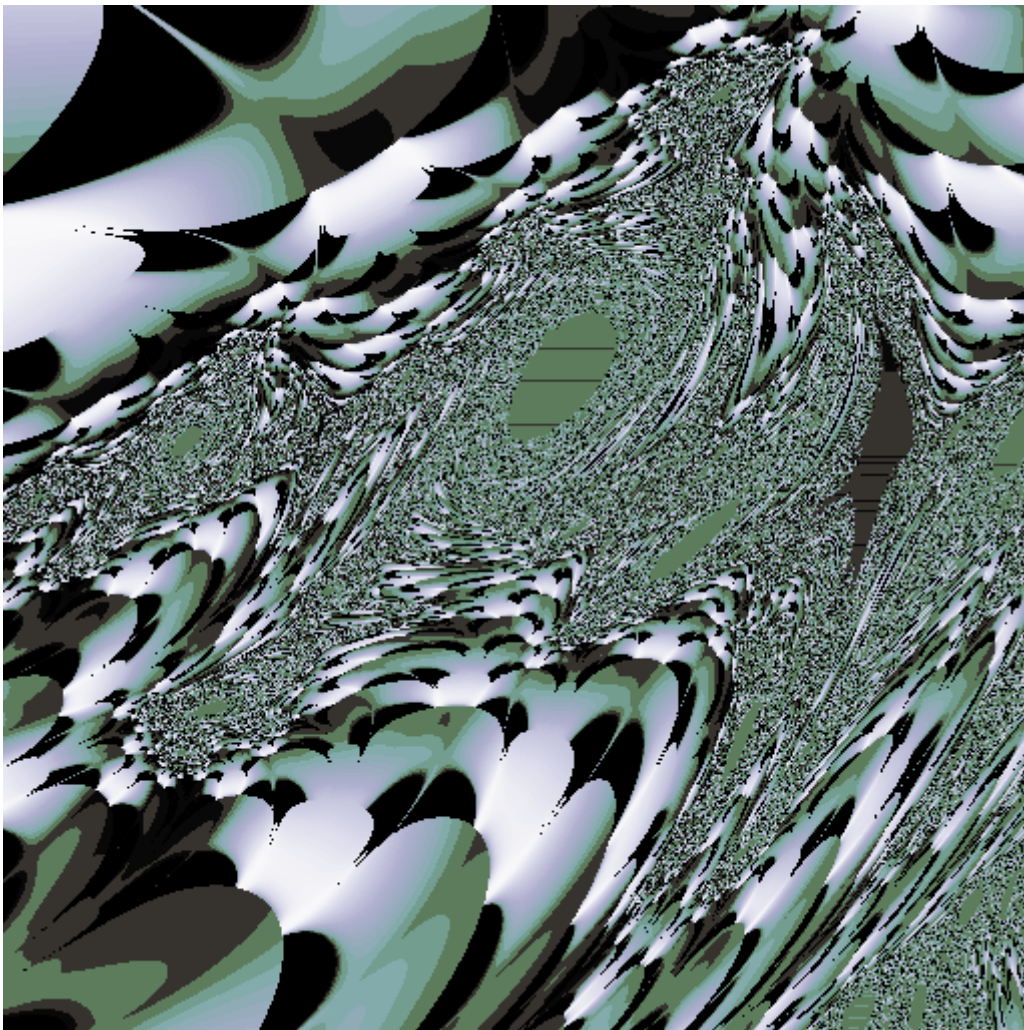
Where the parameters a, b and c are one by default. They don't have to be. You can vary them by entering values in the three text boxes at the top right of the main form and create a different set to the Mandelbrot set. Below I've set them to 1,1 and -1 -main form top right.

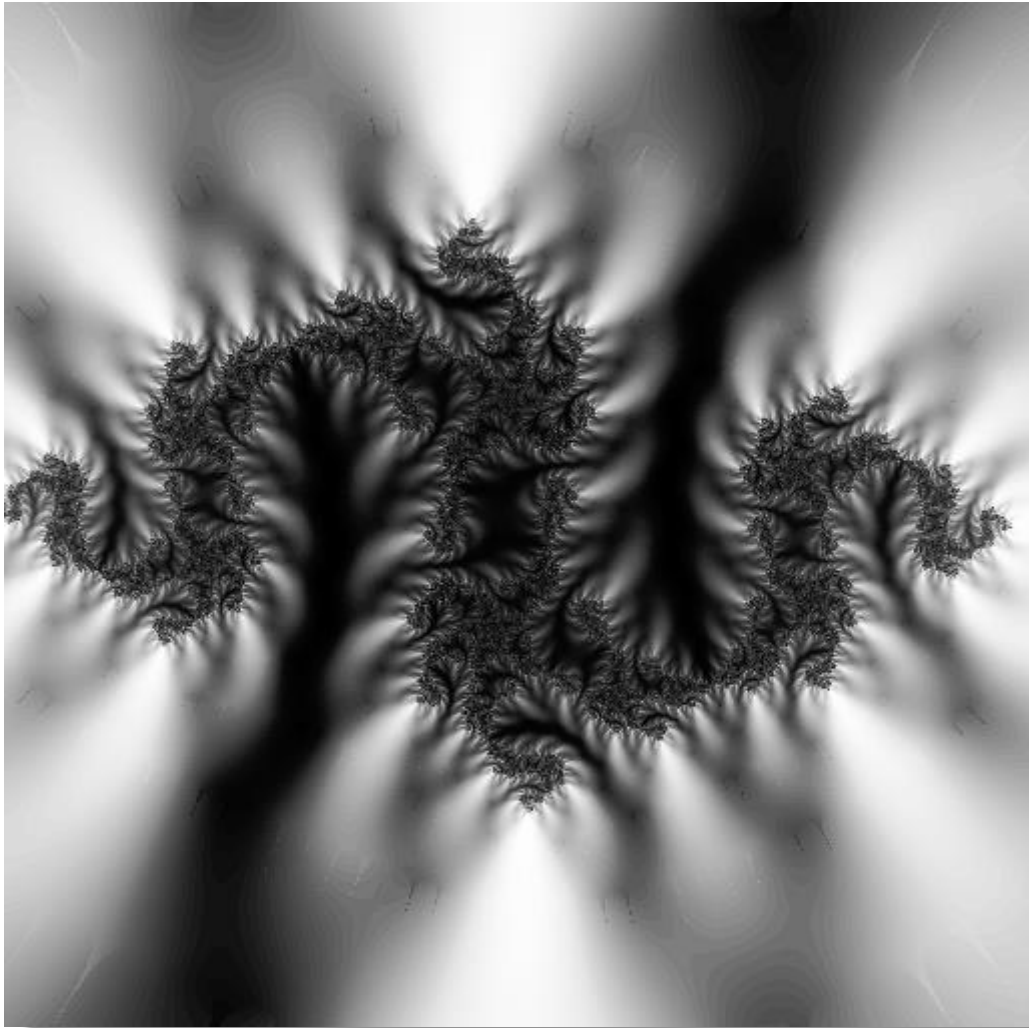


A 'flame' on the edge of the modified Mandelbrot set with a and b slightly bigger than one. 1.5 & 1.3 and c=1



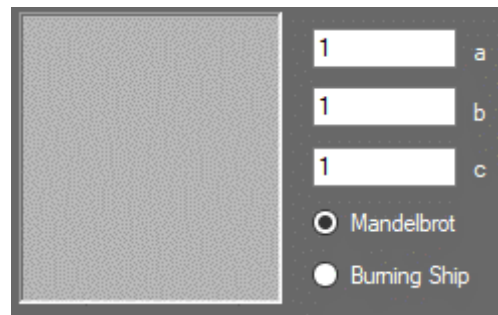
You can get some very strange patterns at the edge of the set and you don't need to make the indices much larger or smaller than one,!





The Serpent
Start Up Julia set with $a=1$, $b=1$ and $c = -1$
TIA, Smoothing and image inverted

THE BURNING SHIP SET



This set was discovered in 1992 and is a variant of the Mandelbrot Set.

$$\text{NewX} = \text{abs}((\text{CurX} * \text{CurX})^a - (\text{CurY} * \text{CurY})^b + \text{OrigX})$$

$$\text{NewY} = \text{abs}((2 * \text{CurX} * \text{CurY}) * c + \text{OrigY})$$

It takes the absolute values for each term. Click on its Radio button above and then Draw. This image is from the left-hand spike zoomed in.



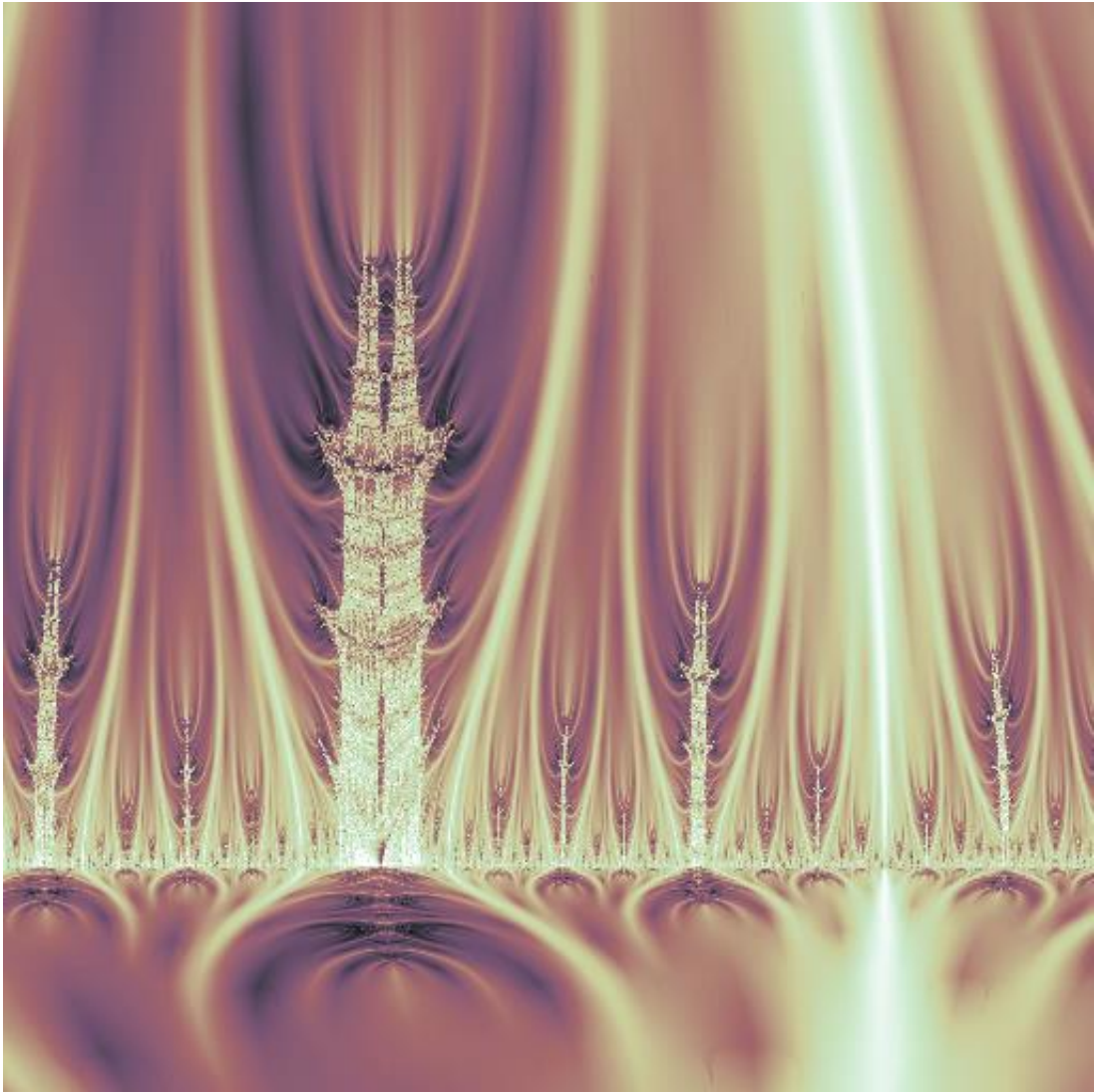


If you move to the right of the last image and along the spike you have another self-similar image! Each image has been coloured.



The Turtle

$a = 1.5$ Burning Ship set - a small region in the top right. TIA

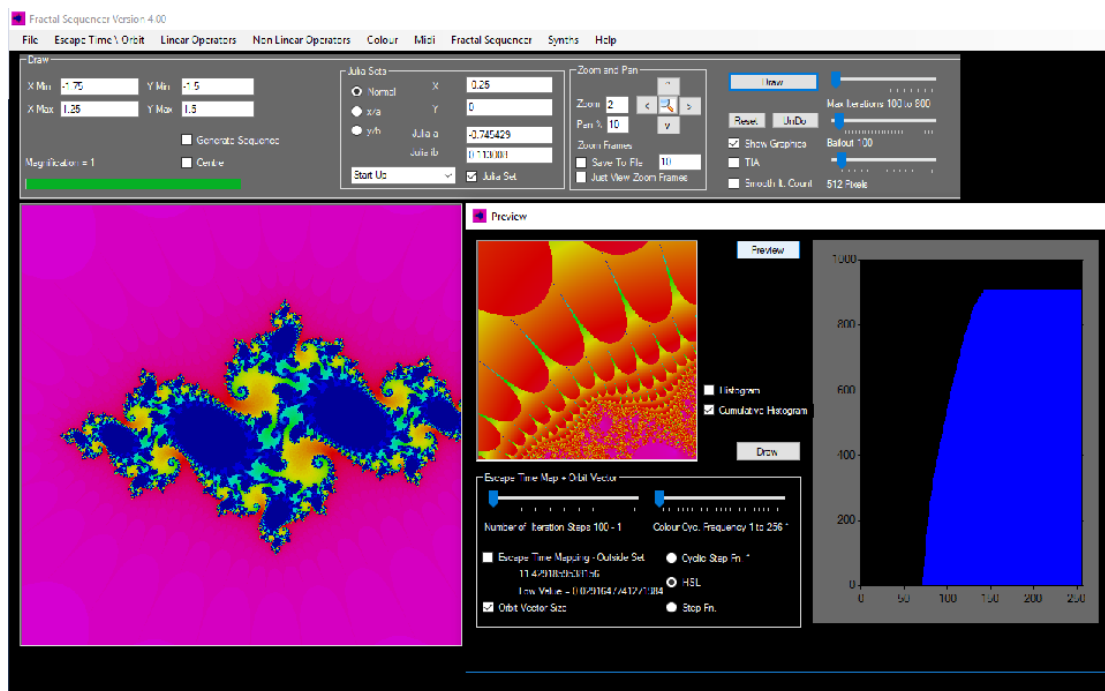


"The Burning Forest"

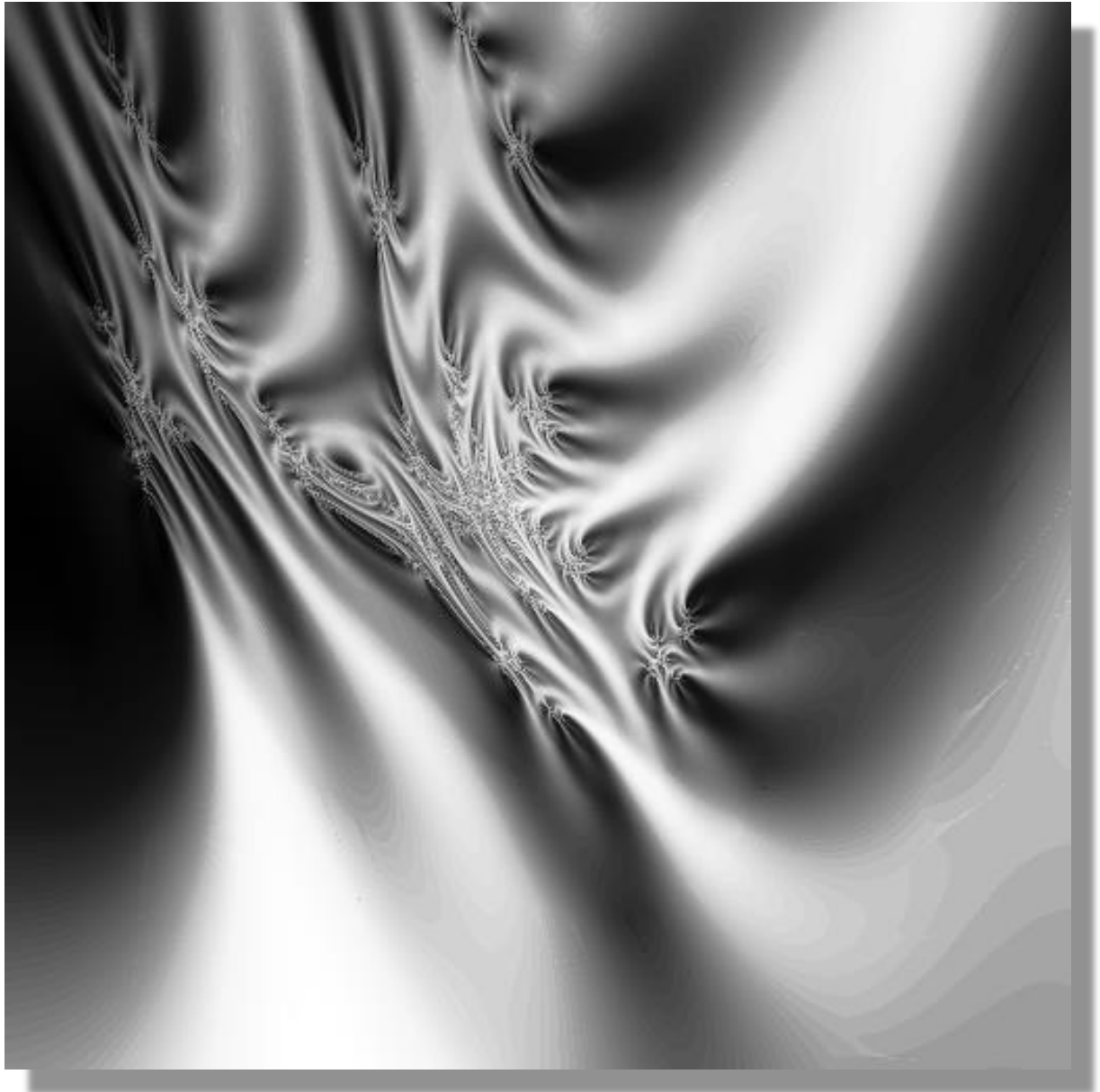
Burning Ship fractal, negative, TIA stripe and colourised HSL

FRACTAL DRAWING

This module can produce the most amazingly detailed images of the Mandelbrot and Quadratic Julia sets. It can also be used to select locations in or outside of the sets to create musical sequences.



A musical sequence will be created based upon the coordinates at the centre of the user's selection box - see later. If the *Generate Sequence* check box is checked this will automatically transfer the parameter values to the sequence engine and starts playing the sequence. Try selecting areas around the boundary of the set. The so called 'coastline' for fantastic images! Areas outside the set produce more varied sequences.

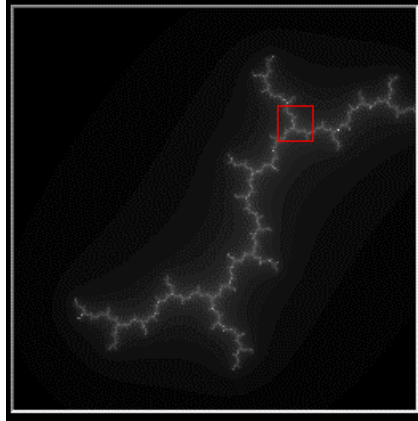


"Caught in a Dream"

One of the infinite number of possible slices through an infinitely detailed 4 dimensional object

QUICK EXAMPLE - DRAWING AN IMAGE

Firstly draw a dendrite fractal. Click on Julia set drop down menu select 'Dendrite' Click on Julia set check box.



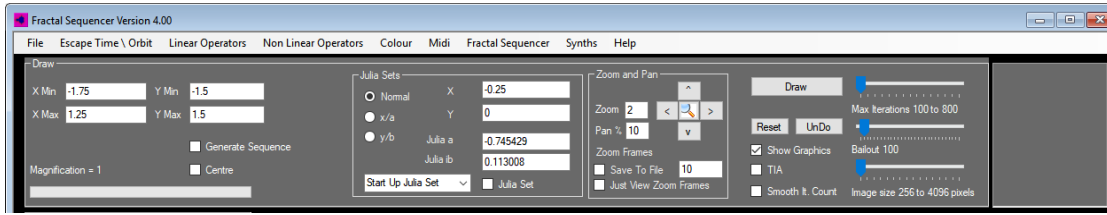
Select a region - say the top intersection of the 3 branches and click on TIA and Smooth iteration count check boxes. Click Draw. Then Transfer Function/Linear equalisation. Preview then Draw.



Click on Colour/RGB. Invert the green slider and gradually increase the red brightness and reduce the green brightness - slide the Green slider to the right as the channel is inverted.

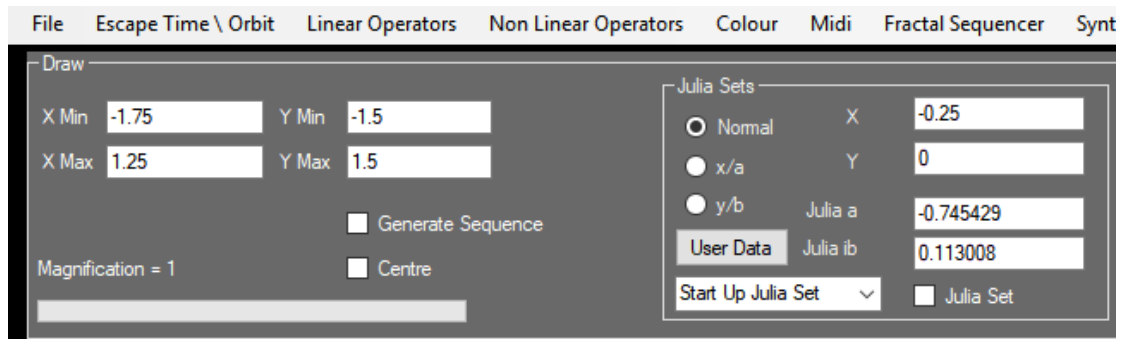


DRAW CONTROLS



This section controls the image on the display and data transfer to the sequencer.

Left Hand side of Draw controls.



1. The Xmin/Xmax and Ymin/Ymax show the coordinated at the four corners of the screen image. X and Y being the coordinates of the screen/image plane.
2. The green progress bar shows how the calculation/draw process is progressing.
3. Magnification - shows the magnification of the current image in relation to the start up image at 256 pixels square. Limit determined by double precision variables in windows.
4. Generate sequence sends Mandelbrot/Julia set parameter data to the sequencer.
5. Using Julia Set check box and Julia a and ib parameters sets the software to use the Julia set rather than the Mandelbrot set.
 - The Julia set fixes a and ib and uses screen pixel coordinate for values of x_0+iy_0 .
 - The Mandelbrot set is one special sub set. Where $F_0 = 0+0i$. a and ib = are supplied by the coordinate of the pixels on the screen.

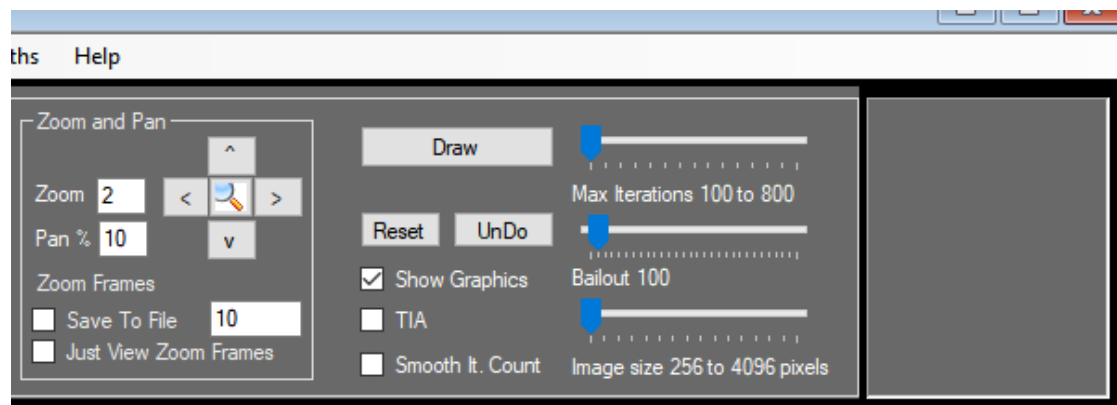
6. The red Centre squares corner shows the exact centre of the picture - bottom right hand corner of red square. It can be toggled on/off by checking/unchecking the show graphics check box and this setting is retained after redraw. It is useful for seeing the precise zoom point on the image or the location of the sequence source on the image.



Note. Scrolling sliders will be added automatically if the image is larger than your display.

7. The four coordinate boxes x,y,a,ib define the Julia Set complex number parameters sent to the sequencer. For Julia Set Image Plane see 'exploring more dimensions' section. The Julia a/ib boxes show the value of the Julia seed constant C .
8. The User Data button adjusts the four screen coordinate boxes on the left hand side of the form to the appropriate values at the current magnification. This is used if you manually enter values of X,Y,a,b .

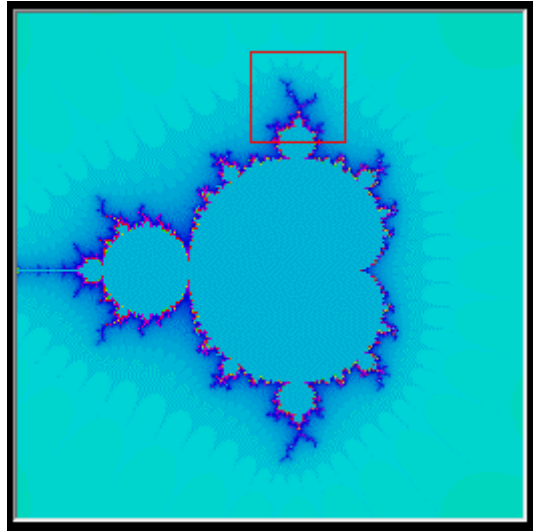
Right Hand side of Draw controls.



9. The four arrows allow the user to move around the image plane. Pan set to 10% of field of view at start of session.
10. The magnifier allows the user to zoom in or out of the image. Zoom set to 2 times at start.
11. No. Of Zoom frames automatically redraws the image successively. So if 10 is set the image will refresh 10 times zooming in on each refresh.
12. Save to file automatically saves a bmp image of the zoom sequence. This can be made into a movie using third party software, The bmp images are stored in the installation directory as 'fractalimage1.bmp, 'fractalimage2.bmp etc.
13. Draw refreshes the image
14. Reset draws the start image of the Mandelbrot set.
15. Show Graphics - turn on or off the red selection box when choosing sequence images for printing. From Ver 4.2 LHS of form.
16. Undo - undoes the image to the previous one. One step recorded.
17. The iteration slider determines how many iterations are applied to see if the series is divergent. More iterations slow the calculation process but produce a more accurate and detailed result.
18. The Bailout slider sets the limit when the calculations terminate.
18. The Image Size slider allows the user to decide upon the size of the calculated image. Bigger images take longer to render. Images from 256 up to 4096 pixels square can be drawn depending on PC, Processor and memory. I can increase the image size upon request by customers to pretty much anything!

Note. The empty text box at the right hand side displays the 'save setting' contents when a file is opened.

SELECTING A REGION



Drawing a square box on the picture by holding down the left mouse button and dragging. The size of the red box is as per the X dimension. Whilst holding the left mouse button down you can drag the red square up using the top right corner of the red box.

- If 'Generate Sequence' is not ticked the software will redraw the region in the box - once Draw button is pressed.
- If 'Generate Sequence' is ticked it only sets values for the sequencer which will begin to play. Note Constant and Imaginary Constant are based upon the coordinated at the centre of the box. You can see the x,y,a,ib values in the text boxes. Grey backgrounds of the text boxes indicates the screen image is drawn in that plane.
- Reminder - Clicking the Julia Set check box changes Julia Set values instead.

EXPLORING MORE DIMENSIONS

Most images of the Mandelbrot set are composed in the x/y plane. You will also see images of the Julia set in the x/y plane. What is very rare is to see the sets in other dimensions.

The Julia set requires four parameters. x, y, a, b . These are used in the iteration $F_{n+1} = (F_n)^2 + C$. Where F and C are complex numbers. $x+iy$ and $C = a+ib$. The Julia set is a four dimensional set. Another way of thinking of it is that we are dealing with a four dimensional object of which the Mandelbrot set is a special sub set, a slice through the super set at $X_0 = iy_0 = 0!$

The Mandelbrot set is a plan view with $x_0+iy_0=0$ and a and b relating to screen coordinates. The Julia set is typically shown in plan with x_0 and y_0 relating to screen coordinates and a and b fixed. However depicting in plan does not show the splendour of the object. If you could only see your house in plan it would not give a clear impression of its form. So from version 1.72 you can now slice the 4 dimensional Julia Set object. So the image on screen can show

X against a. User to specify Y and b.

Or

X against b. User to specify Y and a.

This is like taking slices through your house vertically. You see Elevations. You will see the true form of the Julia set object. See Julia Set example below. $X=0, y=0, a = -0.745429, b=0.113008$. Image on Right is zoom of central region. Images shown in x/y plane.

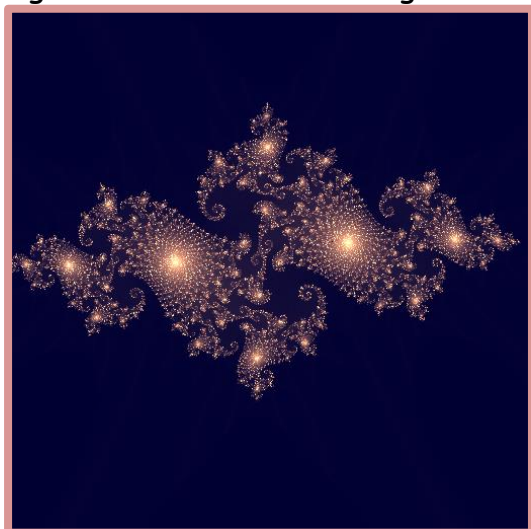
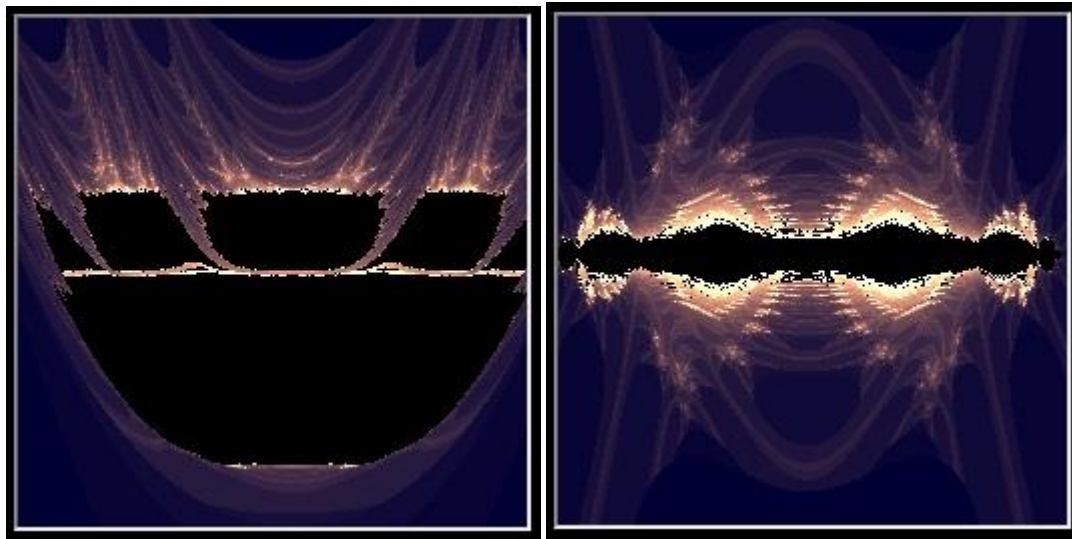


Image on left below is x/a covering region of left hand image above.
 Image on right is same region for x/b . Notice how this four dimensional object looks very strange and difficult to comprehend for us spatially three dimensional beings.



x/a

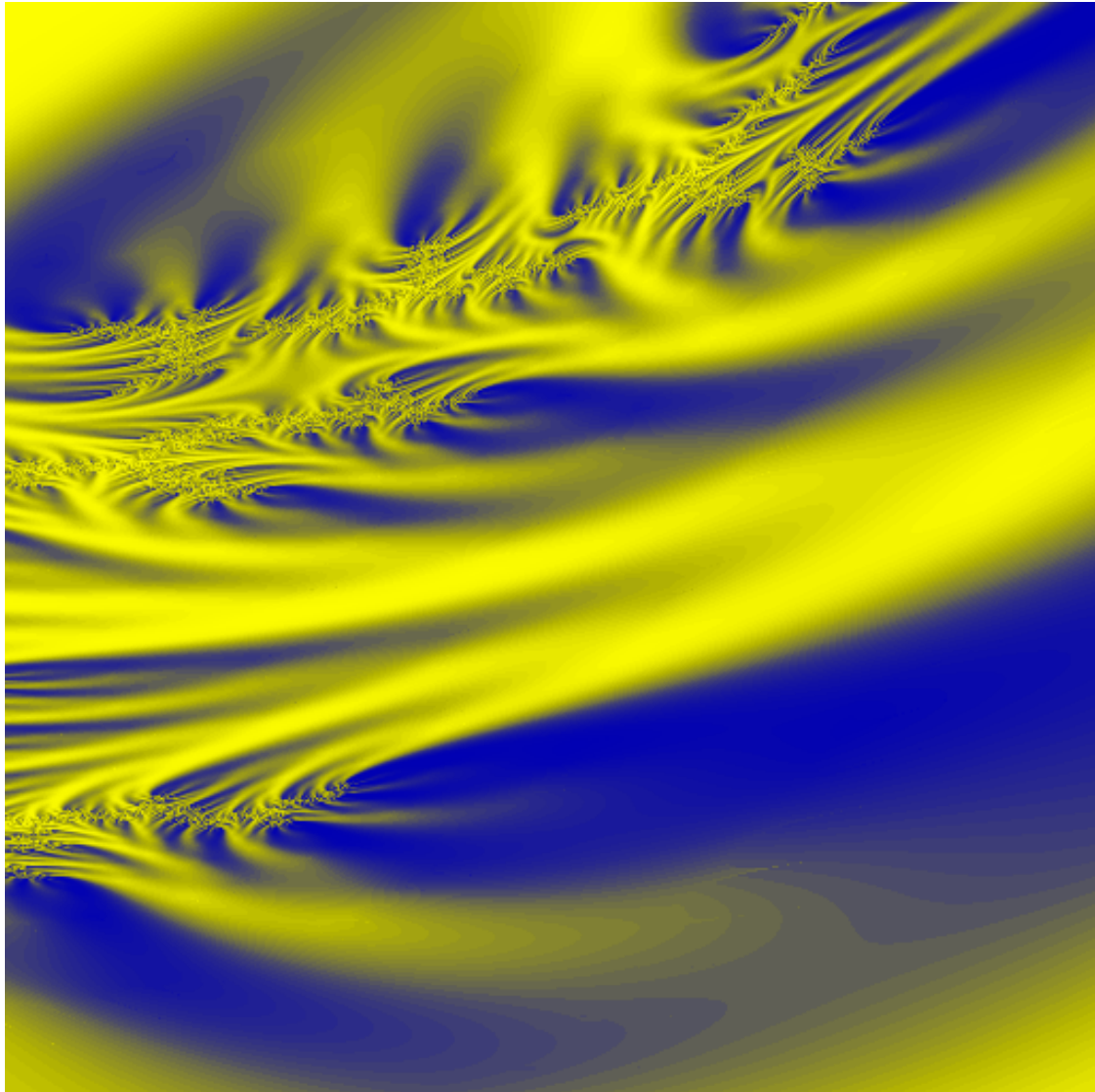
x/b

Note that mathematically x/a is the same as y/b and x/b the same as y/a . So y/a and y/b are not options required. This symmetry is due to the symmetry between the real and imaginary numbers. Below are 3 images of the Julia set dendrite fractal. The first is on the plane x/y , the second x/a and the third x/b . Different elevations of the 4 dimensional object.



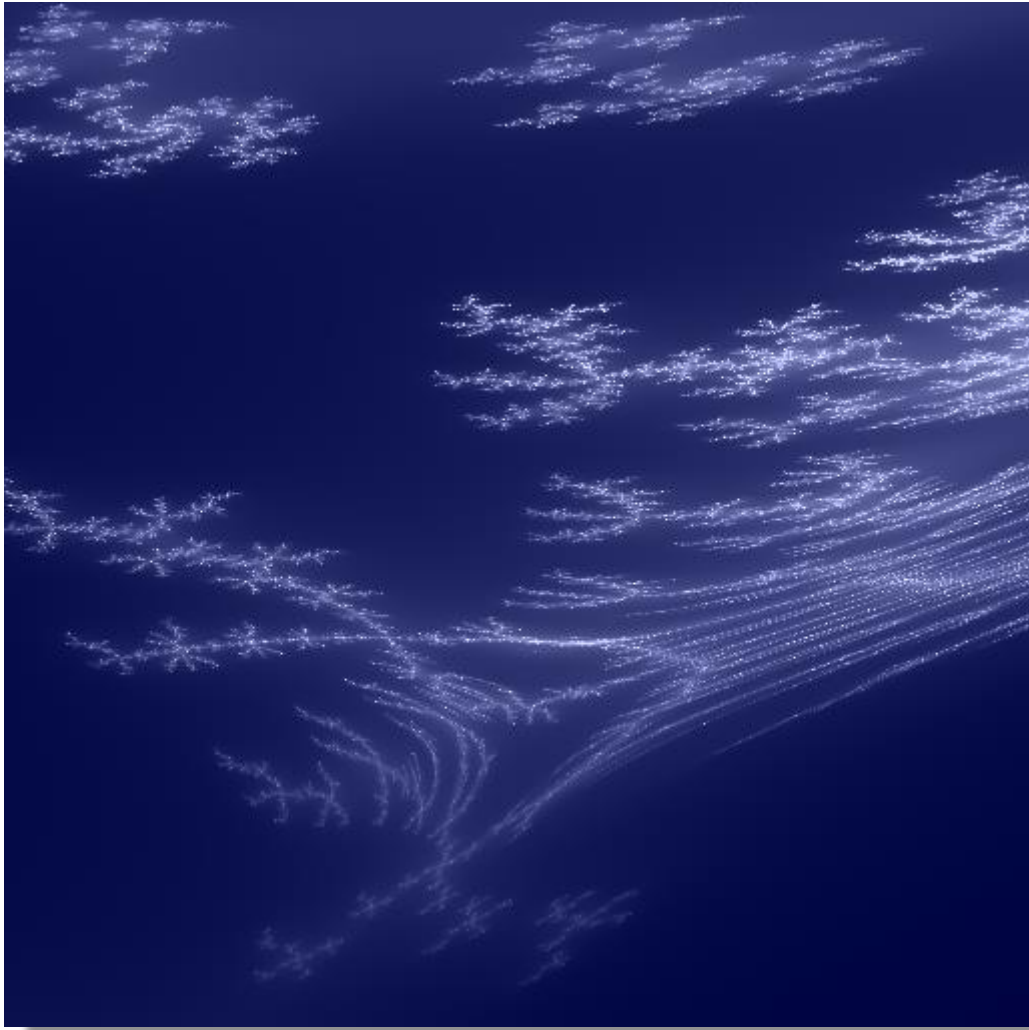
Fractals can be defined by a dimensional property. A simple straight line is 1 dimensional. A square is 2 dimensional. However Fractals have non integer values eg. 1.25. Because they are so tortuous they occupy a space between 1 and 2 dimensions - non integer for fractal lines. However from a solid body perspective the quadratic Julia set is still 4 dimensional.

Note. If you use the mouse to zoom around, a new set is created in x/a or y/b . As X and Y will change. To zoom in without changing the x/a or y/b set in the image window use the magnifier button and arrows. To generate a new sequence at a point on the image point use the mouse to draw a rectangle around the point. Pressing Draw will show the new set.



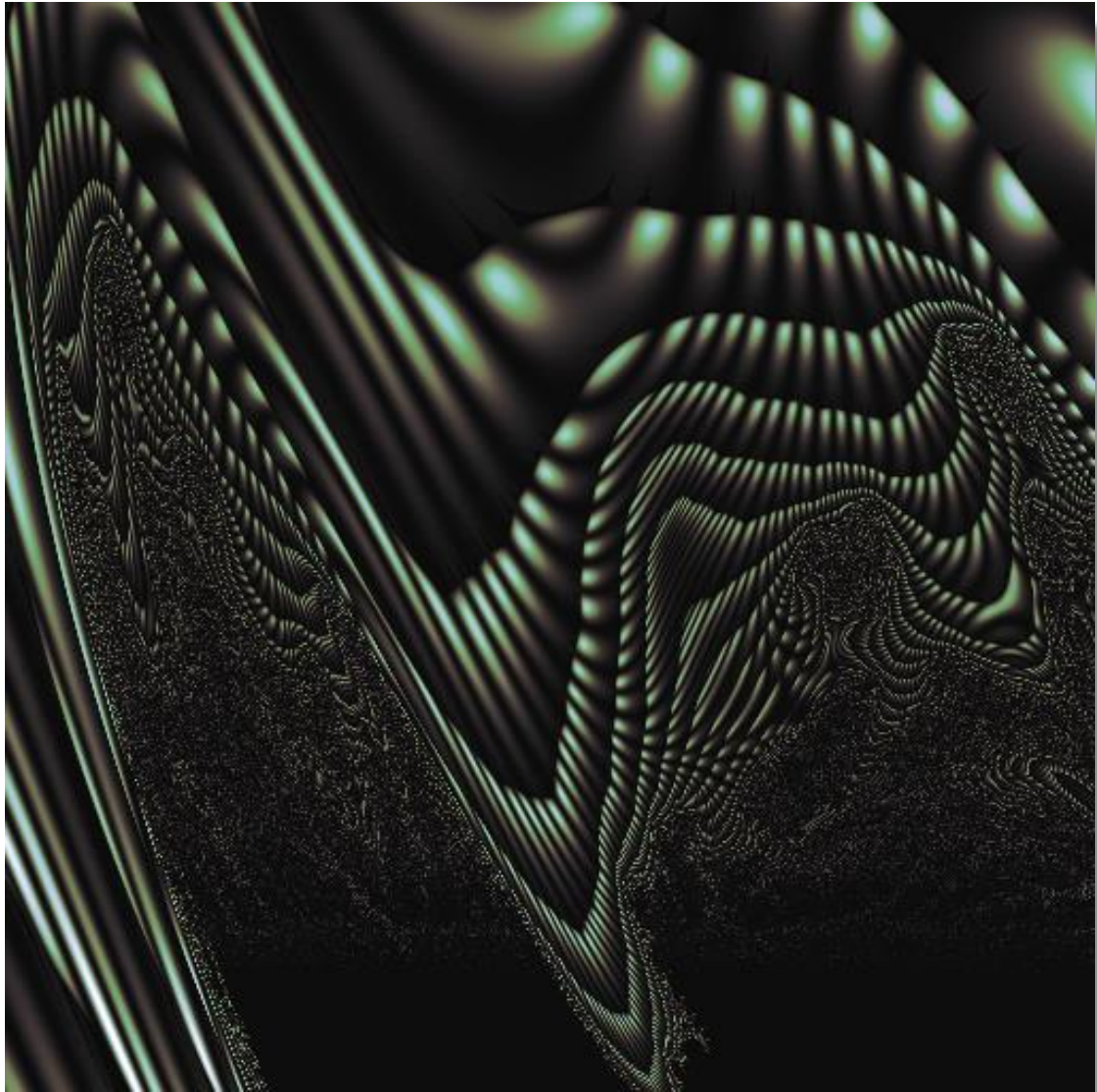
"Alien Sky"

Looking at an image of a four dimensional object. Small changes in x,y,a,b make large changes to the image. TIA and smooth iteration count in the x/a plane.



"Archipelago"

Part of the *Galaxy Julia Set* in the x/a plane



"The Quantum World"

Part of the Start Up Julia Set
TIA, smooth iteration count in y/b Plane

PREVIEW FORM

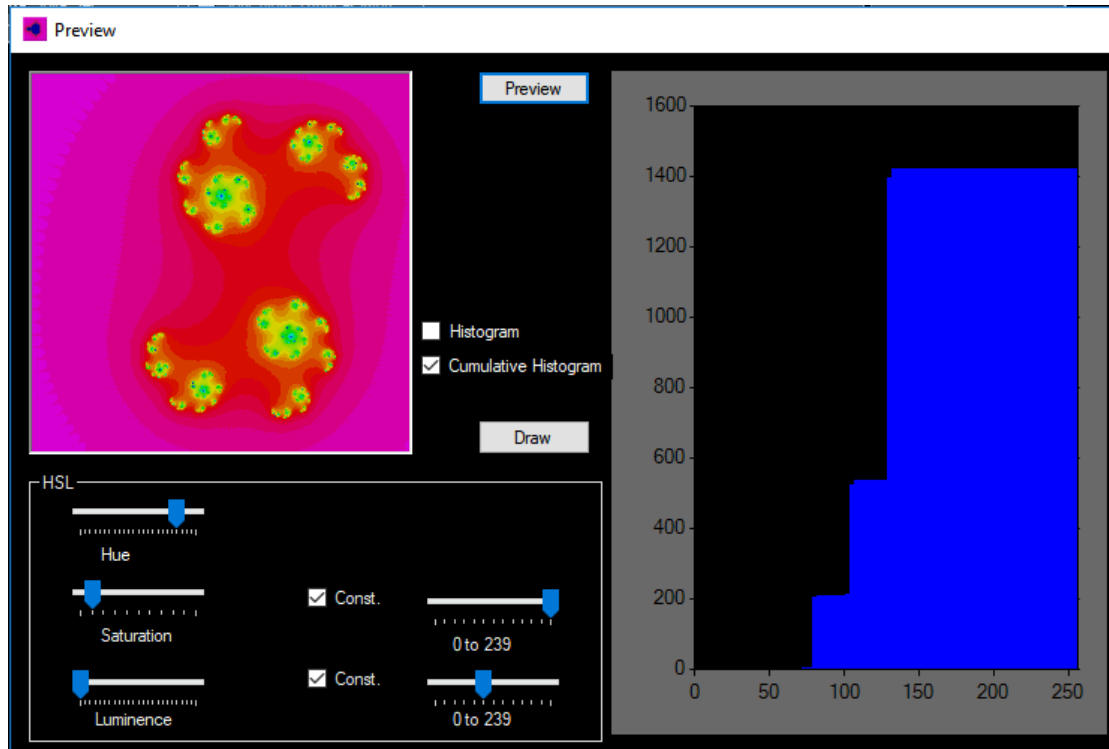
This form allows the user to modify how the image is displayed on the screen or saved to file. In the raw gray scale image the brightness of the pixel is related to whether the series diverges or converges. Often the initial images lack contrast. But we can correct that with image processing. Black is a divergent series. White is a convergent series. For greyscale the software calculates how many iterations are needed for the value of F to reach a certain pre specified value. For divergent series the bail out value limits the calculations as before they stop. So for an unedited image-

- Convergent series = White.
- Divergent series = Black

Note. The Mandelbrot set was shown as black, as when it was discovered in 1979 as most computers could only print in black or white. So consequently the very first computer generated image showed divergent series as white and convergent as black. I have not stuck to convention so white is the default setup for the set! The user can change this. White would be RGB = 255,255,255. Just invert the image in the transfer function form. $Y = 256-X$

PREVIEW WINDOW

The purpose of this feature is to allow the preview and adjustment of the image processing functions on a small image which is much quicker and does not destroy the image array.



The preview image box holds a 256 pixel square copy of the main image array. It enables comparison between before and after processing

IMAGE PROCESSING ROUTINE LOGIC

1. When Draw (main form) is clicked an image is produced in the Draw form. Choose image size, bailout, iteration limit, and whether you want an iteration plot - default, or average plot and or smoothing. Alternatively load a bitmap image .BMP.
2. Clicking a Preview menu option down-samples and copies the main image array to the Preview form array.
3. Once you have done an edit you are happy with Click DRAW (Preview form) which updates the main image and the main image array.
4. Clicking a Preview menu option again updates the preview array from the new draw image. Apply another image processing function in Preview
5. Click Draw (Preview form) updates the main image and the image array.

Etc.

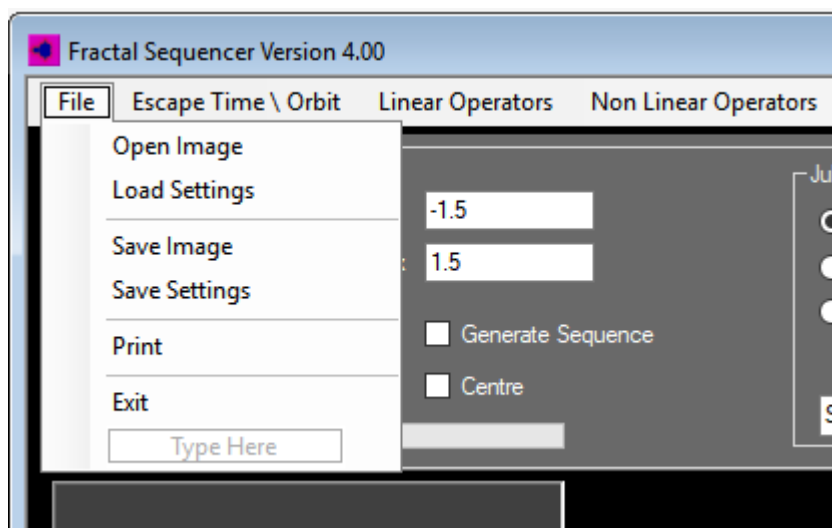
This way you can stack image processing routines and change their order.

Important. Work in monochrome. This avoids stacking colour generation every time you draw and preview which will spoil the final image. You can finally colourise RGB/HSL colour space at the end.

If you want, you can save your draw form image as a bitmap .BMP file and save the monochrome image settings as well.

SAVING IMAGES

For printing and other image processing it is useful to export the image as a 3 channel 24 bit bitmap into programs such as Adobe Photoshop, Paint.net or Astronomical image processing programs such as MaximDL or AIP4Win for example. If you want you can reset all colour sliders if you moved them and click 'Redraw'. This will create a raw greyscale image. Then click 'Save Image' to save image to disc. The BMP stores RGB channels as 8 bits per channel. This produces a possible 16.8 million colours.



OPEN IMAGE

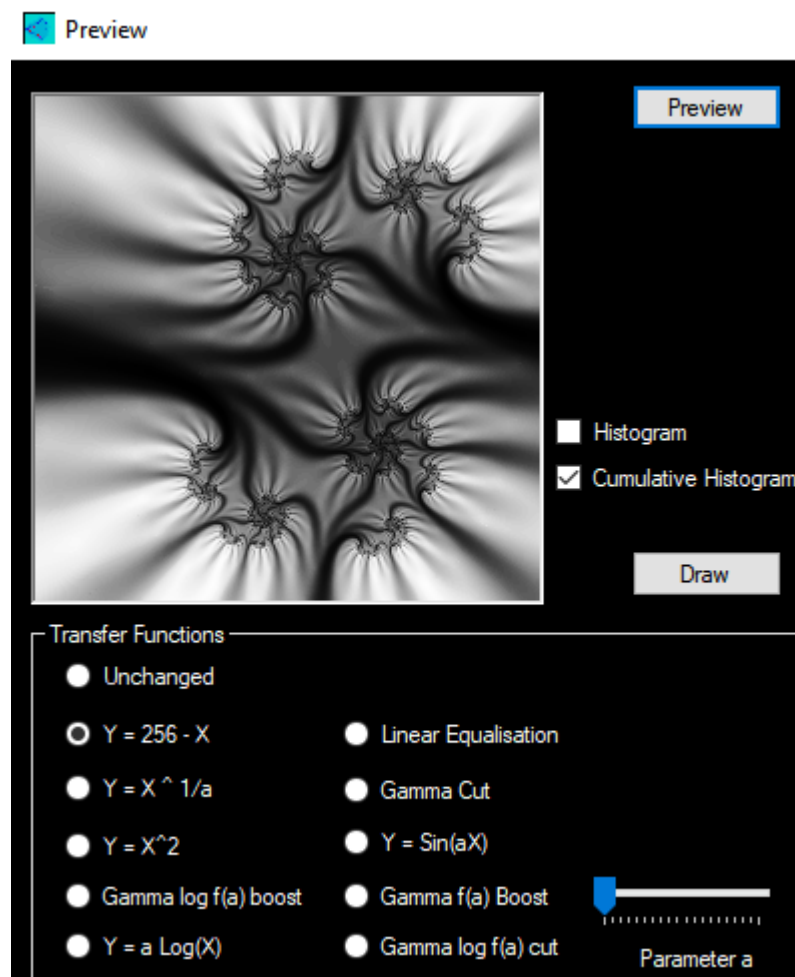
You can open previously saved 24bit bitmaps. Go to Preview/File/Open. The main Draw form picture will be replaced with the opened image in monochrome. Remember to work in monochrome and finally colourise. NB. To reload musical sequences you have to go to Load sequence settings and reload the setting file too. See Saving and Loading sequence parameters.

You can open any bitmap image, but to see it all, increase the size of the picture box to accommodate it. The image will open in monochrome so all of the imaging processing functions can operate on it. You can the colourise it. If you just want to locally edit any colour image and then save it then make sure colorise form is open first.

IMAGE PROCESSING - I.P. LINEAR OPERATORS

TRANSFER FUNCTIONS

When an image is drawn on the main form, an array of the calculation output values for each pixel are stored in memory. Transfer functions operate on these values to modify the image. Below is a negative applied to the Julia Lyra set which brings out low contrast features. There are several functions to choose. Linear Equalisation is a very useful function which redistributes pixel values and produces a much more punchy image. See later. The slider varies a parameter (a) is used in some of the functions.



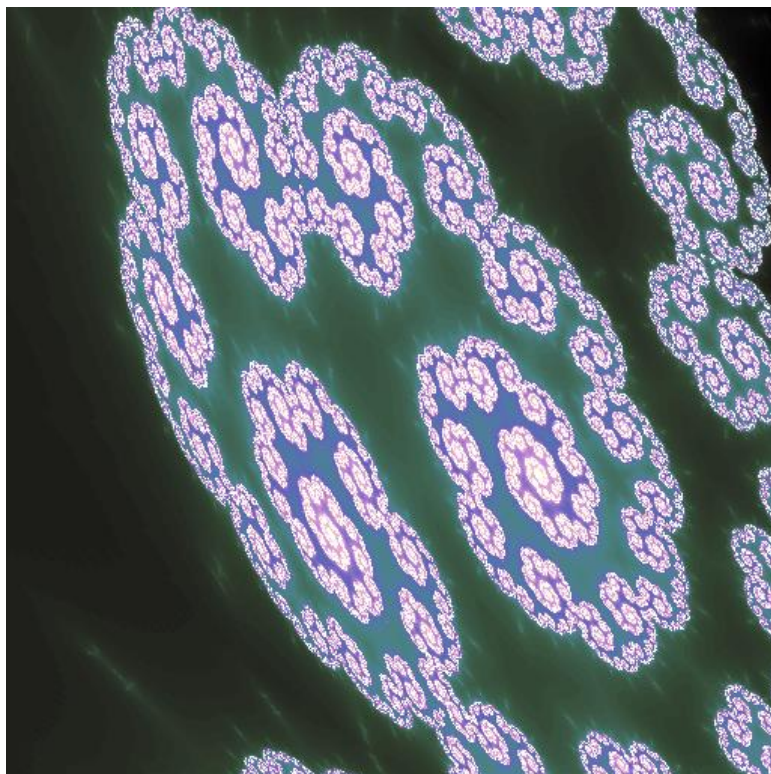
So in addition to the various contrast and brightness controls in the image processing functions you can use the Transfer Functions - for modifying the pixel mapping. Select the option and click Preview.

If you are happy with the result click Draw button on the Preview form to transfer to the main form for further processing. The Transfer function options are:-

- Unchanged - Default
- $Y = 256 - X$ (Negative image)
- $Y = X^{1/a}$
- $Y = X^2$
- Gamma Log - cut / boost midrange
- $Y = a \text{Log}(X)$
- Linear Equalisation
- Gamma - cut / boost midrange
- $Y = \text{Sin}(aX)$
- Gamma $f(a)$ Boost
- Gamma $\log f(a)$ cut

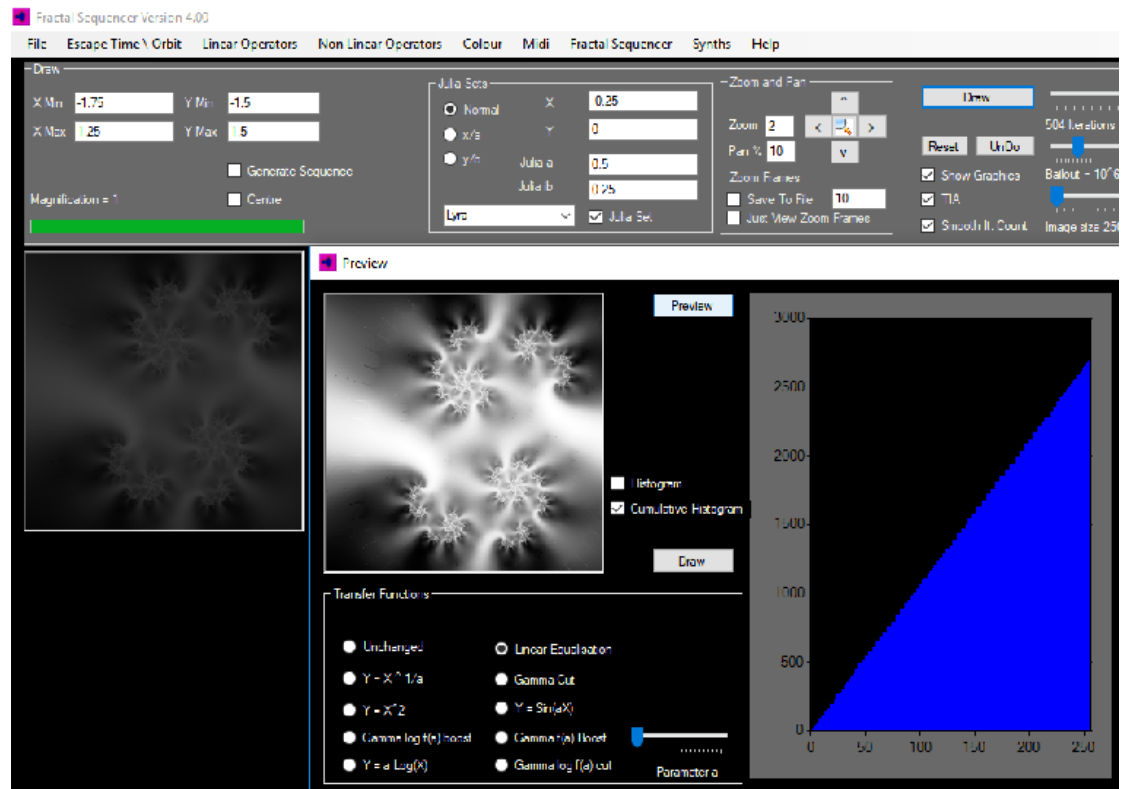
Note. The power, log, sin, reciprocal and gamma functions have a slider for further modification by a parameter 'a'.

Linear equalisation is probably the most useful function as it increases the contrast of the image for further processing.



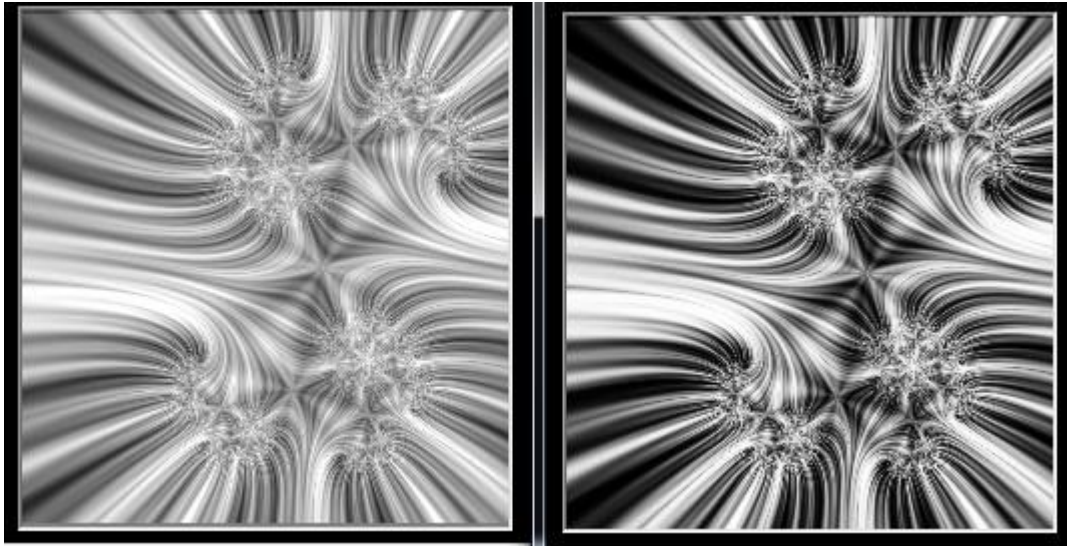
LINEAR EQUALISATION

See the Radio Button 'Linear Equalisation' below on the Transfer function form. This process re distributes the pixel values to make a more dynamic image. Click 'Transfer menu item' -linear equalisation radio button to see it. If you are happy with the result then click DRAW to produce the image on the main form.



See cumulative histogram and compare it to the one without equalisation in the cumulative histogram section later. The original curved histogram is straightened.

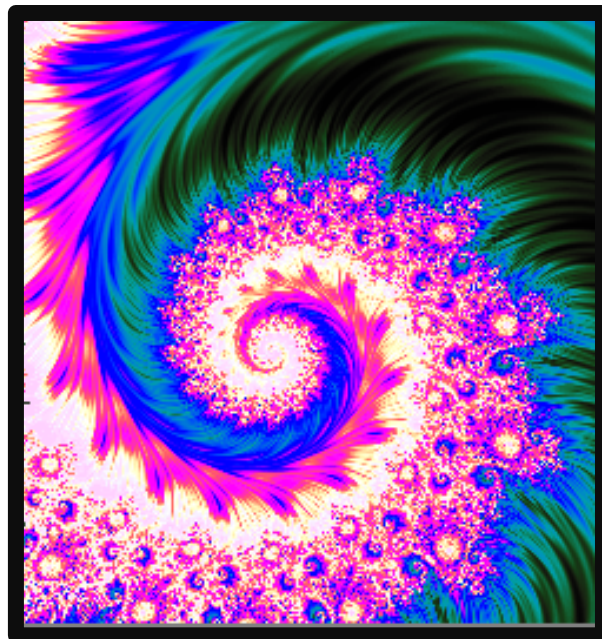
Compare the two images below. The left hand one is without linear equalisation. The right one is with equalisation. In the right hand image there are equal number of pixels at each brightness level 0 to 255 - see histogram above. This produces more contrast or 'punch' in the image.



No equalisation

Linear Equalisation

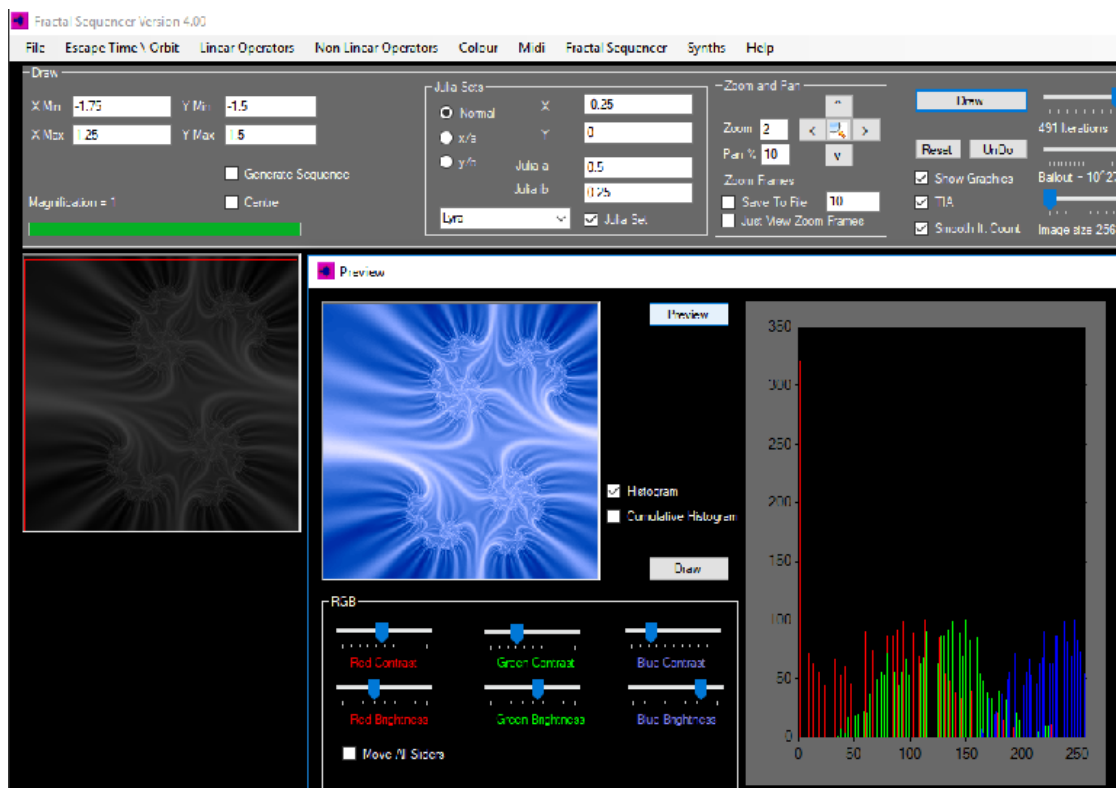
Lyra Julia set. Bailout 10^{22} with 2000 iterations. Smooth iteration count. Stripe average with frequency 8.



Start up Julia Set. Bailout 10^7 , 1200 iterations. Linear Equalisation HSL colour coded.

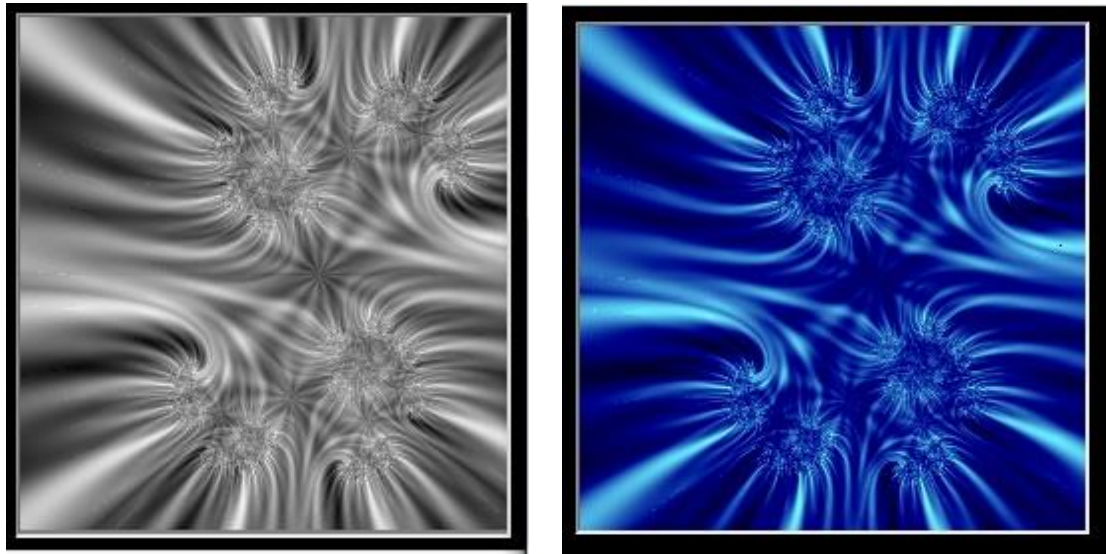
HISTOGRAM

The histogram in Preview shows the pixel brightness graph. The same as you see on many digital cameras. This is used to fine tune the output image to avoid over or under exposing your image. Ideally all image pixels in the red, green and blue channels should be spread in the brightness range 0 to 255. Typically there should be no 'bars' higher than 1 at 0 or 255 brightness levels but it depends on personal preference. All pixels will fall in the range 0 to 255 - see below. Each bar represents how many pixels (y axis) at each brightness level 0 to 255 (x axis) for the three colour channels.

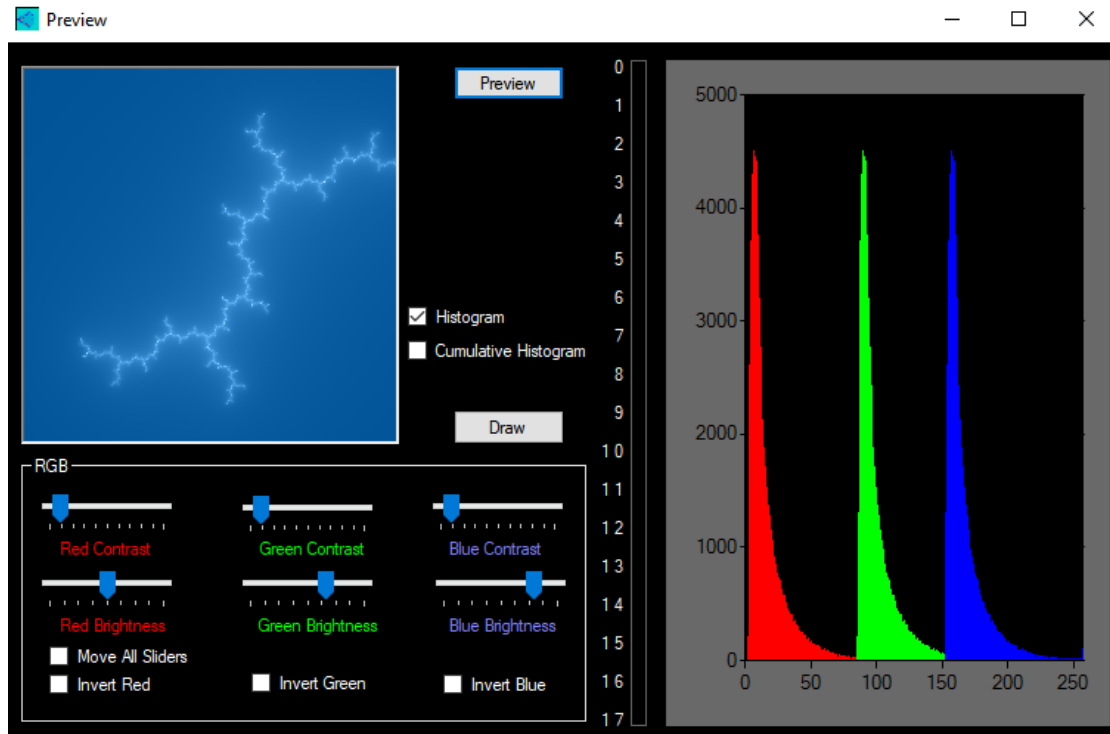


Note. Remember. Final colourisation is normally done at the end before saving or printing.

See close-up of previous images below. This is the Lyra Julia set. Stripe average and smooth iteration count - see later. 500 iterations with a bailout set to 10^6 . Stripe frequency 11.



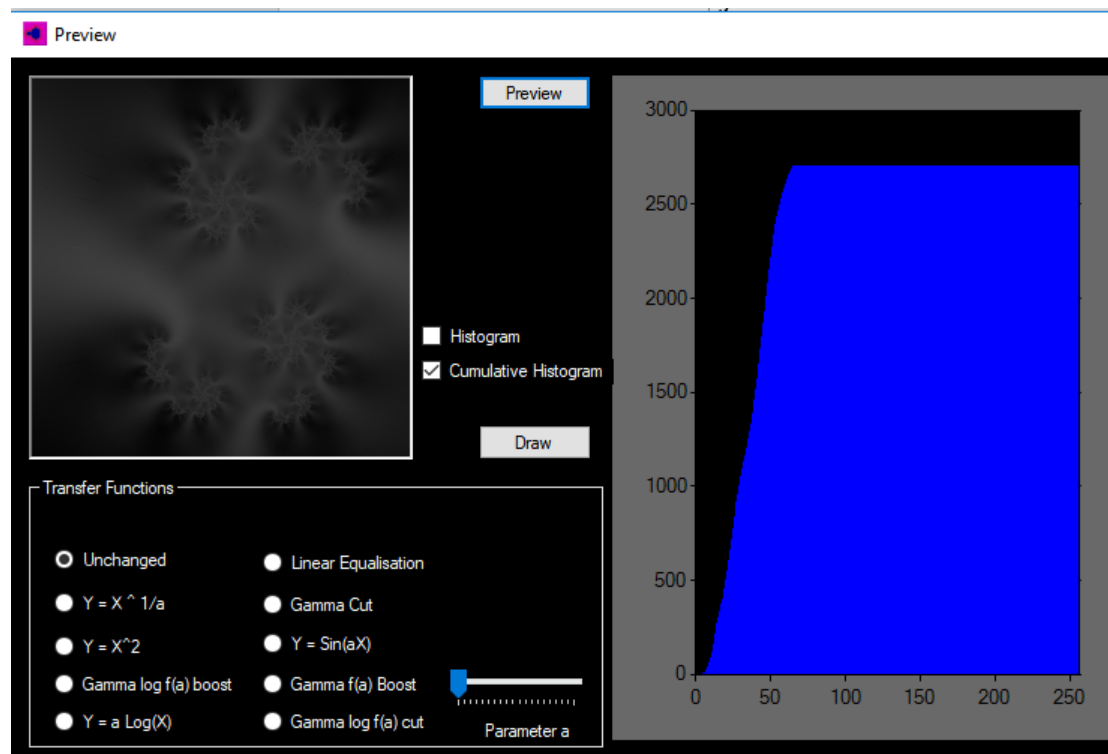
On the previous image notice the colour histogram. The bright pixels in the monochrome image (left) are mapped to the blue channel. The mid brightness pixels are mapped to green and the low brightness pixels to red. See the right hand image. This has been done by just using the RGB contrast and brightness colour sliders. Moving a contrast slider to the right spreads the pixel values for that channel. Moving a brightness slider to the right moves the entire set of channel pixels to the right. The final colourised image is on the right. These are jpeg images in this document. The original bitmap is even more detailed. From version 3 the RGB contrast sliders range number goes from 0.1 to 10 (1 to 100 slider values).



In the example above the three RGB channels are shown and I've separated them by boosting the brightness to different levels for each colour channel. The images in this software don't suffer any digital noise unlike digital cameras. However, it is best to spread the distribution of pixel brightness evenly across the range of the histogram to get a 'punchy' image. Linear equalisation is the best tool for doing this. See next section. To move any slider small amounts you can hold down the left mouse button on the slider and use the left and right arrows on your keyboard.

CUMULATIVE HISTOGRAM

Check the 'Cumulative Histogram' check box.

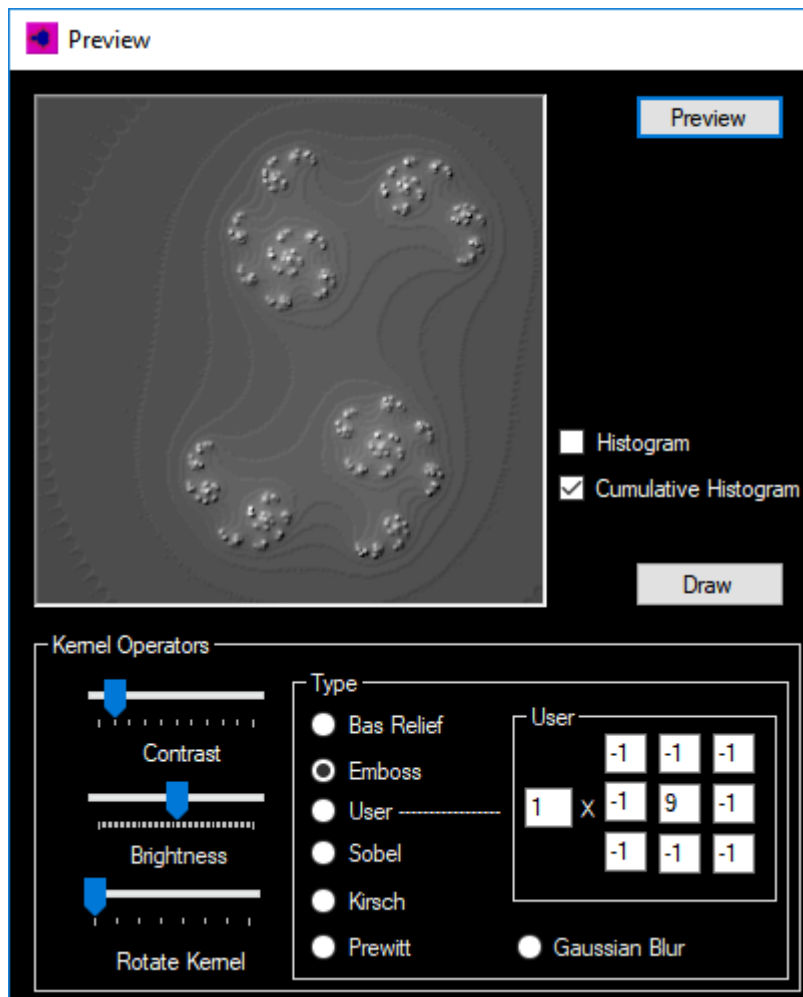


The image above is low contrast, showing a cumulative histogram with no pixels brighter than 75.

The software can display a cumulative histogram . Imagine a histogram with a series 2,5,7. If the terms are added successively you get 2,7,14. So it's a running sum. See image above. 0 pixels are present at value 0 brightness. 100% of pixels are less bright than the maximum value of the graph. A good equalised image will have equal numbers of pixels at each brightness level, producing a straight line from 0,0 to 256, pixels. Linear equalisation will produce this. See next section.

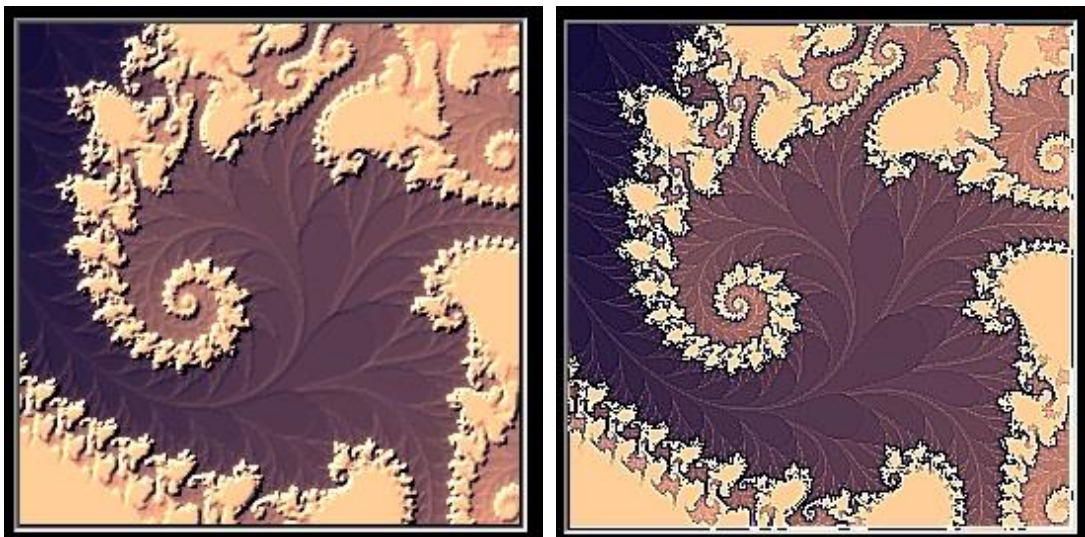
KERNEL OPERATORS

The various kernels are linear operators and convolve the image. That means once applied they can be undone with the inverse kernel. The order in which they are applied (if stacking) makes no difference to the final processed image.

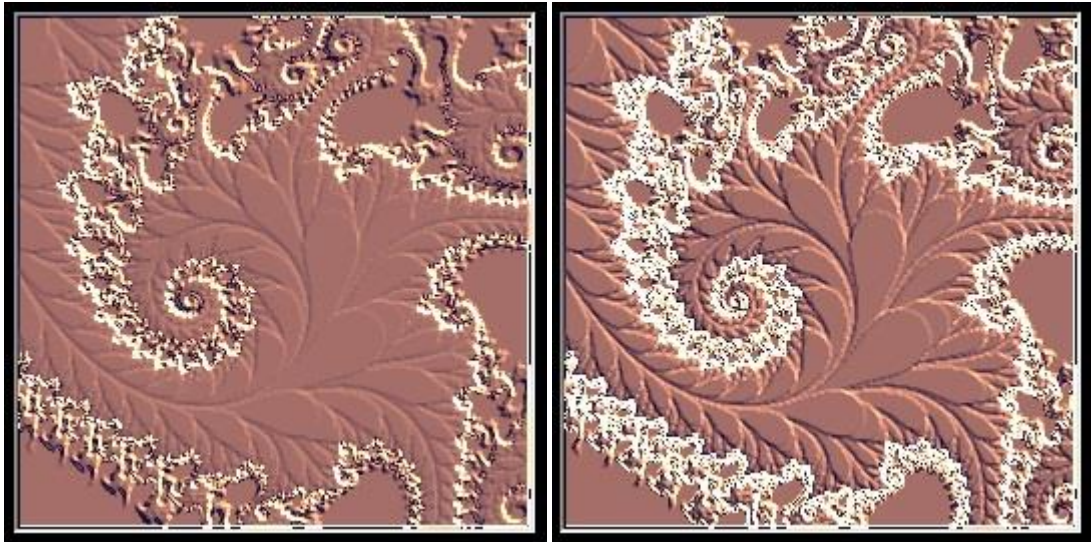


Some examples are shown below:

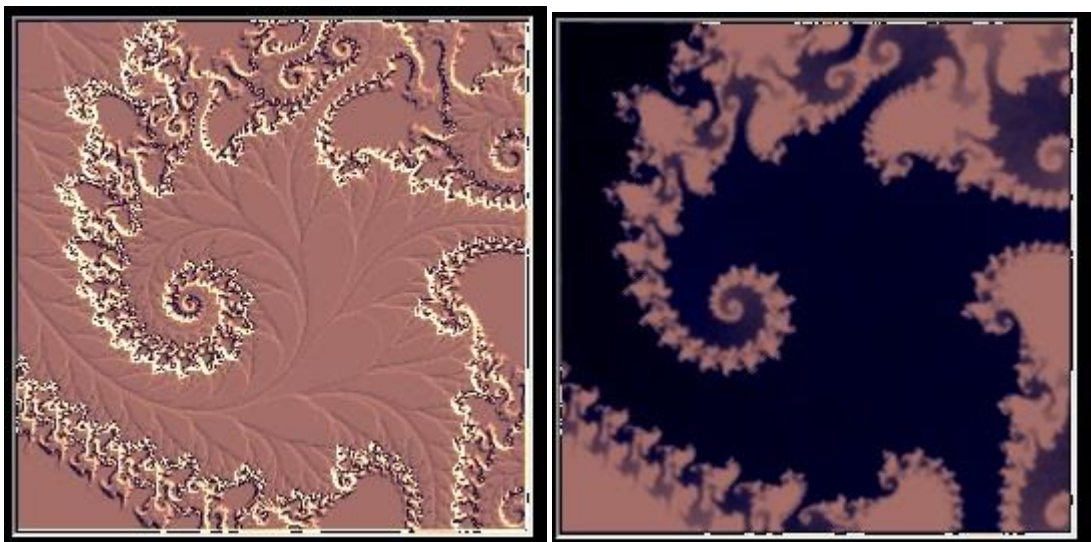
The image below on the left is a part of a Julia Set and is 'unprocessed' other than RGB colourise applied. The image on the right has a Bas Relief Kernel applied.



The Image above on the bottom left has an embossing kernel applied. The one on the bottom right a user defined (default kernel) sharpening filter.



The image above on the left has a Sobel kernel applied. The one on the right a Kirsch kernel.



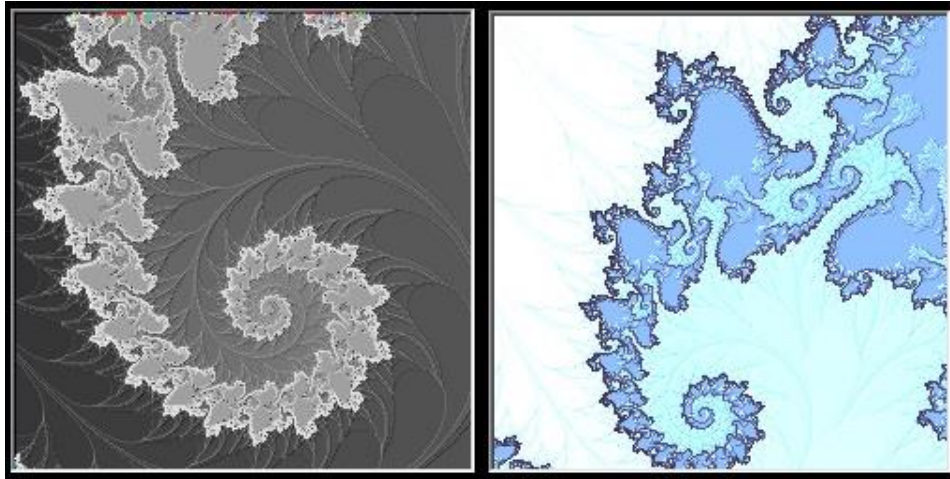
The image above on the left has a Prewitt kernel applied. The one on the right a Gaussian Blur Kernel.

You can start to see the variety of effects possible. They can also be stacked. So once you are happy with the preview. Click OK to update the main window. Then preview and process again!

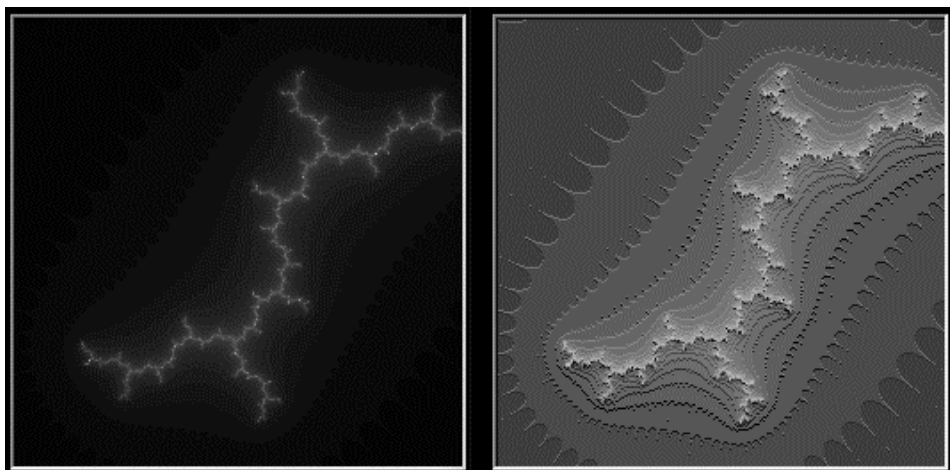
IMAGE PROCESSING - I.P. NON LINEAR OPERATORS

These various processes are non-linear operators. That means once applied they cannot be undone to retrieve the original image. The order in which they are applied makes a difference to the final image.

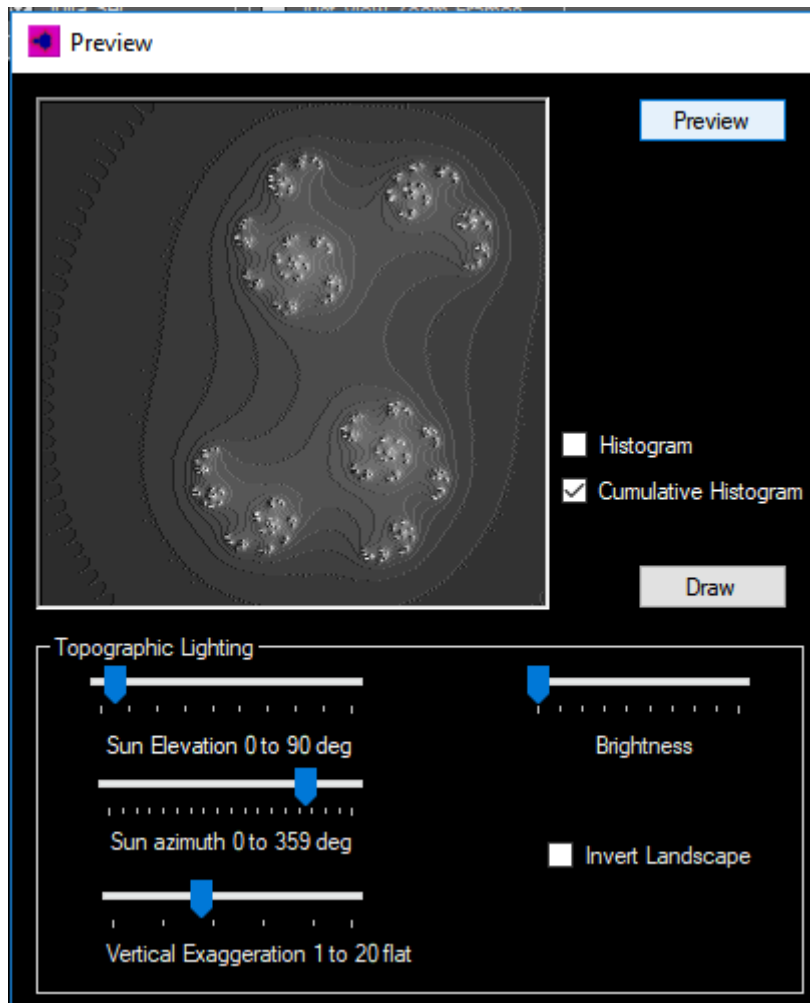
TOPOGRAPHIC OPERATOR



This operator maps iteration count to elevation. So a landscape is produced. The monochrome image above on the left was produced using the default settings. The one on the right has inverted elevation and is colourised. Low areas are blue and represent basins of attraction. The light areas are areas of repulsion. In the former, series converge with tight orbits. The latter is the opposite leading to diverging series.



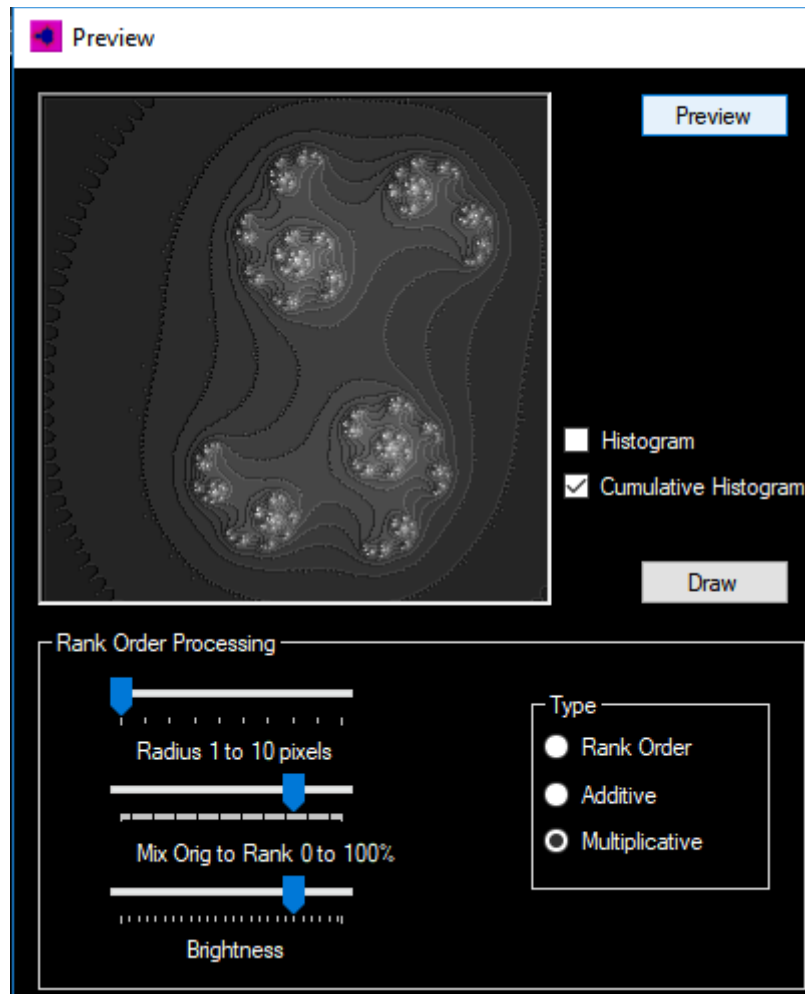
In the example above the dendrite Julia set is processed using the topographic operator.



The user can specify the elevation of the sun 0 to 45 degrees above the horizon in version 4.2.0. Higher elevations don't produce very good results as the image is flattened. The azimuth (compass position of the sun) changes the direction of the light. The exaggeration of the height range magnifies the difference in the iteration count values. Move the slider to the right to flatten the landscape. The brightness slider boosts or cuts the image brightness.

Low sun elevations produce dramatic results : 1 to 10 degrees. The sun is coming from the North East in the images above. The default is inverted landscape to make basins of attraction low elevation. Julia sets are great for this operator. The brightness slider varies the solar intensity,

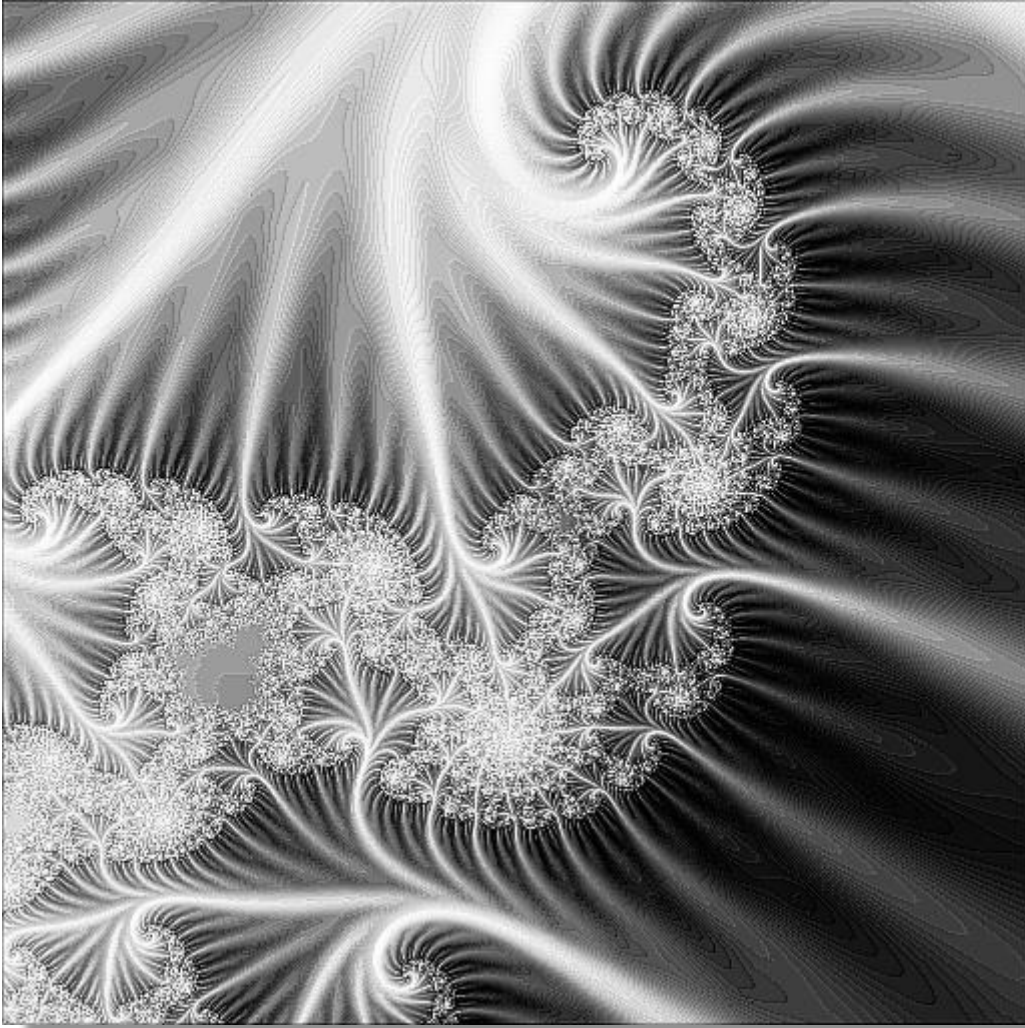
RANK ORDER OPERATOR



This operator is used to bring out fine detail in the image (high frequency information) whilst keeping the low frequency data relatively unchanged or reducing it.

- The radius of the kernel can be adjusted from 1 to 10 pixels.
- The mix works for Additive and Multiplicative. Middle of slider = 50/50.
- The brightness varies the brightness of the image.

The simple Rank Order process is option 1. Additive, mixes option 1 with the original image. Multiplicative is a more sophisticated process again. Blending the two images.



"Grand Central Junction"

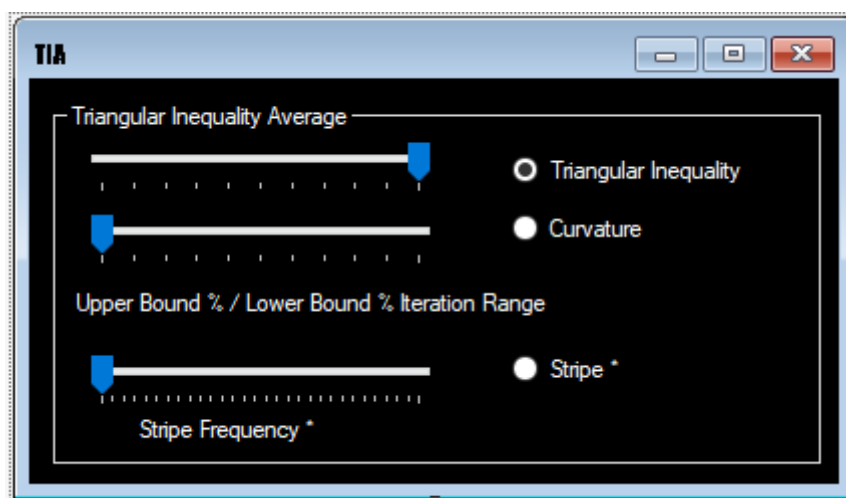
An Additive Rank Order processed image.

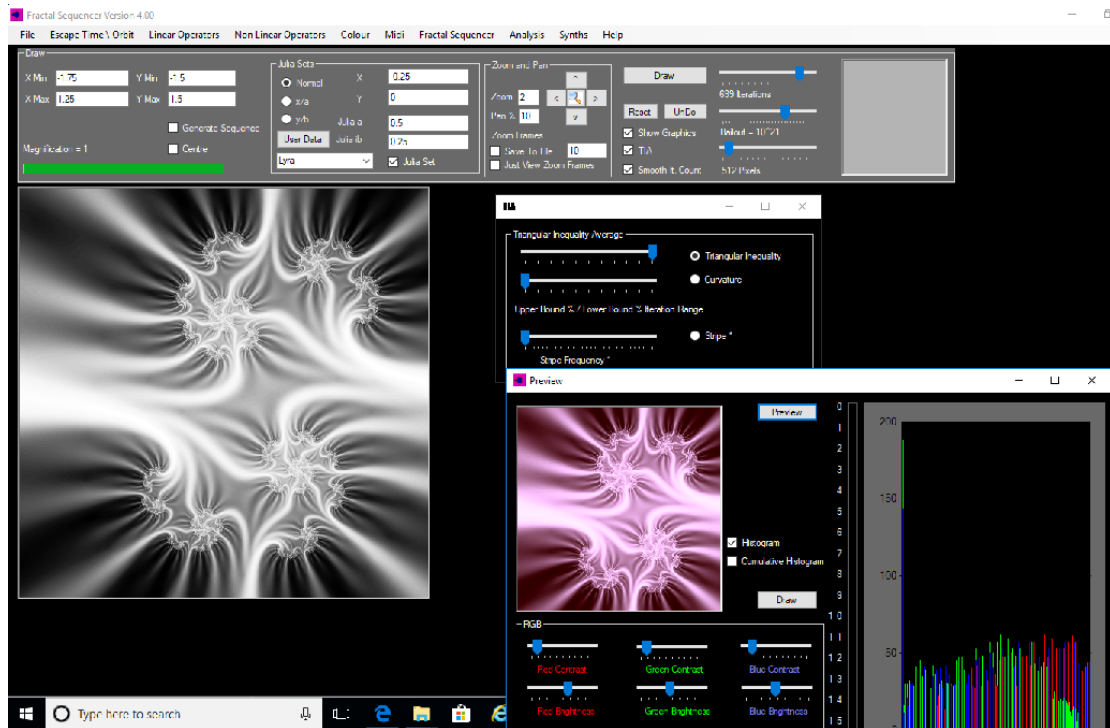
TRIANGLE INEQUALITY (TIA), STRIPE AND CURVATURE AVERAGE WITH SMOOTH IMAGE COUNT

Note. The default mode for images is monochrome. The colourising is done at the end of image processing. This is because it is important not to stack colourisation as version 3 allows for repeated processes. Ie. Draw then Preview, image process, Preview/Draw, Preview, image process, OK etc. So you could do a Rank Order convolution and press OK. Then Preview and do a topographic convolution on it etc. You can of course preview colour at any stage just don't Draw with the Preview form before you do another process.

The TIA process often makes the image more pleasing by reducing image contrast and smoothing the image but it increases the image generation time. It looks at how the orbit for each pixel moves in relation to its upper and lower bound using 3 different approaches and smoothes the iteration steps in the output image. The TIA settings reside on a separate form. Click TIA check box to see.

From Version 3 you can adjust the bailout value. This is the value which determines when the calculation iterations stop. It can be varied between 10 and 10^{30} ! For normal fractal images the number of iterations determines the detail inside the convergent set. Outside the set, the bailout point determines the detail but you have to allow enough iterations to reach the bailout point. Normally >500 iterations and a bailout value of $>10^7$ is sufficient for a reasonable image using this approach. Move the Bailout and Iteration limit sliders a bit to the right to improve the image.

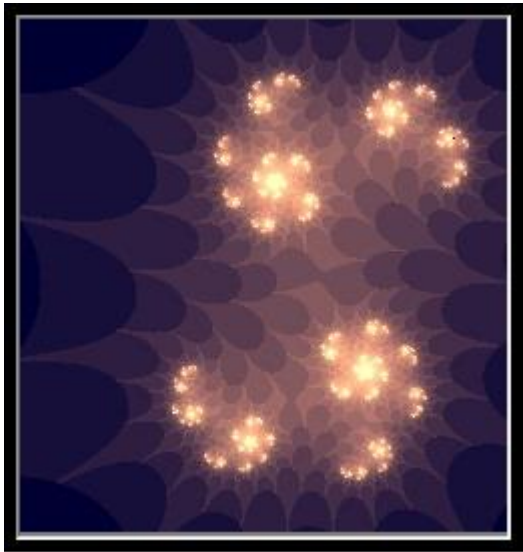




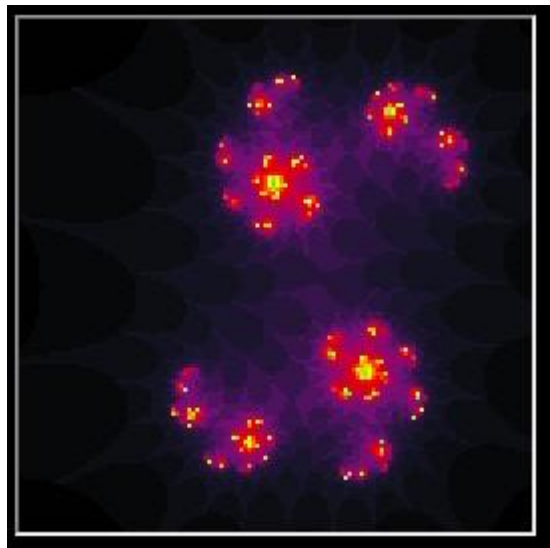
For TIA, 800 iterations and a bailout value of 10^7 will produce good images but they may take minutes to produce depending on image resolutions and your PC specifications. So start off with a 256 pixel square image. When you have set the sliders to a good setting you can then increase the image size. Smoothing without TIA will require less iterations and a lower bailout.

Choose 'TIA' check box by the Draw button, This accesses TIA, Stripe and Curvature average. You can adjust the range of iterations (terms of the series) for which the process analyses the image (upper bound % x number of iteration slider & lower bounds % x iteration slider). Change the bailout value to say 10^7 and select smooth Iteration Count. Increase the Iterations from 100 to 1000 for cleaner results! Adjusting the range allows the selection of a number of iterations to be included in the series producing different image results! So if you decided on 500 iterations. You could vary the terms from 0 to 100 % lower x iterations and from 0 to 100 % upper x iterations upper. Note the upper must be bigger than the lower otherwise you won't get any terms. Higher terms normally make a smaller contribution. If you use analysis tools such as Rank order, Topographic and Kernel operators adjust the contrast and brightness sliders as the original TIA image is lower contrast. Linear Equalisation works very well.

Below left. Normal iteration count/bailout image, Below right. Smooth iteration Count which Averages. Compare the results using similar HSL settings for Lyra Julia set.

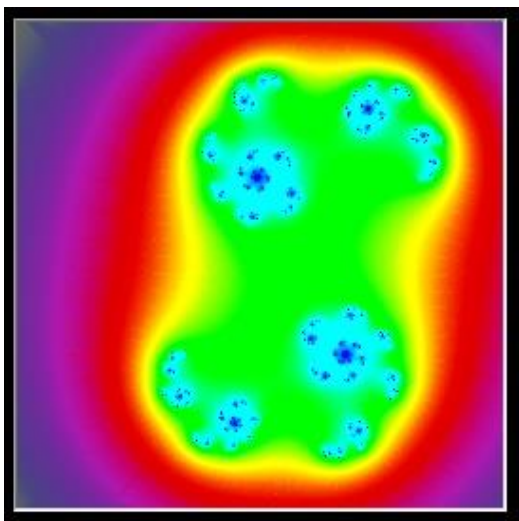


Original Image

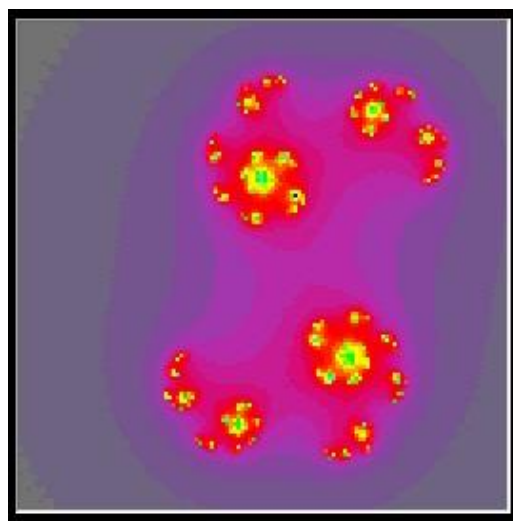


Original Image HSL Colour Coded

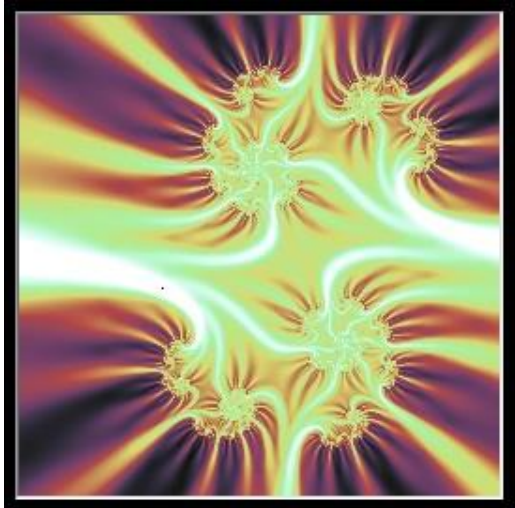
You can use Smooth Iteration Count without TIA and this will smooth the final image.



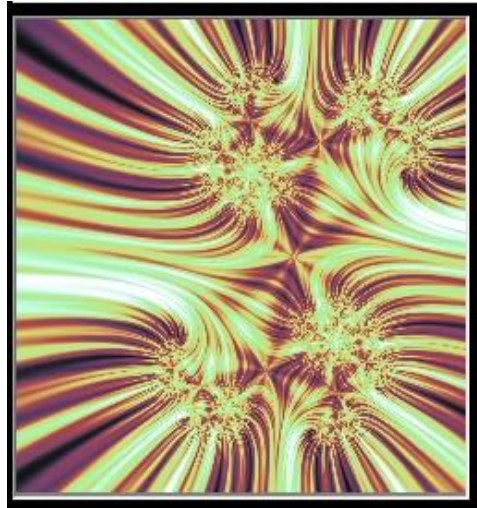
Smooth Iteration Count HSL



TIA without Smoothing HSL

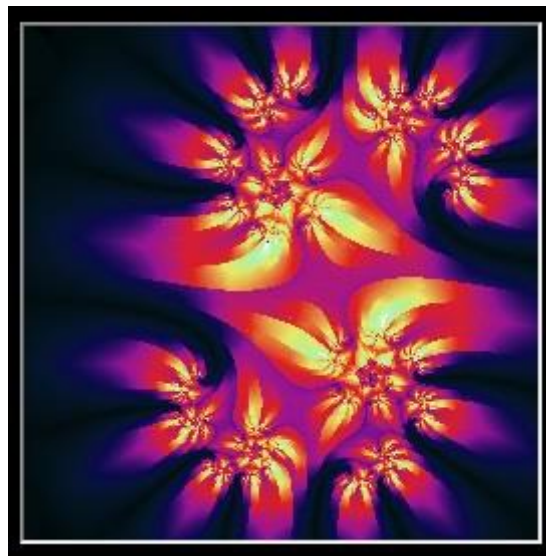


TIA + Smooth Iteration Count

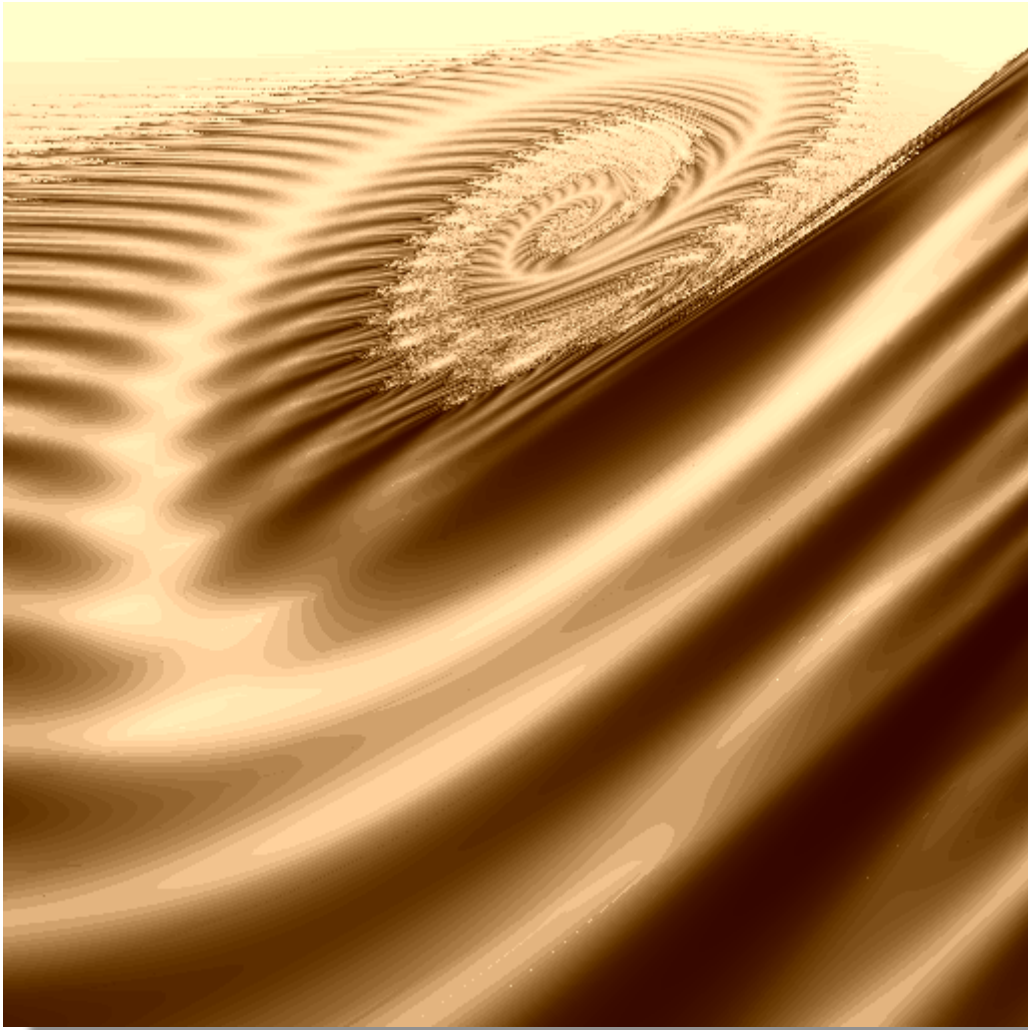


Stripe Av. + Smooth Iteration Count

Stripe average uses a trigonometric function for the terms of the sum rather than ratios and produces radially striped images. The slider changes the stripe frequency 1 to 50. See two images with same HSL settings.



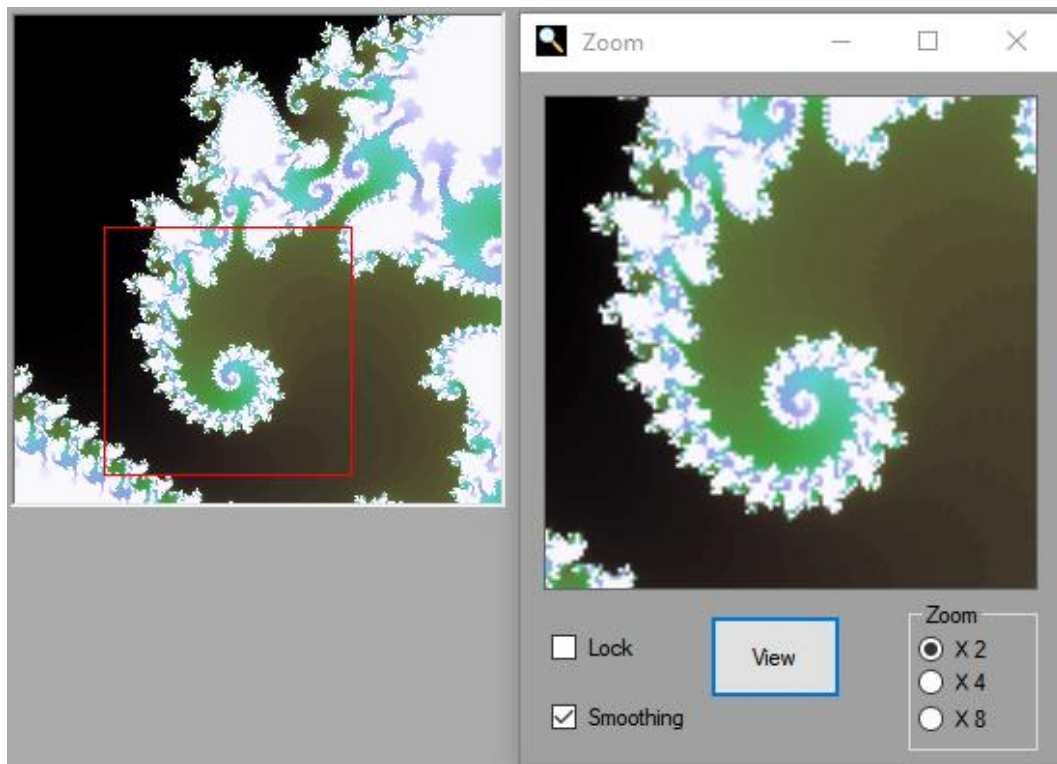
Curvature Average looks at how the curvature of the iteration function changes. See Above image with HSL coding.



"Dunes"

Part of the Julia Start-up set in the y/b plane. Triangular Inequality Analysis and RGB colourised.

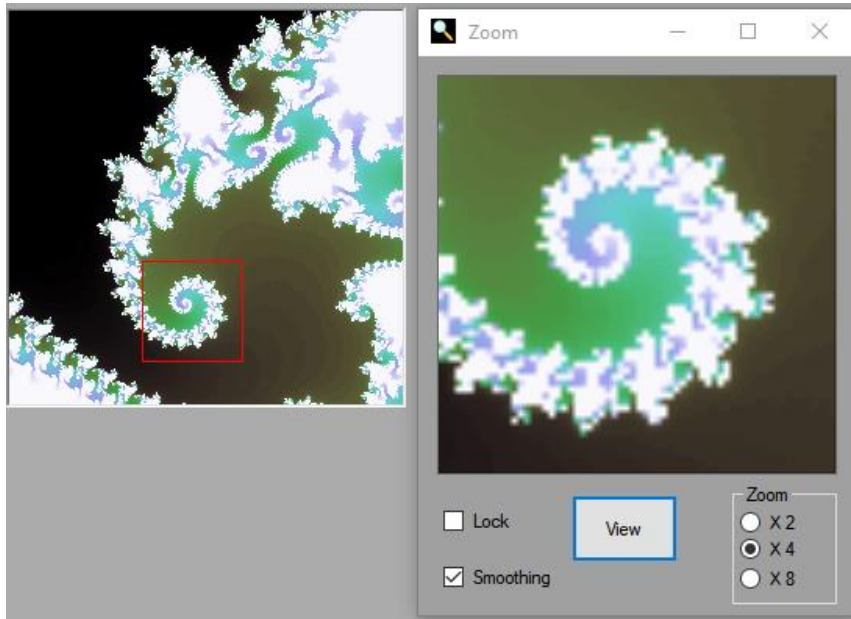
ZOOM



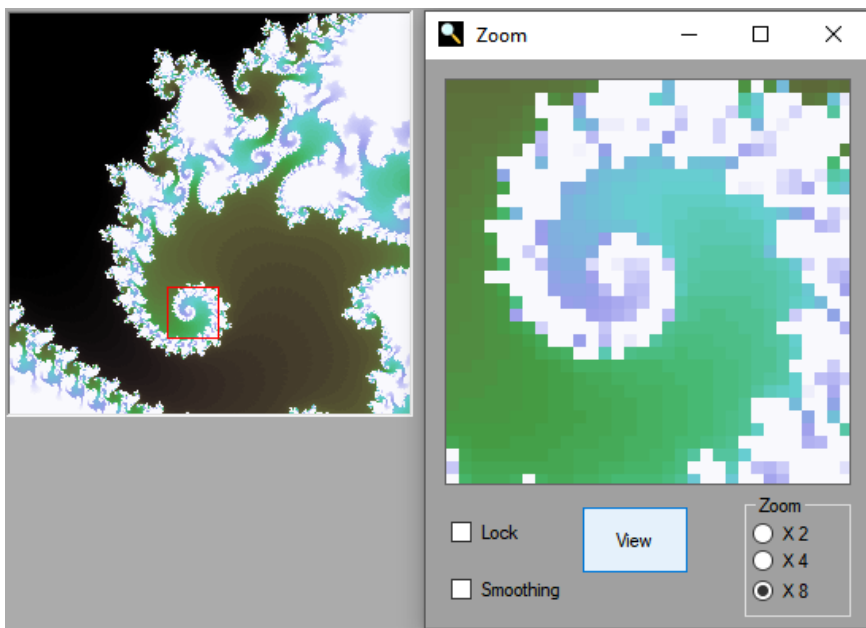
On the main menu there is a zoom option. This enables the user to inspect the main image at a magnification of 2X, 4X or 8X. Its sometimes useful to see detail to help select a new image or see colourise effects. To use it, first have an image loaded in the main image box. Left image above.

Open the Zoom Form and make sure the colorise window is closed (if it was opened close it), Click on the image and a rectangle will be drawn down and across the area of interest. The rectangle is fixed to 128 pixels square for 2x, 64 pixels square for 4X and 32 pixels square for 8X. You can drag the red rectangle around using it's top left corner and the zoom image will follow. You can now see detail at individual pixel level. The Zoom window has a size of 256 pixels square. Note. The Image will have bicubic interpolation applied to the image in the zoom window unless the Smoothing checkbox is unchecked which will then show the raw pixels.

To Zoom at 4X check the Radio button labelled " Zoom 4X". In this case the image will be enlarged again from the top quarter of the red rectangle and the rectangle will shrink to 64 pixels square.



Zoom at 4X with smoothing checked



At 8X Zoom the pixels are clearly visible without the smoothing option checked.

Note. The Lock button stops the zoom area changing so to refresh the image click "View". You can now image zoomed in at pixel level.

COLOURING THE IMAGE

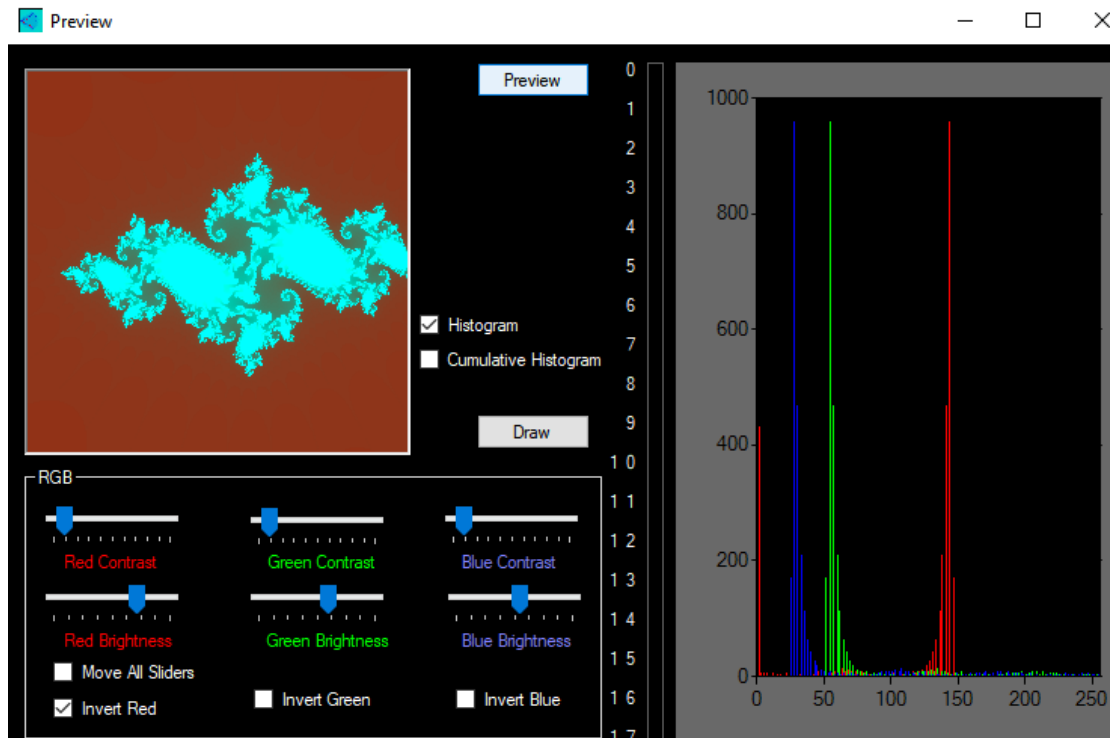
Workflow:-

The image processing operations done so far have been done in monochrome. These include Linear Operators, Non Linear Operators and TIA. Once they are done you can then colour the image.

- Monochrome Image Processing steps -> RGB or HSL Global colour processing. Colours the whole image.
- Once the RGB or HSL Global colour processing is done you can then locally process the colour image using Colourise Locally. That is colour specific areas of the image. Finally save the image and settings.

Note. If you use any of the Image Processing again (except Colorise) the image will revert to monochrome which averages the three colour channels. So Colouring is always done at the end.

COLOURISE RGB



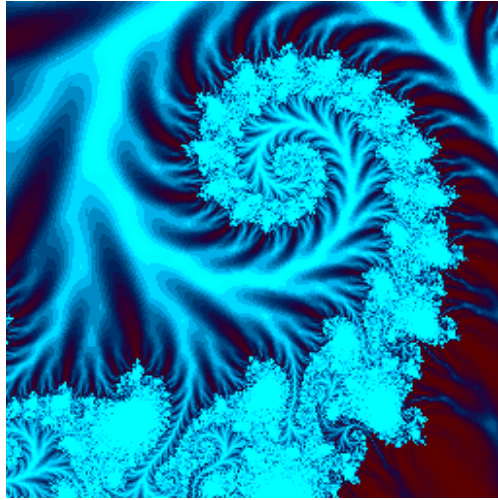
To adjust image brightness, contrast and colour in the Red, green Blue colour space:-

Note. To change the overall contrast and brightness of monochrome images check the 'move all sliders' check box. The aim is to use the whole width of the histogram avoiding clipping the highlights whilst avoiding losing detail in the dark areas. The effect is applied to the image not the array in memory.

Red/Green/Blue - Contrast is defined as $\text{Pixel new} = \text{pixel original} * (C)$. The factor C here is 1 to 10. Individual colour channels can be modified independently, in RGB colour space.

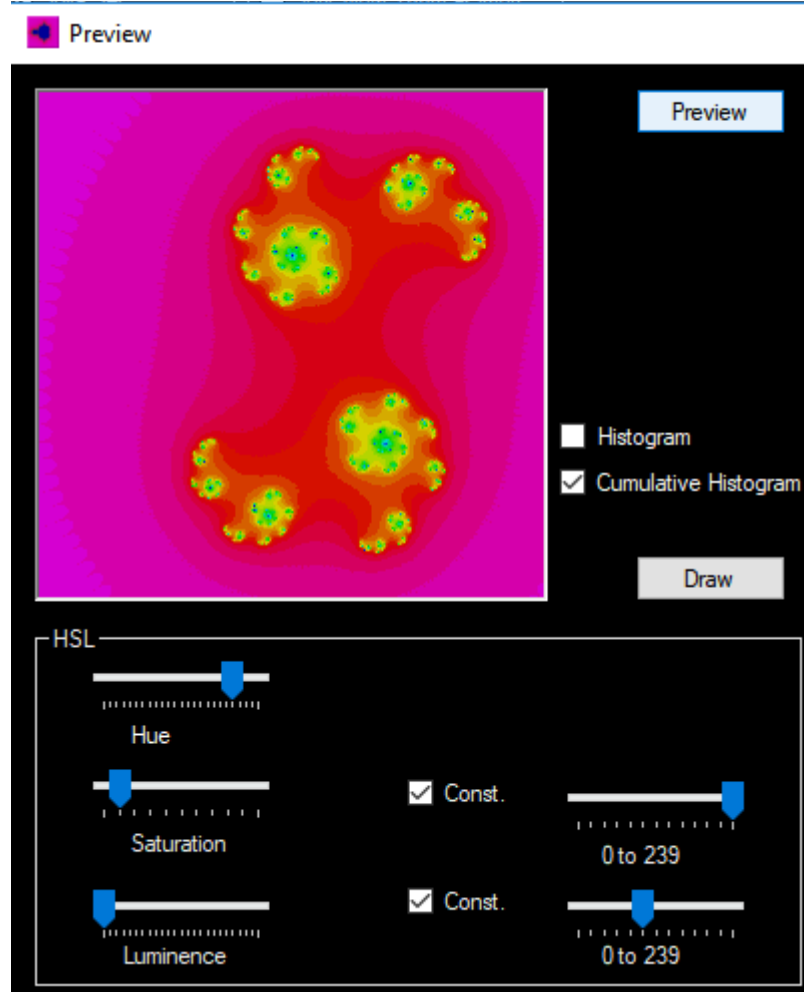
Red/Green/Blue - Balance (Brightness) is defined as $\text{Pixel new} = \text{pixel original} + (B)$. The factor B here is 0 to 255. Individual colour channels can be modified independently, in RGB colour space.

Red/Green/Blue - Invert colours is defined as $\text{Pixel new} = 255 - \text{pixel original}$. Individual colour channels can be modified independently, in RGB colour space.



Part of the start up Julia set. One of the infinite number of spirals. TIA and colour coded RGB. Red mapped to dark areas.

COLOURISE HSL



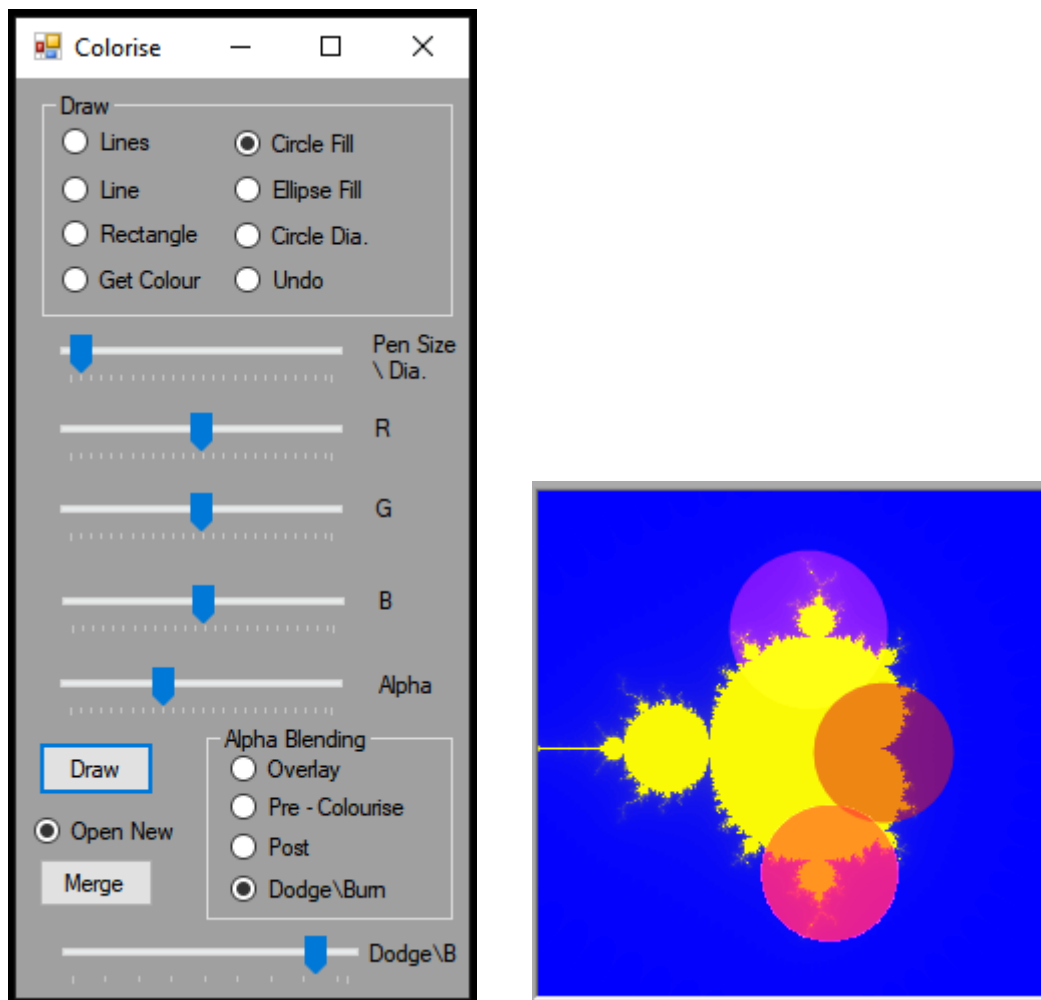
The other colour space which images can be rendered in is HSL Hue, saturation and Luminance. This space gives different images then RGB. HSL is applied to the image not the array in memory.

The Hue slider enables the user to change the colour map of the image cycling through the colour space.

The Saturation slider if set to 0 renders a monochrome image. Higher values magnify the saturation. A fixed saturation for the whole image can be selected if the check box - constant - is checked next to it. A saturation value can be chosen by the 0 to 239 slider.

The Luminance slider changes the overall luminance by adding a constant to the image. A fixed Luminance for the whole image can be selected if the check box - constant - is checked next to it. A Luminance value can be chosen by the 0 to 239 slider.

COLOURISE LOCALLY



The colorise form allows the user to colourise just parts of the image before saving. This is the very last process to use.

If you just want to Open and then locally edit any colour image and then then make sure colorise form is open first before you open the colour image, otherwise the image will open in monochrome. Typically colorise is done at the end of the imaging workflow. This is because the other image processing is done in monochrome.

Using Colorise you can draw individual lines, continuous lines, rectangles with pens or filled circles or ellipses or rectangles with a large pen size to fill them. See above. Use the mouse to draw.

The alpha channel defines the transparency of the drawn graphics.

1. Overlay O , alpha a 0 to 1, basically adds the source colour s in the main picturebox to alpha times the overlay O , top circle pale pink. = $O(a) + s$
2. Pre Alpha - Colourise - My favourite - this option is like painting on the image. Or viewing it through a coloured filter. Centre circle red. = $Oa + s(1-a)$
3. Post alpha - Bottom circle bright red filters the background. = $O + s(1-a)$

To Draw:

1. Line. Click start and finish points on the image with the mouse. You can adjust colour sliders alpha and pen size after. You can draw again if the line is not in the correct position. When done click "Draw" to save edit.
2. Rectangle. Like Line but the mouse clicks determine top left and bottom right of the enclosing rectangle's corners.
3. Lines. Draws a continuous line as you move the mouse good for shading a colour
4. Circle fill. A circle is drawn within the imaginary bounding rectangle defined by mouse clicks on its top left and bottom right corners.
5. Ellipse fill. Like circle.
6. Circle Dia. Set the diameter in pixels with the pen size slider and click on the point to draw. You can move the circle around with the mouse.
7. Get Colour. Sets the Red, Green and Blue (RGB) sliders to the point clicked on in the image.
8. "Undo". If you want to go back one step, just click "Undo" if you have not clicked draw. Or if you have clicked draw select undo and then click draw.

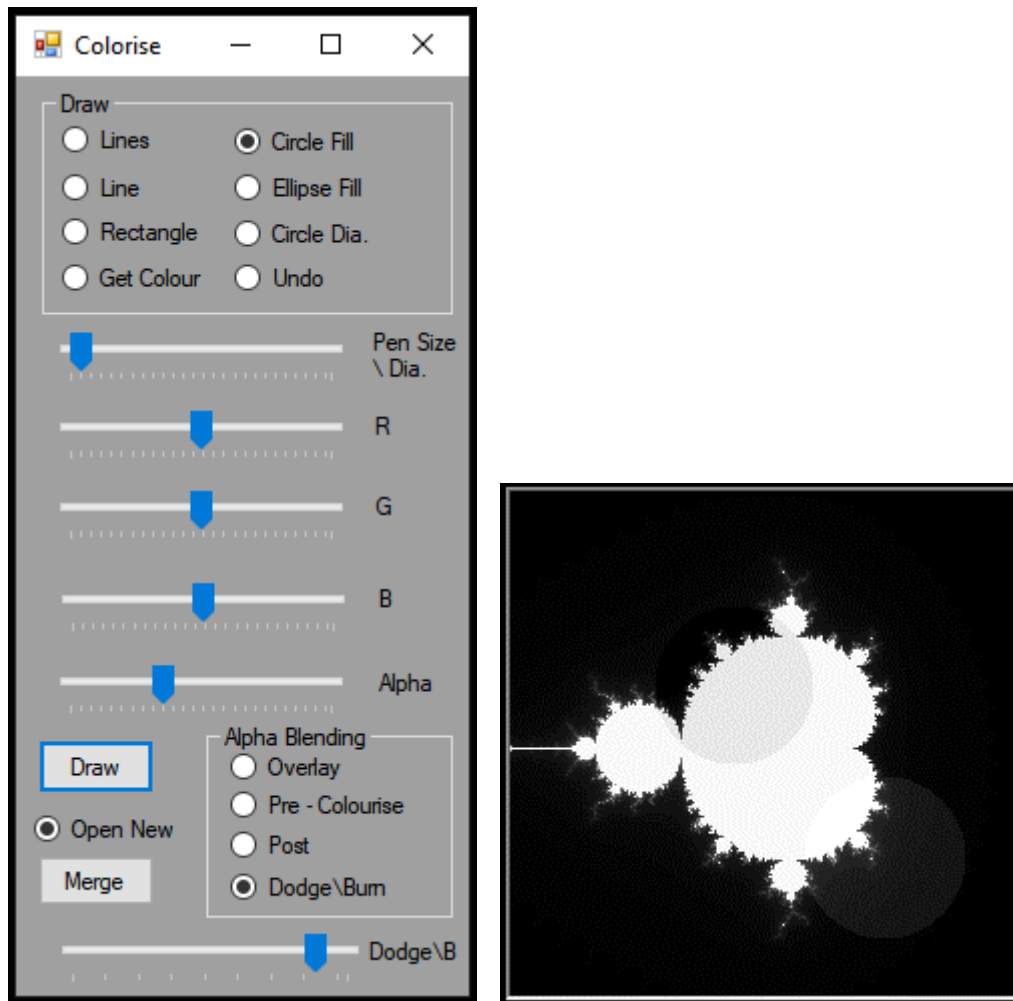
Note. At each step clicking Draw updates the image. Always save edits with a new filename.

Remember:

Normally you would open or create and edit a monochrome image. You must close this form before opening the monochrome image then use the other image editing routines, then use RGB/HSL and at the end Colourise.

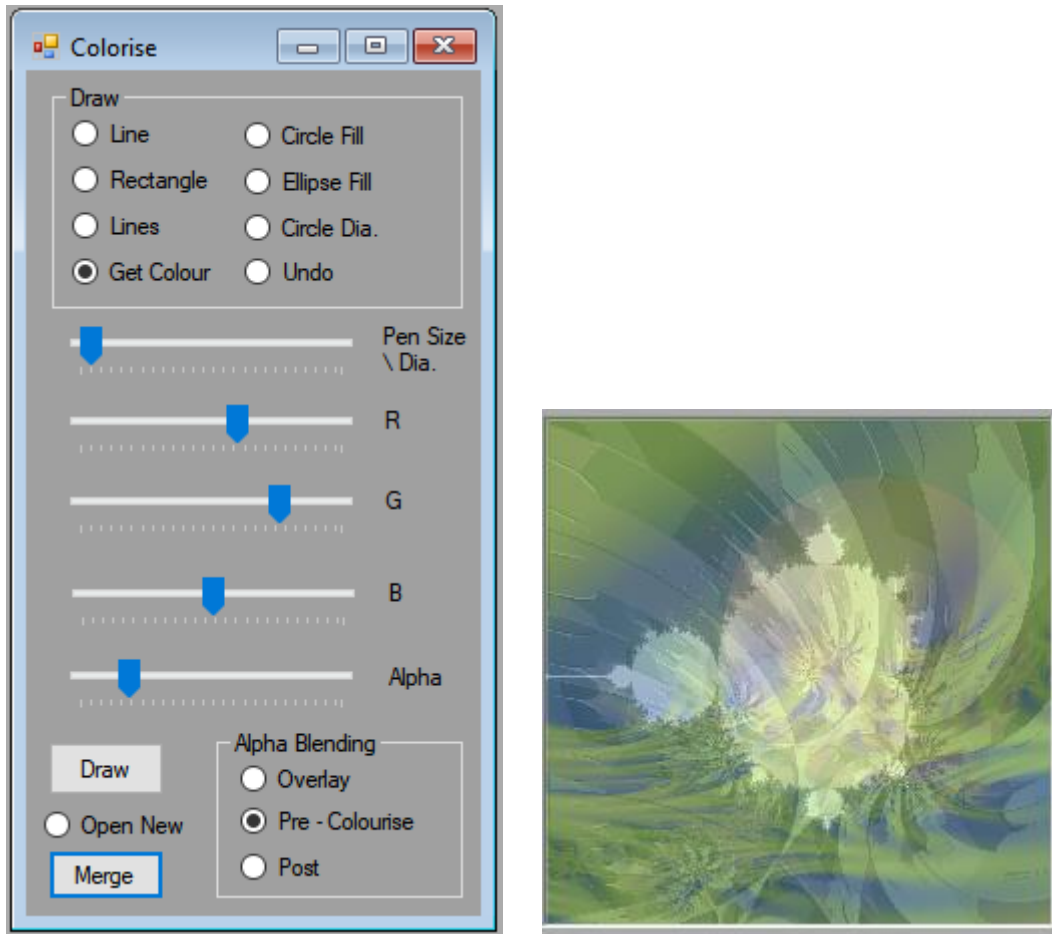
If you just want to open and locally colour edit an existing colour image then open the Colorise form before opening the image file.

DODGE AND BURN



You can increase the local brightness or reduce it using Dodge and Burn without affecting the colour. Select the Draw object, eg circle fill. Click on dodge and burn radio button. Set the bottom slider to the left to darken or to the right to brighten. Now draw the circle and click draw. See Image on the right above. The top feint circle darkens and the bottom one lightens. You can make multiple operations to gradually lighten or darken. Click "Draw" after each step.

MERGE



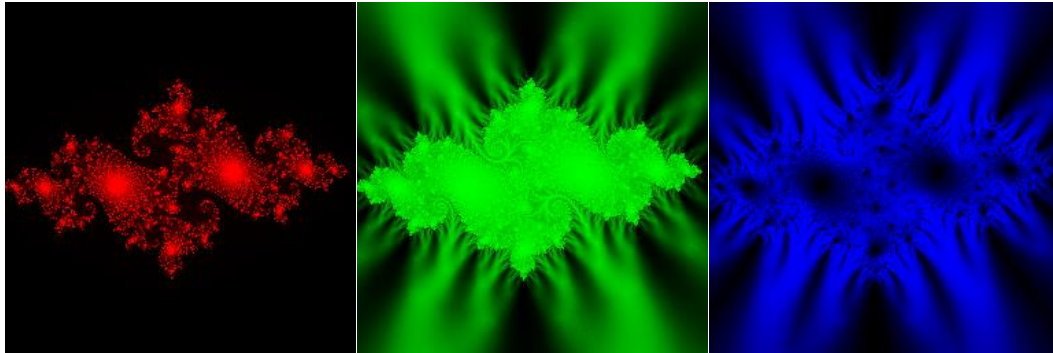
The Colorise form also enables you to merge two or more images. The images should be the same size in pixels but will be fixed to the size of the Image Size slider on the main form at the start of the process. To use.

- Open the colorise form and then File\Open a source image on the main form.
- Click "Merge" which will invite you to open the second image from disc to act as the next Overlay (Layer).
- The merged image will appear.

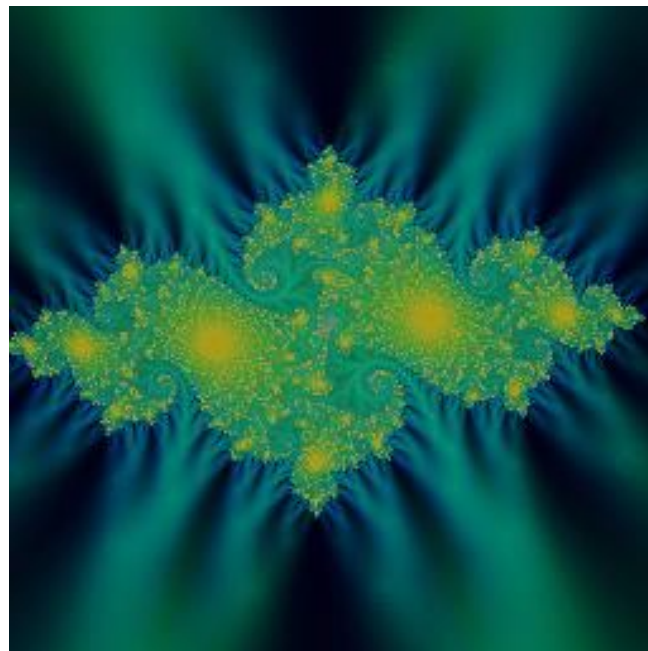
The RGB sliders act as brightness /colour shift sliders. All three set in the middle produces no colour shift or brightness change. Click Merge to see the updated image. You can change the Alpha blending mode/alpha slider too. Click Merge after any changes to settings. The main form image will be updated. To add a third image etc. Click on Open New Radio button and you can select a third layer. And so on. If you want to move back to the previous step, then select "Undo and click merge

COLOUR CHANNEL MERGING

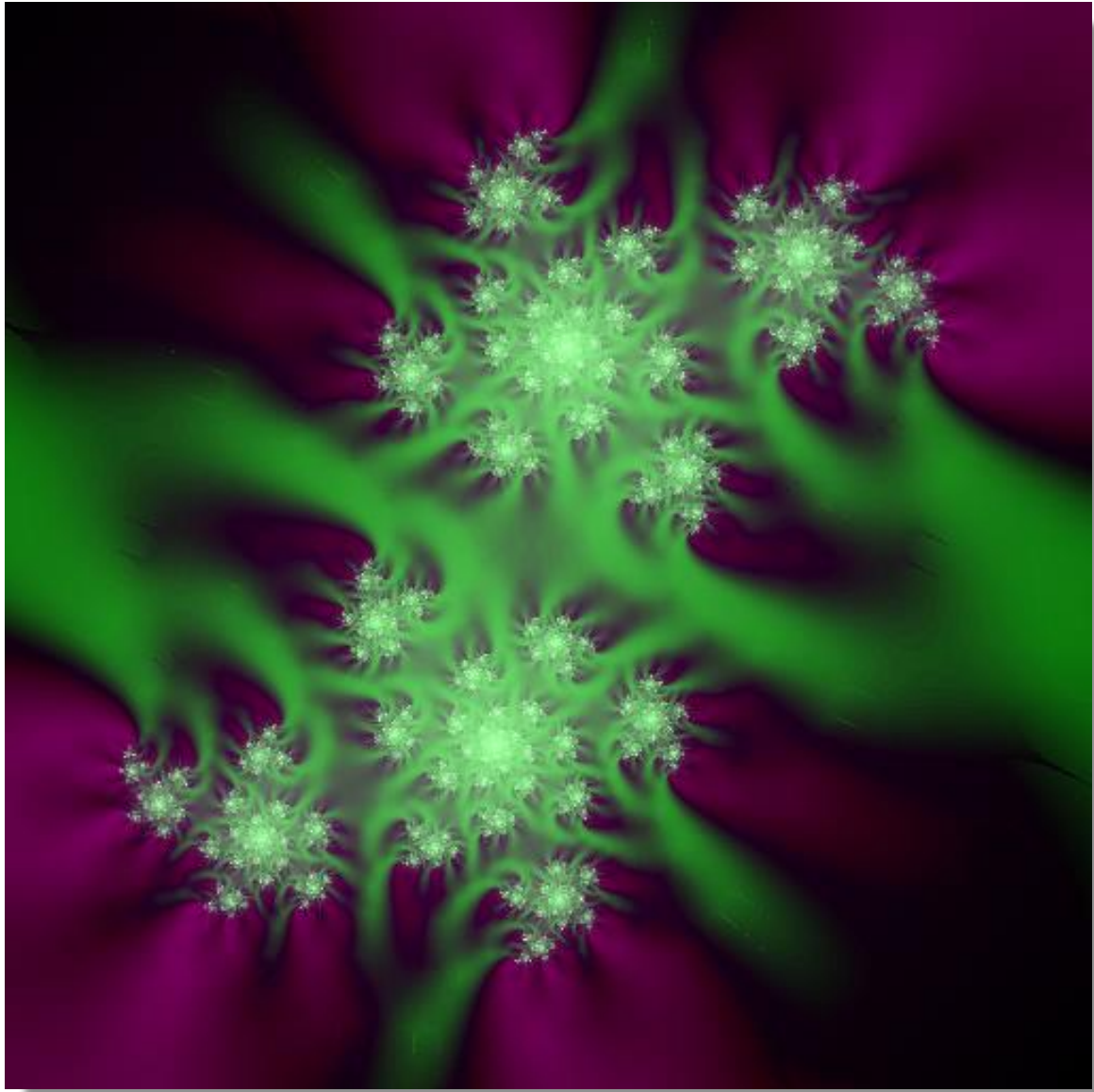
The three images below of the start-up Julia fractal have each been processed differently. Normal, TIA and Stripe average. Each image has been colour coded to Red, Green and Blue Using Preview\RGB, saved and then merged. Always ensure that each of the images have a good dynamic range, that is contrasty.



The merged image is below



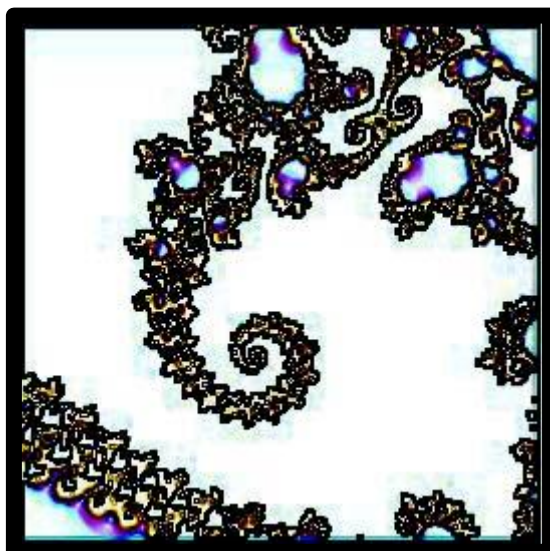
This workflow can produce pleasing images.



Galaxies Julia Set
Three layers merged. Channels mapped to:
White = Normal,
Green = TIA,
Purple = Curvature.

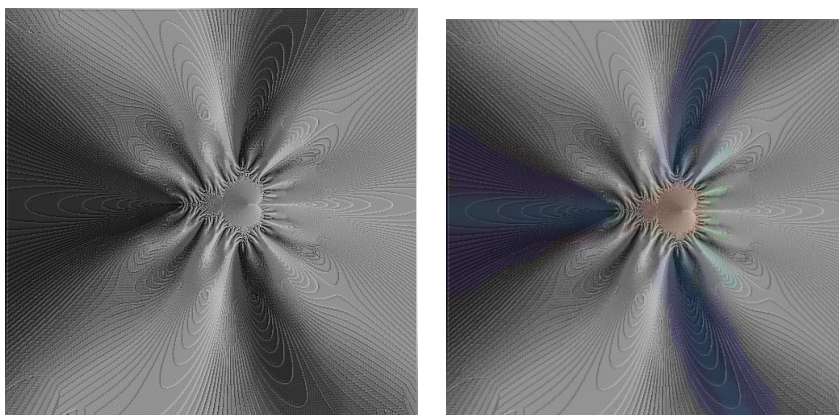
OTHER IMAGING EFFECTS AND FILTERS

There are many different filters and effects available in third party image processing applications. Just load a saved bitmap into an application of your choice for artistic effect. Ones which I have used are Adobe Photoshop, Paint.net as well as astronomical image processing packages such as Maxim DL and AIP4WIN.



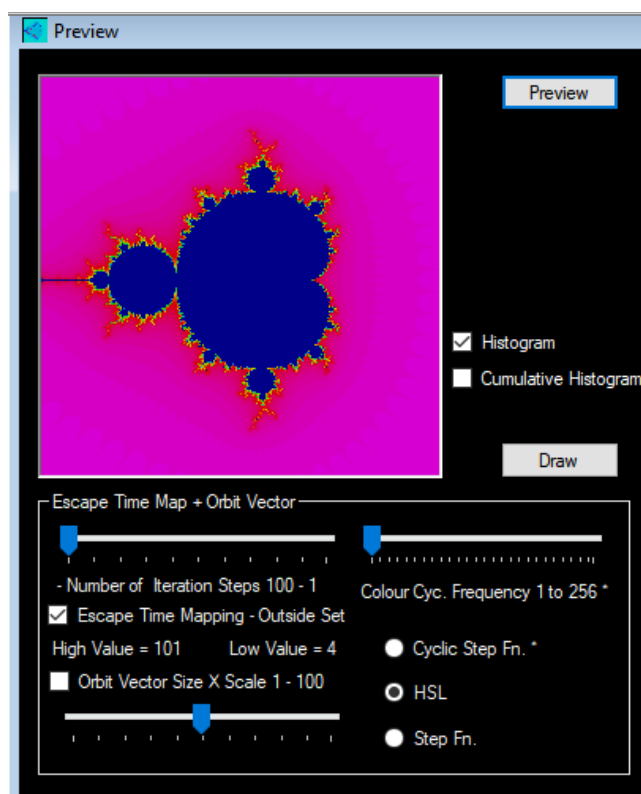
Example - Photoshop - Find Edge

Filters such as watercolour and ink pen produce interesting artistic images! You can also modify the colour of images by using this app or a photo editing app. Use subtle colours with feathered brushes. See below. On the left a monochrome version compared with the colourised one on the right.



"The Dragonfly".

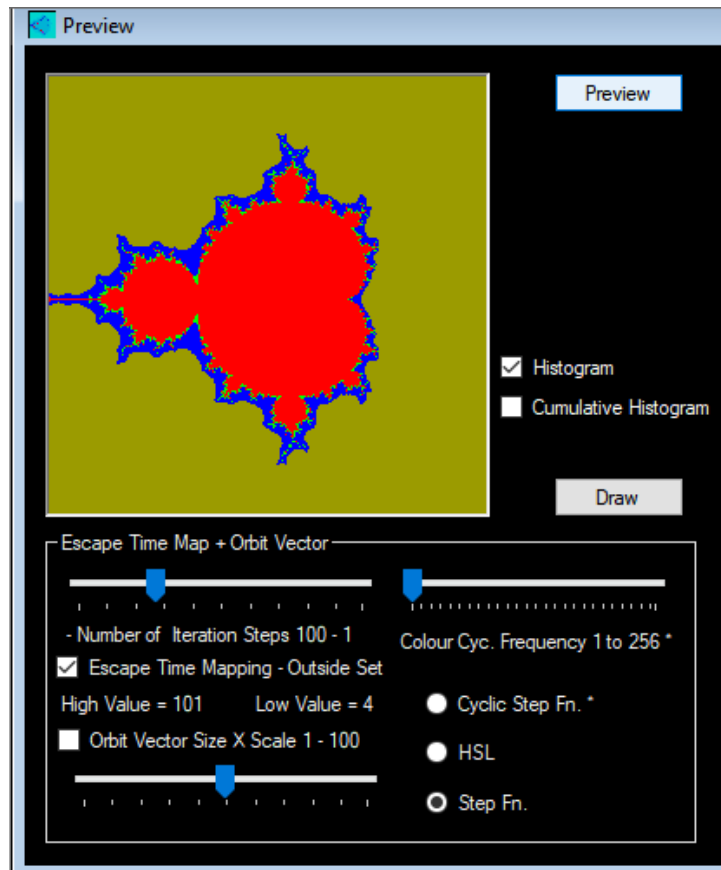
ESCAPE TIME MAPPING



Escape Time Mapping plots the number of iterations required to reach the bailout value specified. This is where the pixel illumination (or colour) is proportional to the number of calculation cycles needed to reach the bailout value. The point where the software assumes the series diverges. Image colouring is shown above by a HSL mapping, You can also use Step function or cyclic step function. High/Low value shows the 'illumination' maximum/minimum.

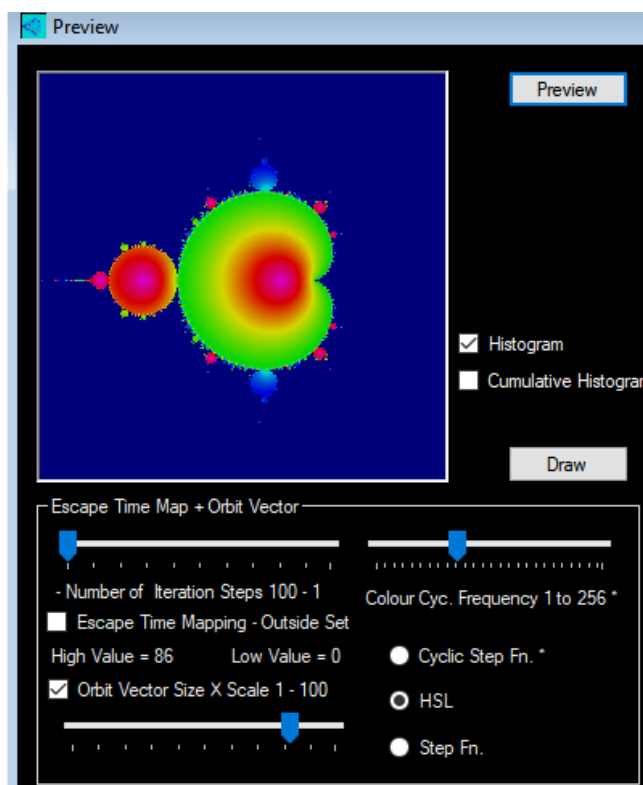
The Orbit Vector (see next section) plots the size of the complex vector between the start and end of the iteration process.

The two approaches are related. The smaller number of iterations to reach the bail out point corresponds to a high value of the vector after x iterations.



Note. The "- Number of Iteration Steps" subtracts the slider value from the iteration limit set by the main form for escape time analysis to give finer control of the number of iterations. The image above shows the Step Function applied to the Escape time mapping to 73 iterations. 100 on main form minus 37 on this form. Red corresponds to high values = ie. It takes a large number of iterations to reach, if at all, the bail out value. Green next, Blue. Yellow, Mauve, Cyan. Black takes the smallest no.

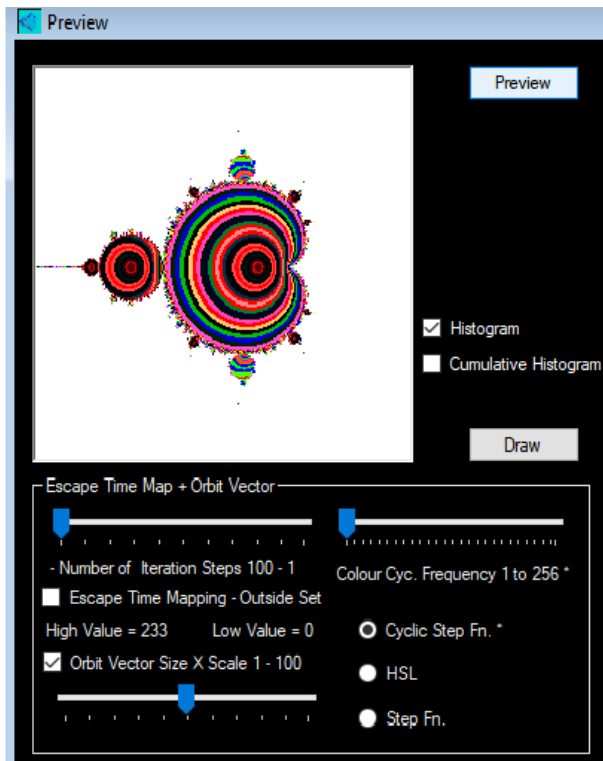
ORBIT MAPPING



The image above is orbit vector plotted as a HSL map. The Orbit Vector is the complex vector length between the start and finish of the orbit for each pixel. This is how the colours are mapped to the steps chosen by the iteration slider value. If you are mapping to HSL you can open the HSL form, adjust values and then open this form again to preview the modified results.

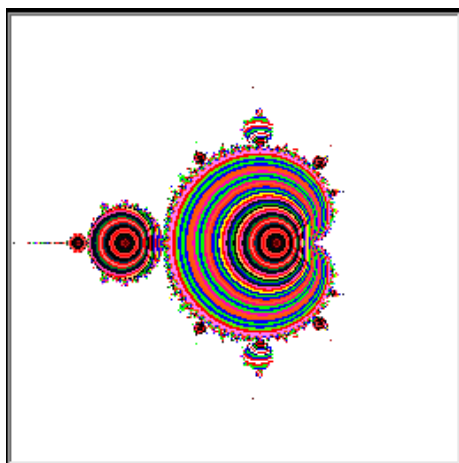
Normally the interior of the Mandelbrot set is shown as black or white. However, using this analysis it is possible to map the size of the modulus of the orbit's radius vector to a colour. It is done for the outside of the set as well. The orbit is the complex vector distance between start and finish of the orbit. The orbit is how the value of the formula at each iteration moves around its starting point. Large orbits means the values change quite a bit - this will produce more variable musical sequences.

The Orbit Vector Scale 1 to 100 multiples the subtle differences in vector size so they can be mapped usefully.



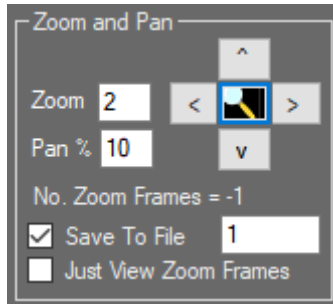
Above the cyclic step function is applied to the Orbit Vector analysis. Rather than have a gradual colour change sometimes it is easier to see if the colours change in discrete steps. This process is a bit slower. You can change the frequency of change of the step map with Colour Cyclic Frequency slider. Moving the colour cyclic frequency slider across further produces a higher frequency map breaking the orbit range or escape time range into smaller intervals. Also change the Vector scale slider.

Using the cyclic step function mapping you get a much bigger pallet than step function, but it is slower. Adjust the colour cycling frequency slider to get the desired result. A high frequency value is used below.



ANIMATIONS

The software can save a series of bmp images, so you can create an animated sequence if you zoom in. To make a zoom sequence movie:-



1. Decide how long you want the movie to last. You will need 25 frames/sec to get good High Definition HD TV. But you can use lower frame rate if you want. Low frame rates will produce more of a slide show.
2. Select a point by zooming in manually.
3. Zoom out so you can see the whole set.
4. Select No. Of zoom frames & check save to file checkbox and just view zoom frames. If you just click just view zoom frames you will see the animation but the individual files won't be saved to disk.
5. Decide upon zoom factor. Click the magnifier. This will start the sequence running. The frame number will be displayed as each one is stored.
6. Once you have a sequence - use third party software to turn them into a movie.
7. Note. You may have to run this for a few hours for a long movie as the number of calculations/frames will generally be large. Make sure you have enough disc space. Images are saved in 'my documents' folder.

Of course, you could add background music - such as the sequence generated by the zoom point!

FRACTAL MUSIC

AN INTRODUCTION TO MIDI

MIDI stands for Musical Instrument Digital Interface and allows externally generated signals to control an instrument. For instance a synth to control another synth, or a computer to control a synth. Not only can MIDI control what notes sound and the instrument played using short MIDI messages, but it can control most of the controls on a fully MIDI enabled instrument using system exclusive Sysex messages; long MIDI messages.

MIDI has been pivotal in the development of electronic music. Originally developed in 1983, the standard is largely unchanged and has enabled computers to fully integrate with synthesizers. MIDI enables one instrument to control another or a computer to control, or be controlled, by an electronic instrument. It's the basis of synth and sequencer communications .

The first sequencer program I wrote was for the Korg MS20/10 in 1982. Without MIDI I had to use analog to digital converters to send the monophonic instructions to the synth. It was not an easy task but something MIDI handles with ease.

The latest synthesizers or sound modules are called software or soft synths. See the Blue, Violet and SH1000 synths included with this software. These synths only exist as a program running on a computer and this approach is immensely powerful but the sound quality depends on the quality of the sound card in the PC. They have not replaced hard wired synths yet, but will probably do so in the future.

For more information see the MIDI association website.

<https://www.midi.org/>

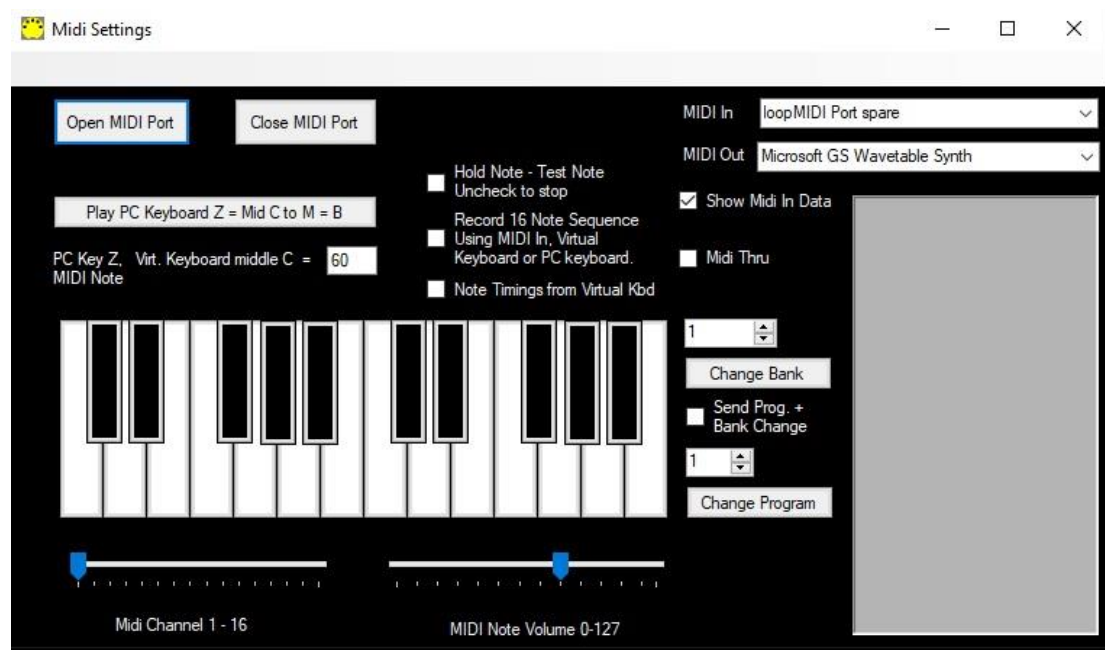
Virtually all midi instruments have a General MIDI instrument list of programs which can be called upon. 128 pre programmed instrument sounds.

General MIDI Instrument list

<p>Piano: 1 Acoustic Grand Piano 2 Bright Acoustic Piano 3 Electric Grand Piano 4 Honky-tonk Piano 5 Electric Piano 1 6 Electric Piano 2 7 Harpsichord 8 Clavinet</p> <p>Chromatic Percussion: 9 Celesta 10 Glockenspiel 11 Music Box 12 Vibraphone 13 Marimba 14 Xylophone 15 Tubular Bells 16 Dulcimer</p> <p>Organ: 17 Drawbar Organ 18 Percussive Organ 19 Rock Organ 20 Church Organ 21 Reed Organ 22 Accordion 23 Harmonica 24 Tango Accordion</p> <p>Guitar: 25 Acoustic Guitar (nylon) 26 Acoustic Guitar (steel) 27 Electric Guitar (jazz) 28 Electric Guitar (clean)</p>	<p>Strings: 41 Violin 42 Viola 43 Cello 44 Contrabass 45 Tremolo Strings 46 Pizzicato Strings 47 Orchestral Harp 48 Timpani</p> <p>Strings (continued): 49 String Ensemble 1 50 String Ensemble 2 51 Synth Strings 1 52 Synth Strings 2 53 Choir Aahs 54 Voice Oohs 55 Synth Voice 56 Orchestra Hit</p> <p>Brass: 57 Trumpet 58 Trombone 59 Tuba 60 Muted Trumpet 61 French Horn 62 Brass Section 63 Synth Brass 1 64 Synth Brass 2</p> <p>Reed: 65 Soprano Sax 66 Alto Sax 67 Tenor Sax 68 Baritone Sax 69 Oboe 70 English Horn</p>	<p>Synth Pad: 89 Pad 1 (new age) 90 Pad 2 (warm) 91 Pad 3 (polysynth) 92 Pad 4 (choir) 93 Pad 5 (bowed) 94 Pad 6 (metallic) 95 Pad 7 (halo) 96 Pad 8 (sweep)</p> <p>Synth Effects: 97 FX 1 (rain) 98 FX 2 (soundtrack) 99 FX 3 (crystal) 100 FX 4 (atmosphere) 101 FX 5 (brightness) 102 FX 6 (goblins) 103 FX 7 (echoes) 104 FX 8 (sci-fi)</p> <p>Ethnic: 105 Sitar 106 Banjo 107 Shamisen 108 Koto 109 Kalimba 110 Bag pipe 111 Fiddle 112 Shanai</p> <p>Percussive: 113 Tinkle Bell 114 Agogo 115 Steel Drums 116 Woodblock 117 Taiko Drum 118 Melodic Tom 119 Synth Drum</p>
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<p>29 Electric Guitar (muted) 30 Overdriven Guitar 31 Distortion Guitar 32 Guitar harmonics</p> <p>Bass: 33 Acoustic Bass 34 Electric Bass (finger) 35 Electric Bass (pick) 36 Fretless Bass 37 Slap Bass 1 38 Slap Bass 2 39 Synth Bass 1 40 Synth Bass 2</p>	<p>71 Bassoon 72 Clarinet</p> <p>Pipe: 73 Piccolo 74 Flute 75 Recorder 76 Pan Flute 77 Blown Bottle 78 Shakuhachi 79 Whistle 80 Ocarina</p> <p>Synth Lead: 81 Lead 1 (square) 82 Lead 2 (sawtooth) 83 Lead 3 (calliope) 84 Lead 4 (chiff) 85 Lead 5 (charang) 86 Lead 6 (voice) 87 Lead 7 (fifths) 88 Lead 8 (bass + lead)</p>	<p>Sound effects: 120 Reverse Cymbal 121 Guitar Fret Noise 122 Breath Noise 123 Seashore 124 Bird Tweet 125 Telephone Ring 126 Helicopter 127 Applause 128 Gunshot</p>
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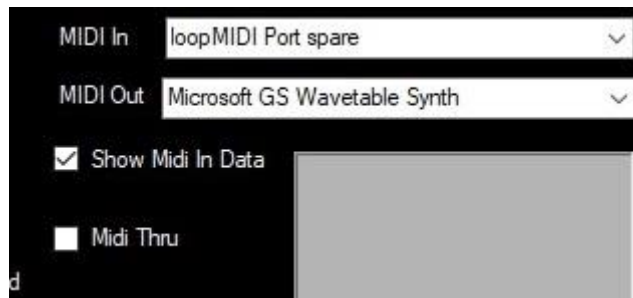
SETTING UP MIDI IN/OUT FOR THE SOFTWARE



Click Midi/Settings on menu bar. An example of the midi devices in/out are shown above. Your list will look different. You can select the MIDI input and output ports.

1. Select midi input/output device connected to the Midi Keyboard or midi routing application for virtual instruments- see later. Do not select the same midi input and output if midi thru is checked otherwise you risk getting a midi loop if the device you are playing has midi thru enabled as well! This may crash the application but depends on midi driver's behaviour.
2. Set midi channel to correct channel - default on this software is 1 (so you can leave it at that). Set the same channel on your Midi instrument.
3. Press 'Open Midi Port' Button.
4. **Important Use the mouse to play the virtual keyboard to check the software can play the device you are connected to.**
5. You can play the Midi software or device from the PC keyboard. Press 'Play PC Keyboard Z= Mid C...' button **immediately** before playing the pc keyboard.

This is to check all is working, if you play a note on the virtual piano keyboard or PC keyboard the instrument on your synth should sound.



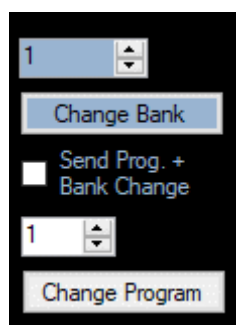
The 'Show Midi In Data' checkbox shows Midi data coming into the app such as channel voice messages (notes) and Sysex.

The Midi Thru check box passes Midi data coming into the Midi In port to the apps Midi output port. Normally this is left unchecked unless you want to monitor traffic between two other devices and place this app in-between them.

For inputting a sequence - see later re composing - you can use a Midi keyboard to record notes and timings. You can also use the virtual keyboard to record just notes or also timings if you check the 'Note Timings from Virtual Keyboard' check box.

The hold note check box holds a note until its unchecked - useful if you are adjusting a sound on a connected instrument.

From version 4.1 you can change the MIDI program (instrument) on your midi output device. On the MIDI form:-

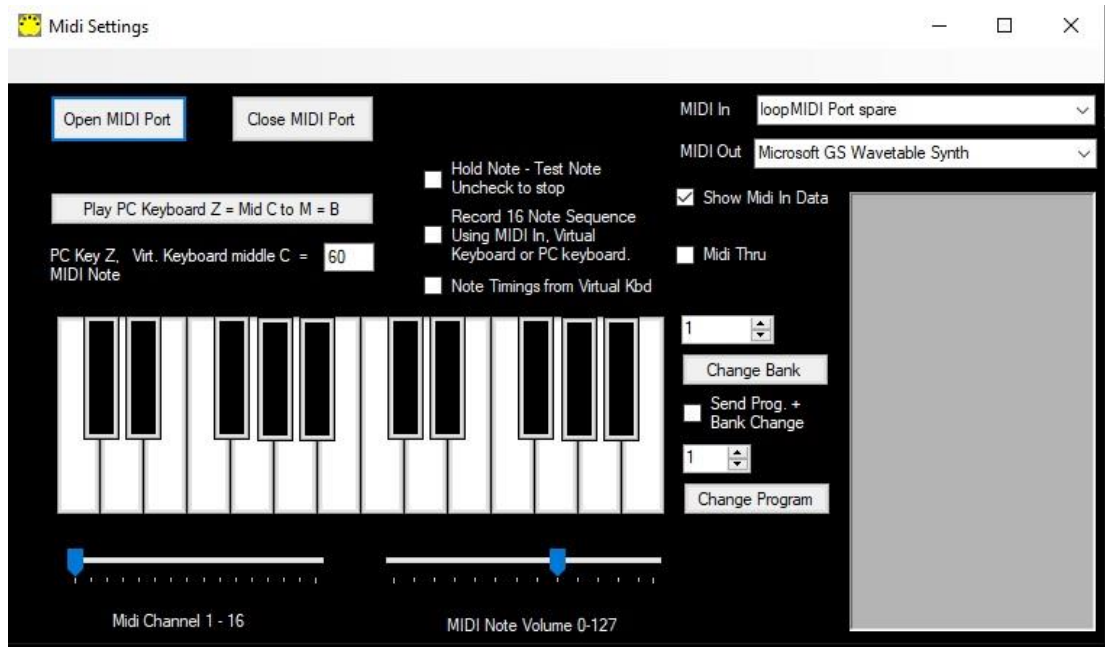


Set the programme number 1 to 128 and press button " Change Program". "1" is Piano in General MIDI which is the default when the software loads.
 - See General MIDI instrument list earlier in this document.

If you need to change the Bank to something different than 1 you can also change Bank. There are $128 \times 128 = 16384$ banks available in midi, with each one containing 128 programs! Note that many midi instruments (Roland, Yamaha and Korg) use sysex for this, so this may not work. To try it. Set Bank and click 'Change Bank'. Sometimes instruments need the program change message sent immediately for this to work, so try also checking 'Send Prog + Bank Change' check box.

Note that if you set the MIDI channel to "10", Bank 1, you will get the General Midi percussion instruments with each key sounding a different percussion instrument. There is no change if you vary the MIDI instrument number

24 NOTE KEYBOARD



The MIDI form has a nifty virtual keyboard for remotely playing the Midi software or device whilst you edit the sounds on the PC. The keyboard has a range of 2 octaves.

If you want to play the Midi software or device using the PC keyboard - press the 'Play PC Keyboard Z=....' Button on the midi settings form just before playing. You must press the 'PC keyboard' button every time - immediately before you use the PC keyboard to play the Midi software or device. PC Key z = Note C. s = note C#. x = note D. etc. The notes run from z s x d c v g b h n j m. Which map to C, C#, D, D# etc. The 'PC Keyboard' is polyphonic. So you can play chords.

The pitch of note Z can be set using PC Key Z or Virtual Keyboard C = Midi Note text box at the top left of the form. This facility to play from the PC keyboard has been added to enable the user to audition sounds whilst editing.

Current note number in the sequence and current midi note 0 - 127 are displayed in the grey text box.

USING WITH VIRTUAL INSTRUMENTS

If you want to connect the software to a virtual instrument you will need to route the midi signal internally in the PC. There is an easy way to do this.

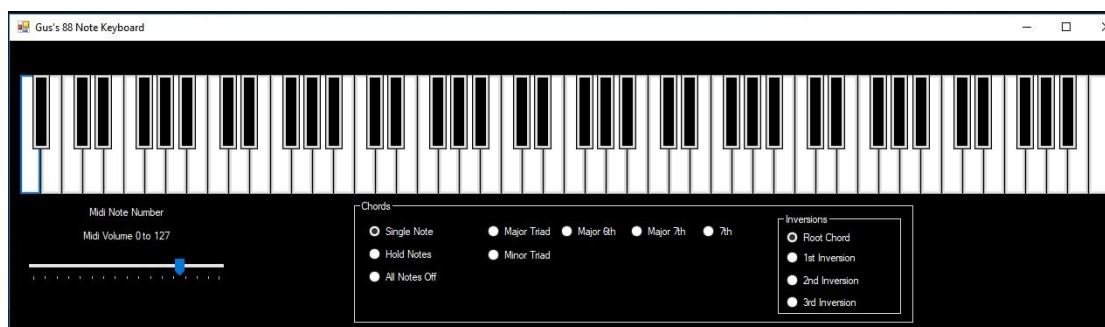
1. Download Freeware applications - For internal PC midi routing I recommend LoopMidi [Software | Tobias Erichsen \(tobias-erichsen.de\)](#) or LoopBe1 <http://www.nerds.de>.
2. Set the Midi **output** of the Fractal Sequencer to say LoopBe1 (internal midi) or Midi Yoke - port 1.
3. Set your instrument midi **input** to LoopBe1 (internal midi) or Midi Yoke - port 1
4. You can now transfer midi from this application to the other application!

RECORDING SEQUENCES USING DAW SOFTWARE

You can record sequences on a midi sequencer/editor on a synth or directly into a midi/audio PC sequencer/editor like Logic, Cubase Cantabile, Bitwig or Cakewalk Bandlab

Also see the section for saving all settings as a text file which can be loaded for use later - see Saving and Loading.

88 NOTE KEYBOARD



The 88 Note Keyboard is useful for playing synths and editing synth sounds. It is included in the RD 2000 software and is dedicated to Gus at Roland Clan forums who did a lot of the testing.

To open it - select Midi menu item on the main form - 88 note keyboard.

The keyboard is useful when designing sounds as you can hear the entire range of the standard instrument keyboard. First set Midi ports and input/output on the Midi settings form.

The Midi volume is controlled by the slider on this form.

You can play single notes, hold notes (for editing sounds or playing chords with the mouse). Held notes sound until 'all notes off' selected. Various chord types are included too, together with their inversion

STOPPING PROCESS AND NOTES

- The 'Stop Sequencer' checkbox on the Fractal Sequencer form stops the fractal sequencer engine and stops all notes. This is the Panic Button!
- 'All Notes Off' midi command is not always well implemented, by manufacturers. Not all instruments/software respond to it. Notes decay as per their release envelope.

The screenshot shows the 'Fractal Sequencer Settings' window. The 'Sequencer' section has a 'Generate Fractal Seq.' button, a 'Replay Seq. from Note No.' field, a checked 'Stop Sequencer' checkbox, an 'All Notes Off' button, and a 'Loop' checkbox. The 'Note Generation' section has radio buttons for 'Real Number for note', 'Real No. - Complex No. for note', and 'Imaginary Number', with a 'Note Multiplier' field set to 200. The 'Note Mapping' section has radio buttons for 'Linear Mapping' and 'Log Mapping'. The 'Scale Keyboard' section has a piano roll and a '+1 Semitone' button. The 'Chords' section has checkboxes for 'Major Triads', 'Minor Triads', 'Major 7th', 'Minor 7th', 'Sixth', 'Minor Sixth', 'Dominant Seventh', 'Diminished Seventh', 'Augmented 9th', and 'Minor 7th Flat 9th', along with a 'Probability of Chord Shells' slider and a 'Random Volume Fluctuation 0 to 30' slider. The 'Evolution Graph' shows a single red vertical line at MIDI note 67. The '16 Note Sequencer' table is as follows:

MIDI Note	Time On	Time Off
67	1	0.1
69	1	0.1
65	1	0.1
53	1	0.1
60	2	0.1
65	1	0.1
66	1	0.1
67	1	0.1
68	1	0.1
69	2	0.1
70	1	0.1
71	1	0.1
71	1	0.1
71	1	0.1
71	2	0.1
71	1	0.1

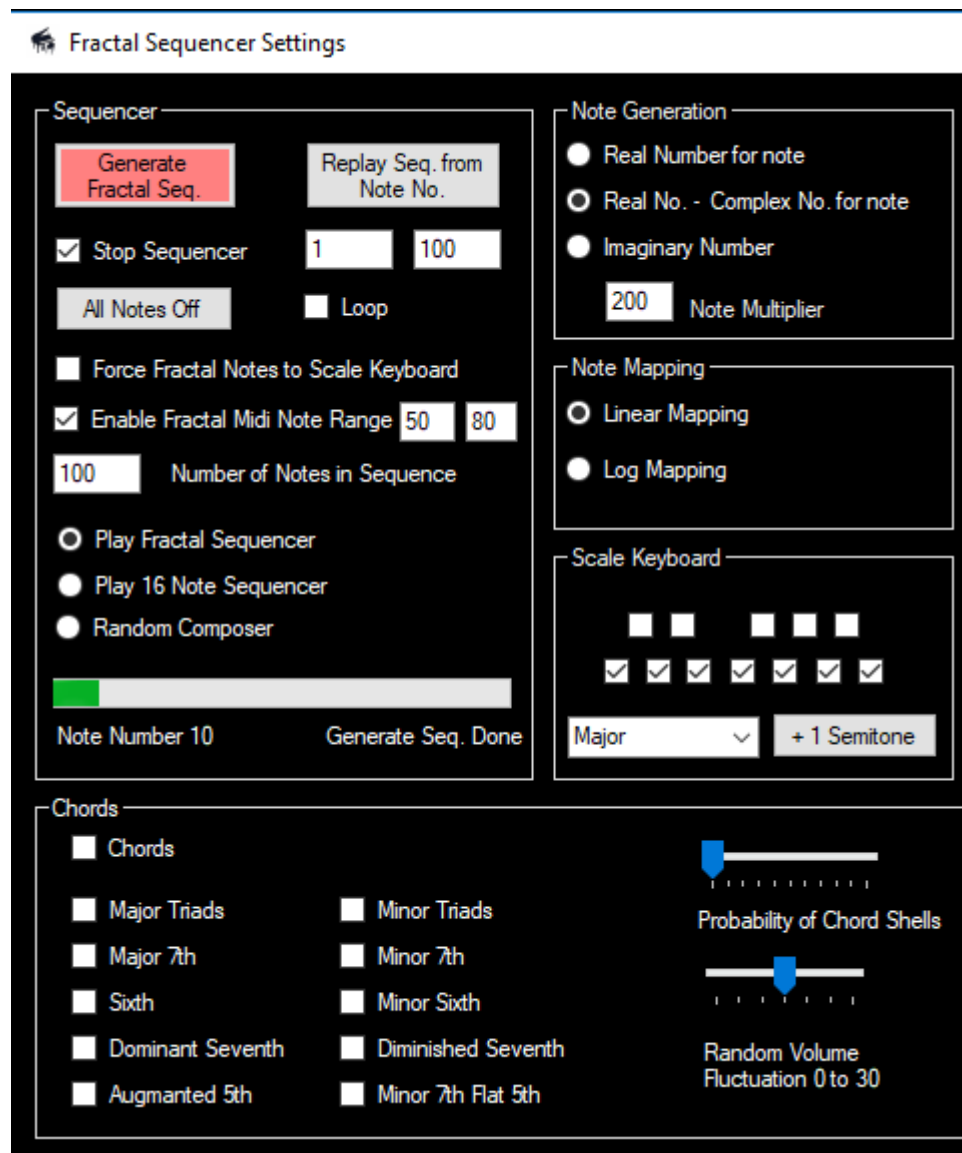
NB. The midi note values generated by the software are constrained between 0 and 127 to prevent Midi errors and are reported in the text box below the graph. The Volume Control on the MIDI form and the Volume Fluctuation slider on the Fractal Sequencer form control the volume of any note created by the sequencers. The Fluctuation mimics a human player's variation of key pressure.

The Random Composer radio button generates purely random notes which can be constrained by scale and note range.

The 16 Note Sequencer notes and timings are defined by the user.

Fractal Sequencer - The user can force the sequence to a note range (by checking the box - Enable Note range). This fixes the note range as specified by the user. Minimum of 12 Notes allowed.

The default is to just use constants comprising real part of imaginary numbers. The user can select complex numbers by clicking on the radio buttons 'Real No. part' or 'Imaginary component' of complex number or just real numbers. Press 'Generate Fractal Seq.' to start and play sequence. **Check 'Stop Sequencer' check box at top left to stop.**



Notes can be mapped to Midi Note numbers 0 to 127 using linear or log mapping by checking the appropriate radio button.

Pressing the replay button once you have stopped the sequence will replay the sequence between the notes input into the two boxes below 'Replay

Seq. from Note No.' button. If the loop check box is ticked the sequence will repeat until the user presses the 'Stop Sequencer' checkbox.

Click 'Replay sequence from note number' plays the sequence you created last from the note number you specify to the note number you specify to finish.

The Note Multiplier box modifies the output of the note generator but can normally be left at 200.

CHORDS

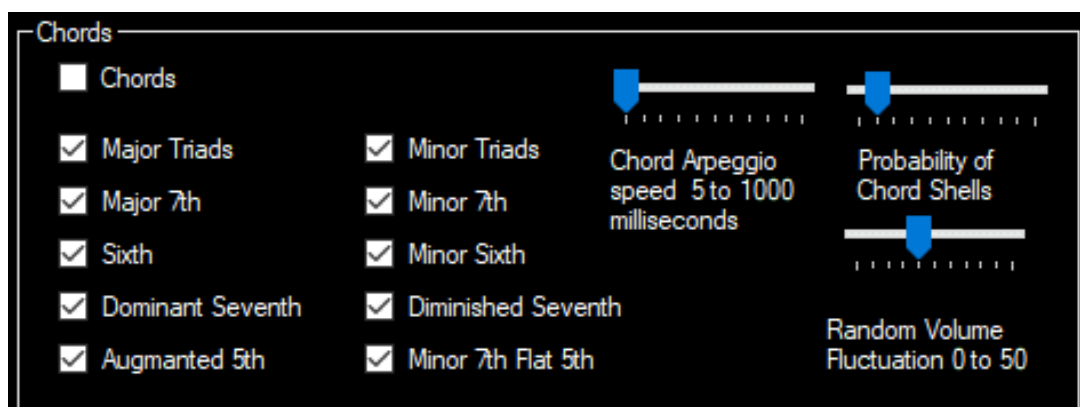
Checking 'Chords' on the Fractal Sequencer form enables the generated notes to produce chords. These chords will be randomly selected by the chord types checked by the user on the Fractal Sequencer form. Random chords will alternate between various chord types selected or just check 1 chord if you want only one.

The slider controls 'chord shell probability'. Move to the right to produce fewer chord notes, the root note is always played. Move slider to the left to produce more chord notes. Note the chord type font changes to blue when it's playing.

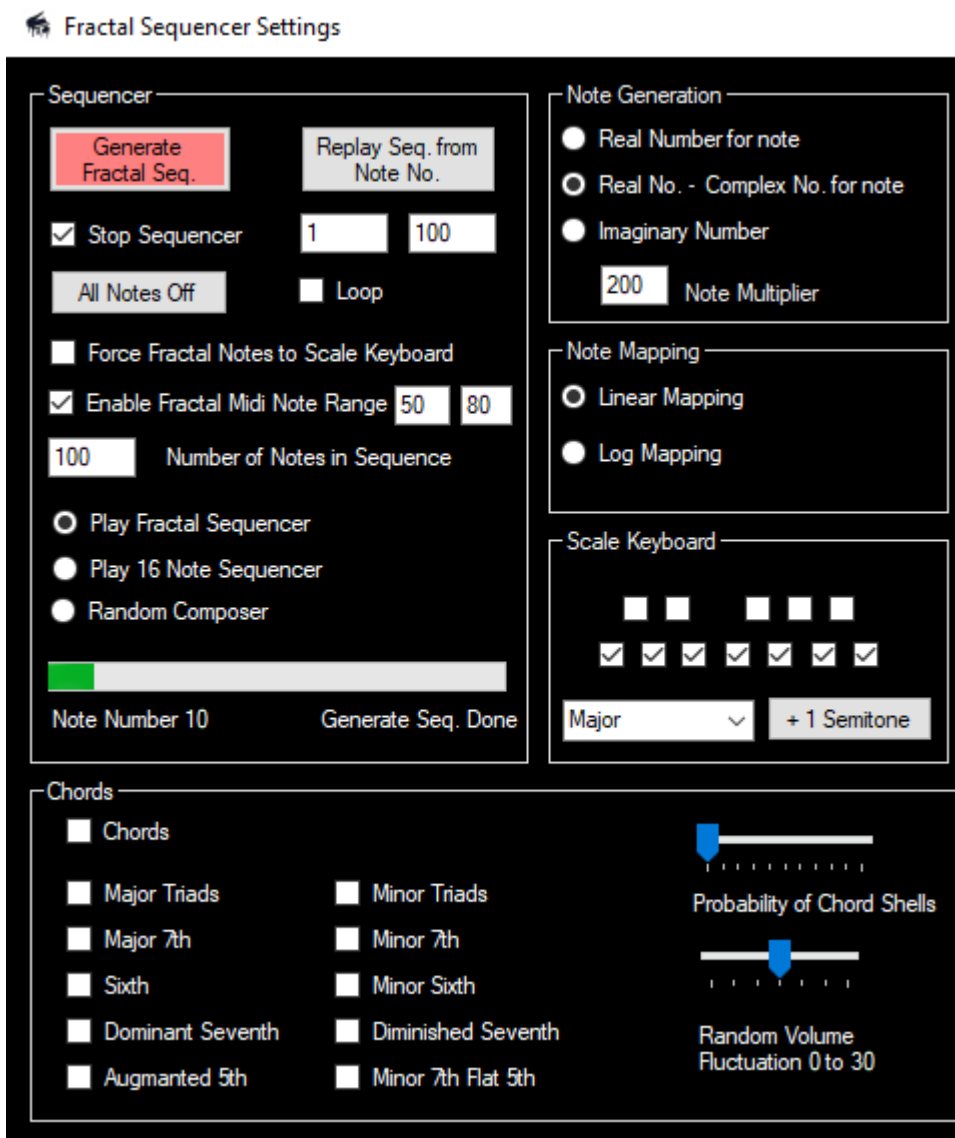
The Random Volume Fluctuation checkbox randomly varies the volume like a human musician.

The 'Chord Arpeggio' slider stops the chord notes all being sent at once, so a MIDI bottle neck does not happen. 5 milliseconds is the minimum note separation. Moving to the right will separate the chord note up to 1 second but this may affect playback timing. Normally set to 5 or 10 milliseconds. Higher values will enable the individual chord notes being played one after another.

Note. Always have at least one chord selected if you check 'Chords' check box otherwise the software won't work properly.



SCALES



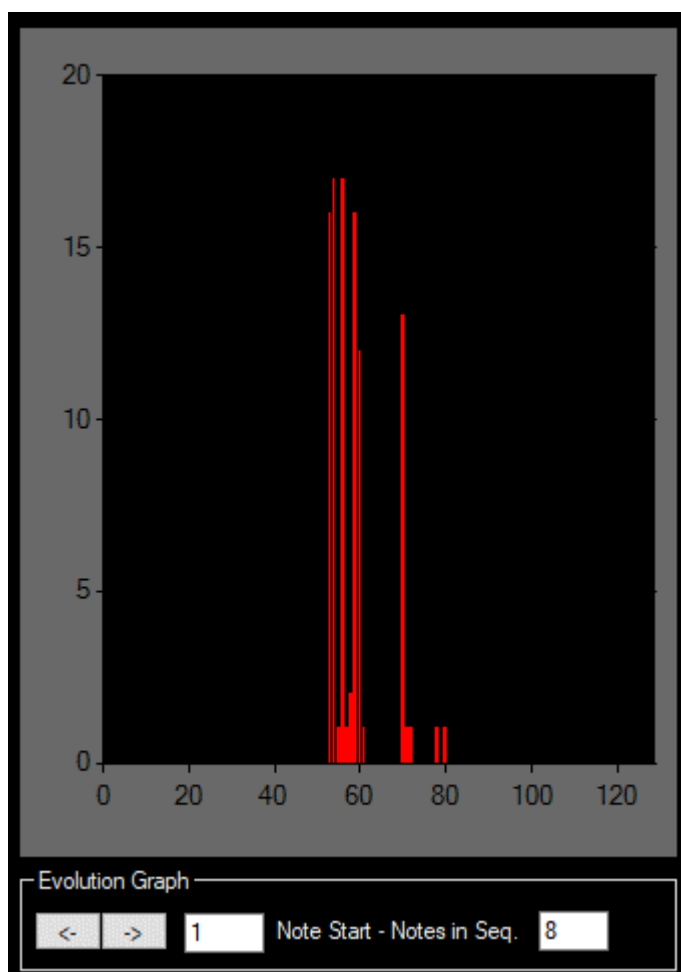
Check 'Force Notes to Scale Keyboard' to activate. The scale keyboard forces scale based Fractal or Random compositions. It also has the facility for the user to enter user-based scales (just check the notes you want) and a wide selection of standard scales in the combo box.

SCALES OTHER THAN IN C

Go to scale keyboard. If you check 'Force Note to Scale' on the Fractal Sequencer you can control the scale of the resulting sequence. The default is the scale C. To get C# (C is default scale) select the scale type you want - say Pentatonic - and increase by one semitone to C# etc. So you want D you could do that by transposing each check to the right by another semitone.

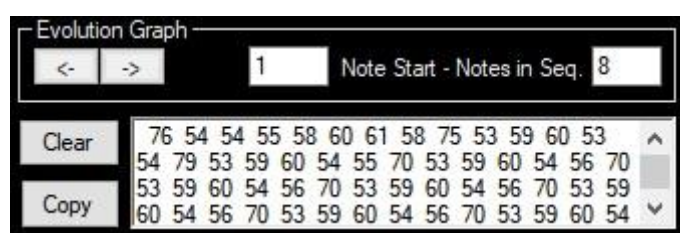
GRAPH & EVOLUTION GRAPH SERIES

Note Frequency Distribution of Sequence - Some 'note constant' values will converge to a single value (note or timing), others will never converge, others will diverge to infinity and are not part of the Mandelbrot set. However you can still use the divergent series to make a sequence! Try it and see! Divergence to infinity will be safely error trapped by the software. You can see how many times a note occurs in a sequence by clicking on the 'Show Note Distribution Graph' tab. See example below. midi note 55 and 57 occur 17 times, In the example below the maximum note reoccurrence is 17.



EVOLUTION PARAMETERS

Imagine you have generated a series containing say 1000 notes. How does the note series develop? Does it converge to 1 note, stay chaotic or become periodic? How do the melodic patterns develop with time? By sampling a 'frame' every few notes it's possible to see on a graph how the distribution of notes changes with time. This can be presented in the form of a movie. So graph 1 (frame 1) shows the first 8 notes, graph 2 (frame 2) the next 8 notes and so on...



The Evolution parameter box on the same tab allows the user to specify the note number in the sequence the movie starts, the number of notes sampled every frame. Press the '>' button repeatedly to play the movie once you have generated a sequence. To go back press the '<-' button

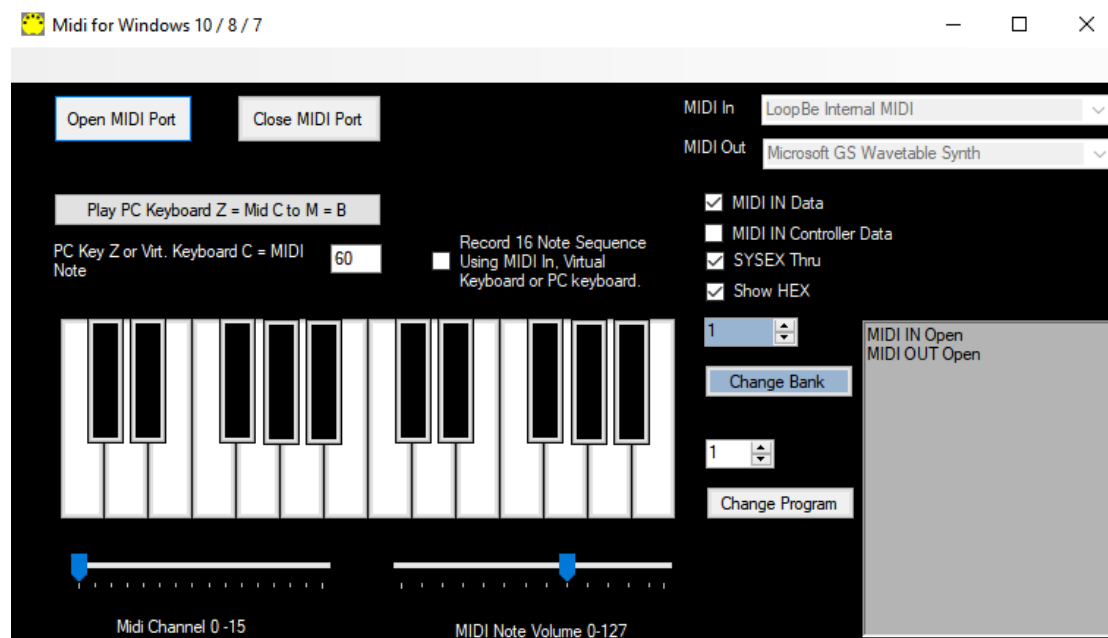
You move just a frame at a time forward and backwards by using the two arrow buttons. If the 'Play Sequence.' Check box is checked and the MIDI port open the note series in that frame will sound.

The 'Clear' button emptied the box. And 'Copy' copies its contents to the windows clipboard. Added in 4.2.1.

INPUTTING SEQUENCES

The Right Section of the fractal sequencer form allows the user to input 16 note sequences. The program can improvise around the sequence - see later. Input is via a midi instrument, the virtual keyboard section, manually entering values or pc keyboard, after checking the 'Record Sequence' checkbox on the MIDI form.

16 Note Sequencer		
MIDI Note	Time On	Time Off
67	1	0.1
69	1	0.1
65	1	0.1
53	1	0.1
60	2	0.1
65	1	0.1



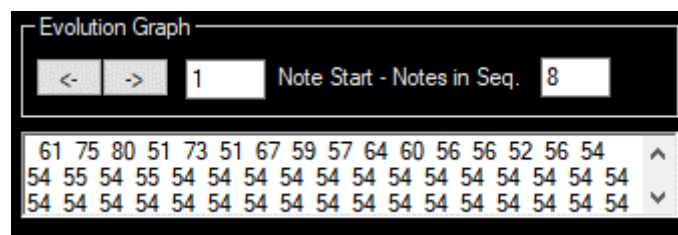
Depending on your PC using the PC keyboard may result in key repeats so generally use an instrument or the Virtual Keyboard

On the Sequencer form:-

- If you select 'Play Fractal Sequence' check box the fractal sequencer plays using the note timings specified in the sequencer.
- If you select 'Play 16 Note Sequence' the 16 sequencer notes and timings are played.
- If you select 'Play Random Composer check box the Random Composer plays using the note timings specified in the sequencer.

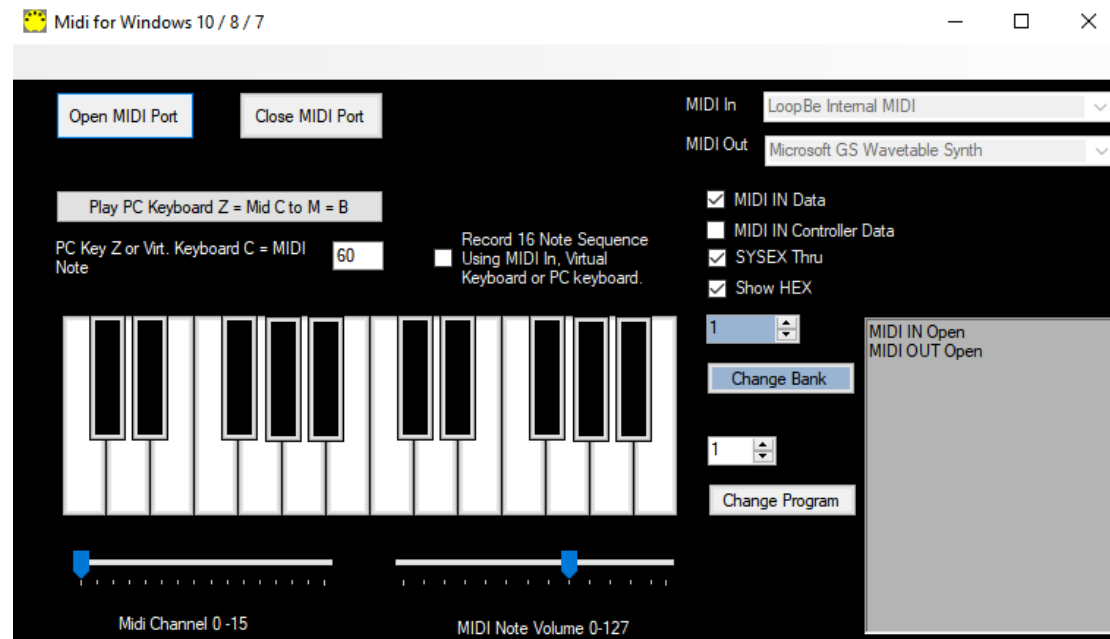
Setting any note Time On to a value of 0 limits the length of the sequence up to when the 0 occurs.

Remember. The text box on the sequencer form below the graph shows the midi note numbers produced by a particular Fractal sequence.



INPUTTING SEQUENCES USING A MIDI INSTRUMENT

From version 4.1 it is possible to input notes and rhythm (note timings - note on / note off) using a midi instrument.



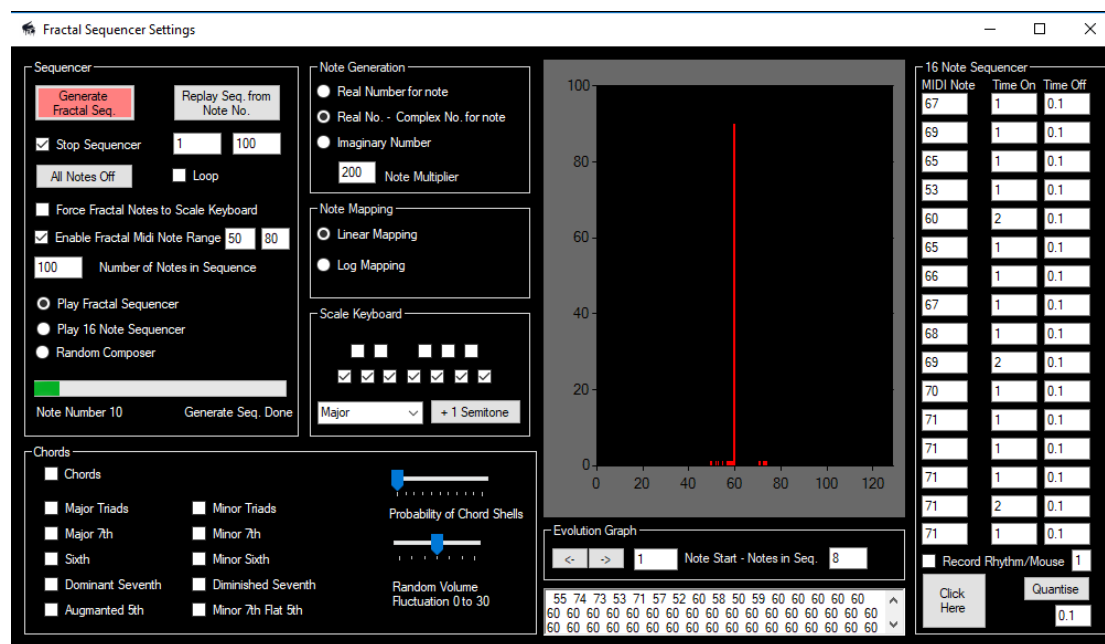
Just check the 'Record 16 note Sequence...' check box. Set MIDI In to the stream from your instrument, set output to a MIDI sound source and then Open MIDI port.

Play your instrument. Remember the sequencer is monophonic so play one note at a time. Release the note before playing the next one. Once 16 notes and their timings are recorded a message box will tell you the sequence is complete.

If you make mistakes with notes re-enter sequence by clicking on checkbox again, or edit the note and timings text boxes on the Fractal Sequencer form. You can also overwrite the Rhythm by using manual input of Rhythm using your mouse on the virtual keyboard or on the sequencer form.

MANUAL INPUT OF RHYTHM

If you just need to input a rhythm you can also do it this way - click in the rhythm of the sequence using the computer mouse. This has been added following the requests of several users. See below. A simple default rhythm is pre-loaded at the start.



In the 16 note sequencer box at the bottom - there is a 'click here' button. This is where you click with the mouse after checking 'Record Rhythm Mouse'

To change the default rhythm.

- I find it helpful to hear actual notes so opening the midi out port sounds the associated note in the sequencer by sending midi data.
- Check 'Record Rhythm. **You must then click out the rhythm with the mouse pointer over the 'click here' box.** If you make a mistake just record again

Note - click the mouse to record 16 note timings. Left Mouse button down note on. Left Mouse button Up note off.

- Time Signatures. To use fewer beats - just set the 'time on' to 0 after your last beat. For instance, 4/4 or 2/2 time could use all 16 beats (text boxes) as 16 is divisible by 2 and 4. You could also use 8 or 4 beats only.
- 3/4 time will use 15 beats as 15 is divisible by 3. You could use 12 or 9 or 6 or 3 beats. See image below with 0's in last two boxes to reduce sequence to 15 beats.
- 6/4 time will use 12 beats or 6 beats etc.

70	1	0.1
71	1	0.1
71	1	0.1
71	1	0.1
71	2	0.1
71	1	0.1
<input type="checkbox"/> Record Rhythm/Mouse		1
Click Here	0.05	Quantise
	120	BPM sec
Crotchet 1/4 Note at BPM = ? Sec		

The Quantise button and text box to its left enables the user to vary the tempo after you have recorded your rhythm. 1 = the same 2 = twice length of time on and off. 0.5 = twice as fast etc.

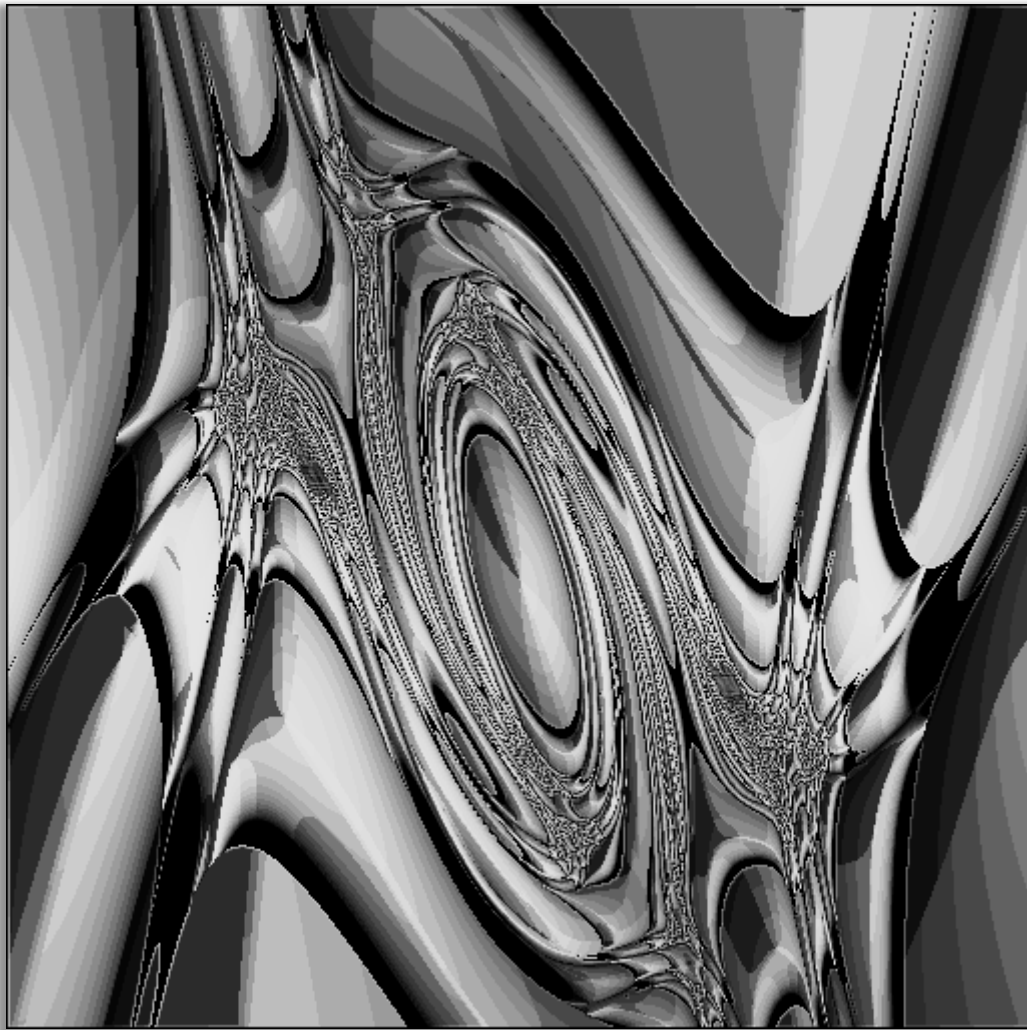
There is a simple default rhythm set when you load the software.

Pressing 'Quantise' also quantises the timings so that each time is rounded. So if the recorded timings were 0.15, 0.132, 0.122. sec
Then if the quantise text box is set to 0.1 sec
then the timings would be 0.1, 0.1, 0.1 sec

It is best to set the quantise box to less than half the smallest time you record to avoid getting a machine-like accuracy.

If you use the 'Save settings' option in the menu bar of the composer form, the 16 notes and their on/off values will be saved together with all of the fractal parameters etc. They can then be reloaded using the Load settings menu item.

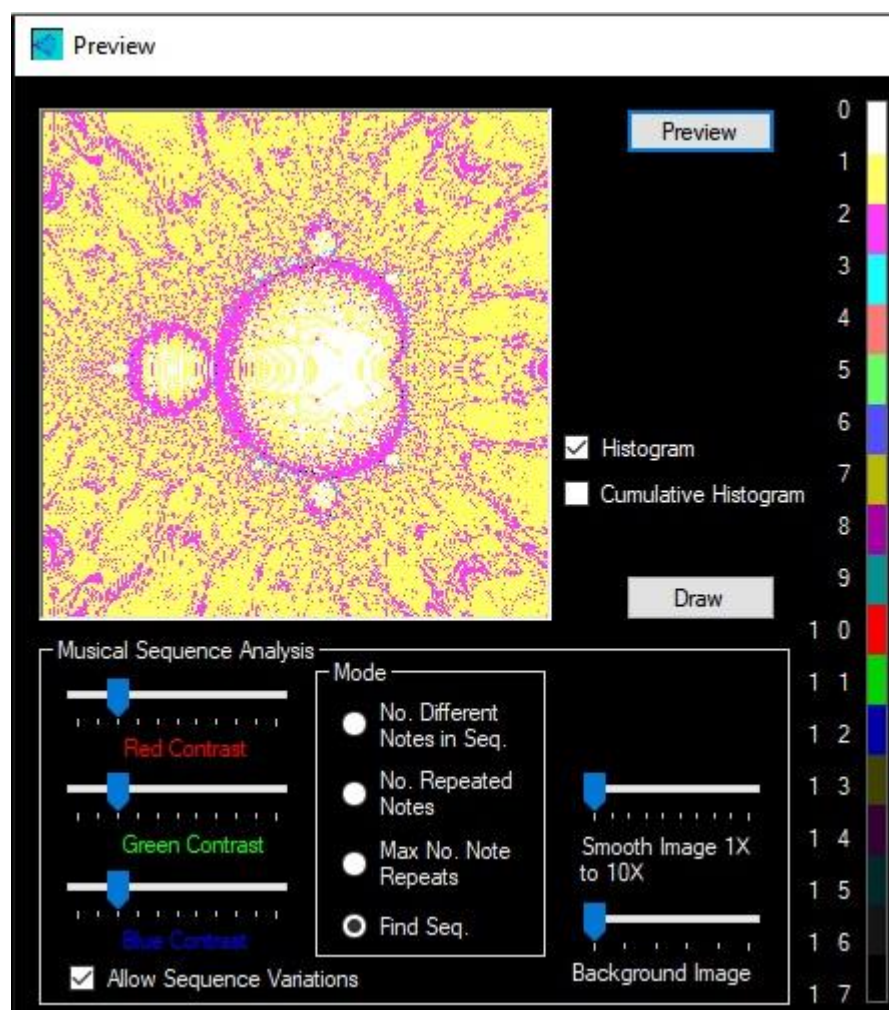
The BPM Sec button shows the length of a quaver or quarter note in sec for the input Beats per Minute BPM box to its length.



Part of a Julia Set with $a = 1.1$, $b = 1.3$ and $c = 0.6$
TIA, smoothing and Rank Order multiplicative.

MUSICAL SEQUENCE ANALYSIS

Using images to find interesting musical sequences!



The sequence analysis images can act as a guide to finding rich areas for musical sequences. The main guidelines are:

- Use Sequence Analysis to help. See form above.
- Use the graph in the composer module to see the range of notes the sequence produces for the point chosen.
- Use the text in the fractal form to see the individual midi notes when a sequence is selected. Close preview (sequencer analysis) to see notes whilst using the mouse to select sequences.
- Choosing points inside convergent sets will result in converging sequences with more repetitious midi notes.
- Choosing points outside convergent sets will produce more varied sequences with a wider variety of midi note numbers (notes).

- The further from the convergent set you go the more varied the notes but there is a trade off as the series will diverge quickly and may very occasionally be stopped by the sequencer.
- Experiment - as much as possible. The most important thing is to listen to the musical sequence!
- These guidelines are not rules!

Sequence Analysis looks at a musical sequence (100 to the first 1000 notes). Set by the number of iterations slider on the main form. Generally, the more notes sampled the better - however 100 is a good start = default setting. Set Bailout to 10^6 . Here is a simple example. A sequence of just 5 midi notes for a single pixel might look like this:-

41 56 73 40 78.

Number of different notes = 5 = green = number of unique midi notes = number of bars on graph

Number of repeated notes (ie. note numbers which are repeated) = 0 = White = number of midi notes which repeat = number of bars on graph with height > 1

Max number of repeats of any note = 0 = white = maximum number of how many times a midi note repeats = max height of bar on graph

40 56 56 40 78.

Number of different notes = 3 = cyan

Number of repeated notes = 2 = magenta

Max number of repeats of any note = 2 = magenta

40 56 56 56 78.

Number of different notes = 3 = cyan

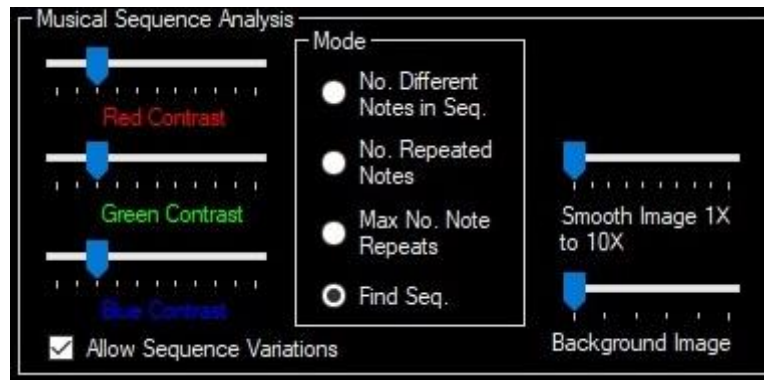
Number of repeated notes = 1 = yellow

Max number of repeats of any note = 3 = cyan

Remember you are trying to find a sequence which is not just one note repeating. However, think of your favourite melodies. They all contain repeating notes. So it's a balance.

An image is built up by analysing every single pixels sequence! 100 to 1000 notes long. The iteration limit. You may need to adjust the contrast sliders to see the image with longer sequences as increasing the number of notes will darken the number of repeated notes image. You can see

the list of midi note numbers in the text box in the fractal sequencer module after you select a sequence. Close Preview first.

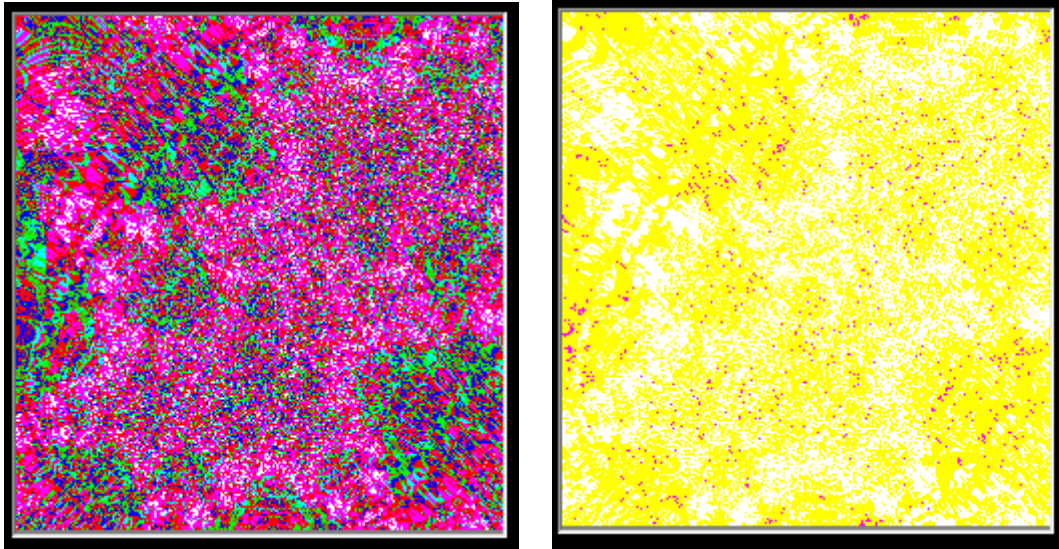


See the key on the preview form previous page. When musical sequence analysis is chosen you can see how colours map to numbers. Applies if all contrast sliders set to 2 = default and smooth slider set to 1. White = 0. Yellow=1, Magenta 2, Cyan 3, red 4, green 5, blue 6, dark yellow 7, dark magenta 8, dark cyan 9, dark red 10, dark green 11, dark blue 12, darker yellow 13, darker magenta 14, darker cyan 15, dark grey 16, Black ≥ 17 . However if you move the contrast sliders on the form the key colours will update automatically.

The user can vary the colour contrast for RGB individually. 0= colour channel invisible. The number of notes analysed in a sequence can be adjusted from 100 to 1000. As this analysis has to do millions of calculations you need to let the computer process for several minutes. Be patient, The progress bar on the main form will show the progress of the analysis. A 256 pixel sq. image on my i5 Laptop takes 90 seconds to render an analysis image for 100 notes. Click on play on the draw form and explore. Remember to select the sequence type - real only, real part of complex or imaginary part of complex, linear or log on composer form as well.

NB. The notes are mapped from the fractal series number sequence $+0$ to 10^{320} (i) to midi note numbers 1 to 128, using sophisticated routines controlled by the composer form controls and the sequencer engine. The 'smooth 1x to 100x' slider multiplies the note range by a factor of 1 to 100. 1 is normal. 5 means 5 notes now occupy a colour. So magenta = 2 - 3 notes smooth of 1 = default value, is now notes 5×2 to $5 \times 3 = 10 - 15$ notes. This can smooth out a speckled image (which occur in chaotic areas) to make the image clearer. Normally a smoothing value of 2 is

sufficient. However if you are looking for 'number of repeated notes' use 10 to 20,



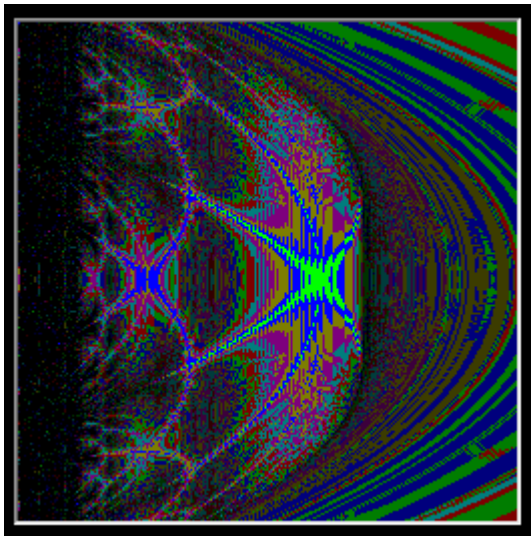
The Number of Repeated Notes

The image on the left above is the dendrite Julia set fractal. Sampled 100 notes deep. The simpler image on the right is smoothed by 10. White = 0 to 10 notes repeated. Yellow = 11 to 20 notes repeated. Magenta 21 to 30 notes repeated. Remember to use smooth when looking at the number of repeated notes. Remember in this sequence 1,2,3,4,4,4,5,6,7,7,8. There are two notes which repeat. 4 and 7.

Maximum Number of Repeated notes

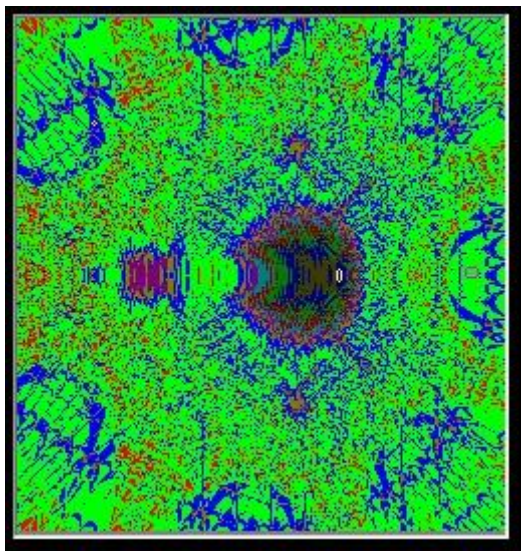
The maximum number of repeated notes is 3, because 4 repeats the most. 3 times.

The Number of Different Notes



The image above is a simple quadratic equation of the form $X_{(n+1)} = x_{(n)}^2 + c$. X and C are real numbers only. Number of different notes plotted. Red lines are very thin and have the minimum number of different notes. Green indicates more different notes. Blue indicates even more different notes in sequence etc. Black has most different notes.

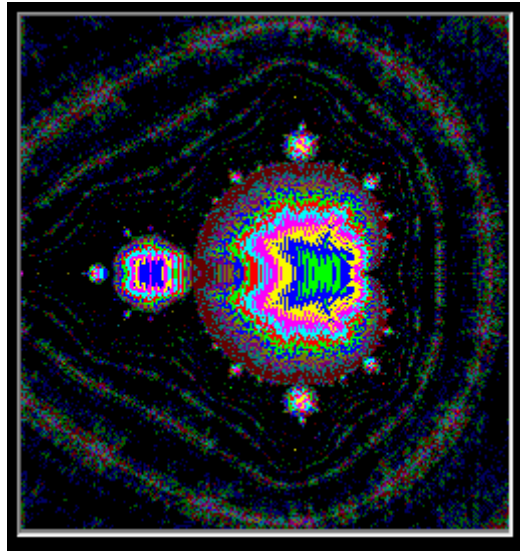
In the sequence 1,2,3,4,4,5,6,7,7,7,8 the number of different notes is 8 notes. 1,2,3,4,5,6,7,8



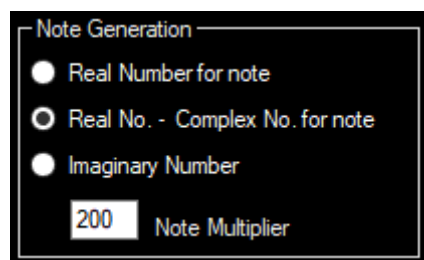
In the image above dark colours indicate more repeated notes in the sequence. Map of real number part of complex number equations used as musical sequence. Notice this strange mapping of the Mandelbrot set. A

shadow of the source set can be rendered in the background using the Background Image Contrast slider.

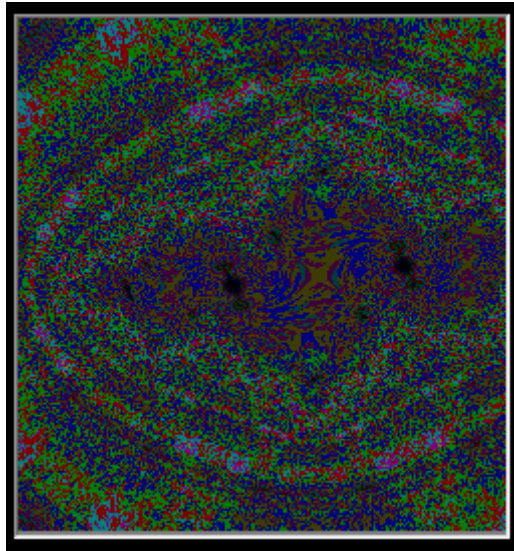
Note. Imaginary numbers used in the complex number equations for musical sequence produce totally different sequences. So does log mapping.



Looking 40 notes deep at every pixel into the Mandelbrot set - image above. Brighter colours show more repeated notes. i.e. A less varied sequence. Areas outside the set are richer. To get the corresponding midi sequence, select the appropriate radio button on the composer module before you draw it and after it is drawn, check play sequence and use the draw box to select a sequence.



If you draw using imaginary numbers only for sequence, select the Imaginary Component radio button. You can also map notes using the log function.



The image above is of the startup Julia set - number of repeated notes. You draw using a Julia set by checking the 'Julia set' on the main form and change the Julia set drop down list.

Julia Sets			
<input type="radio"/> Normal	X		-0.25
<input type="radio"/> x/a	Y		0
<input type="radio"/> y/b	Julia a		-0.745429
<input type="button" value="User Data"/>	Julia ib		0.113008
Start Up Julia Set		▼	<input checked="" type="checkbox"/> Julia Set

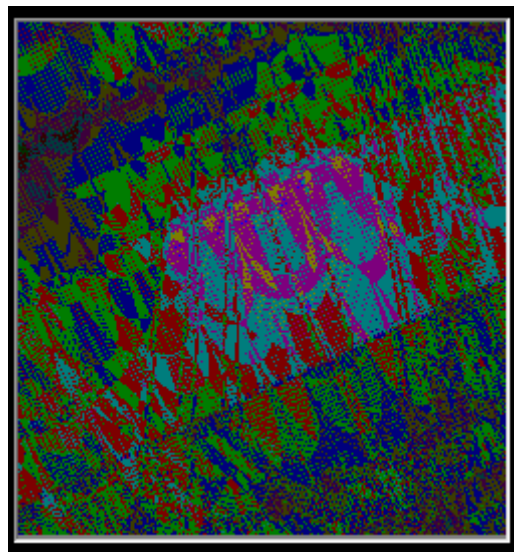
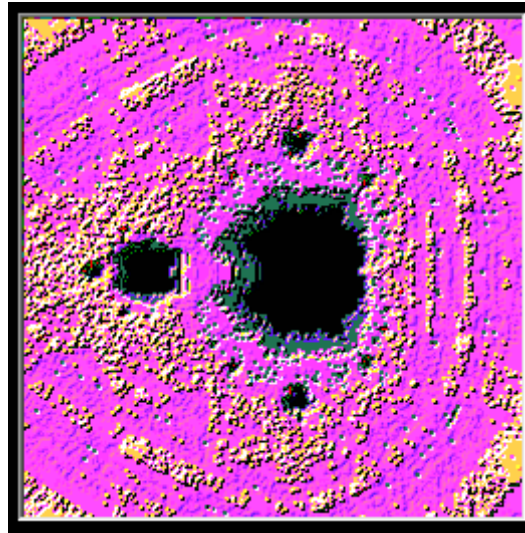
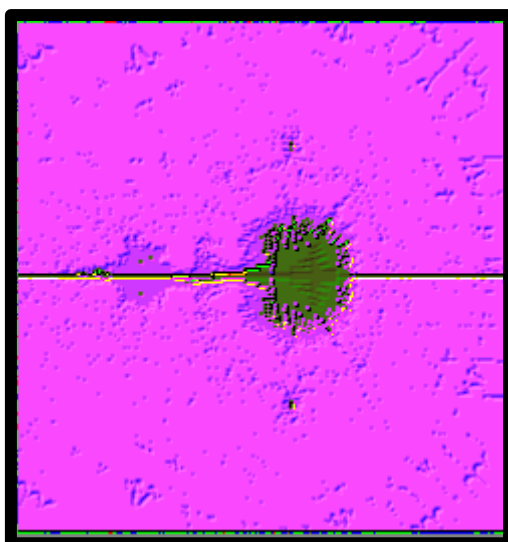


Image above. Magnification X10 of a rich seam of sequences in the image above. Red only 4 notes repeated. Green 5 notes repeated, Blue 6 etc.

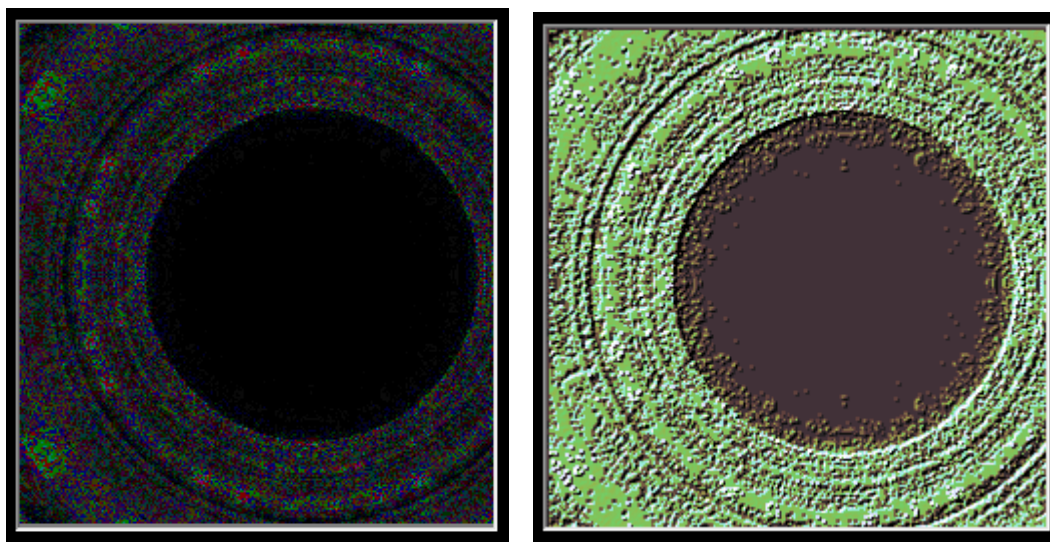
Other image processing features such as kernel etc. can be applied as after clicking 'Draw" the main image array is updated. So, click preview after the main image is redrawn and the image can be manipulated further. Emboss for instance brings out the detail well. Once you are happy with the image, clicking OK again will transfer the image to the main window so you can try different sequences.



The image above has been analysed for the number of different notes in sequence. Compare this to the one in the Musical Analysis form window at the start of this section. Processing makes a clearer image - but the colours no longer correspond to the note numbers as HSL is used. An emboss filter has been applied to the original image and then it has been HSL colour coded. Black = few different notes. Yellow = mainly different notes. The low lying areas in black will produce sequences with many repeated notes. Green a few less repetitions. The magenta plateau will be much better. The yellow hills are even better again.

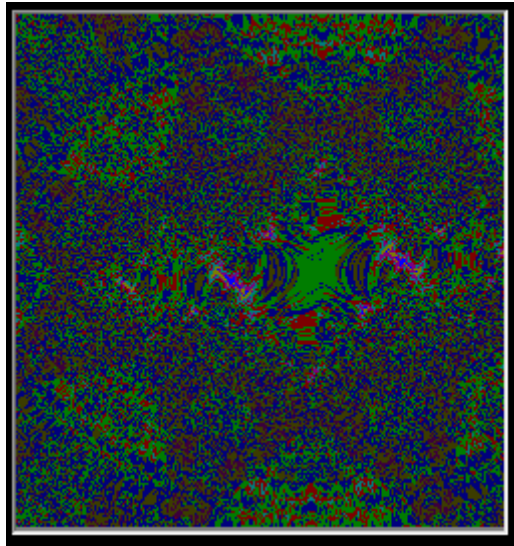


The image above is the imaginary cousin of the one previous. This shows maximum number of repeats of any note. An emboss filter has been applied to the original image and then it has been HSL colour coded.

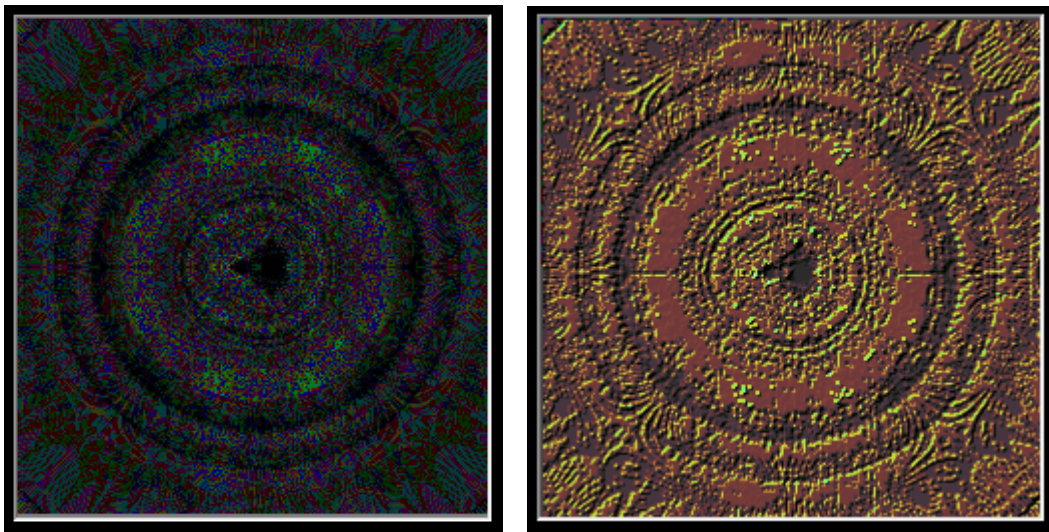


A Circle Julia set. An emboss filter has been applied (right hand image) to the original image (left) and then it has been HSL colour coded.

Without Musical Sequence Analysis finding sequence rich areas involves much more 'trial and error'. Remember zooming in will increase the sequence numbers as fractals are infinitely detailed! Also zooming out will uncover areas further outside of the set which will be rich as well!



Chaos. The image above is of the start up Julia set - number of different notes. It clearly shows the chaotic nature of the set and its surroundings. Very small movements in the plane result in very different sequences.

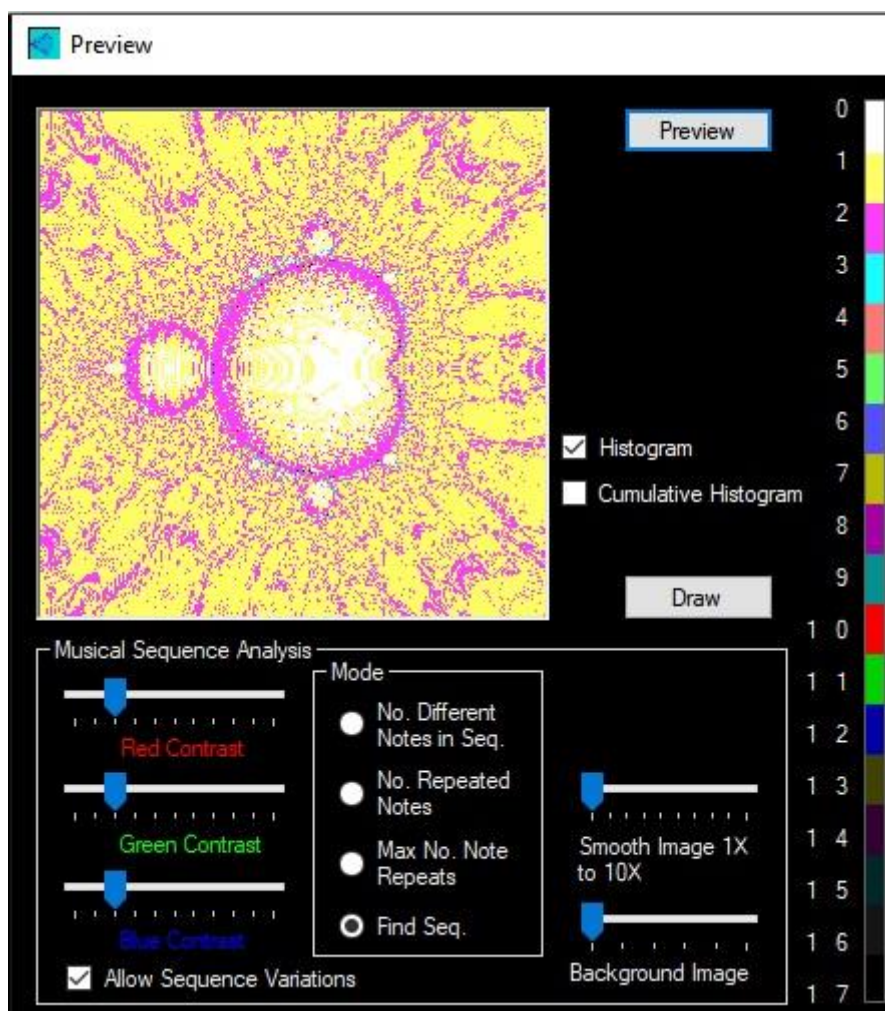


Rich hunting grounds far outside of the Mandelbrot set. Zoom 0.2 on start image. An emboss filter has been applied (right hand image) to the original image on the left - number of repeated notes - and then it has been HSL colour coded.

FINDING SEQUENCES

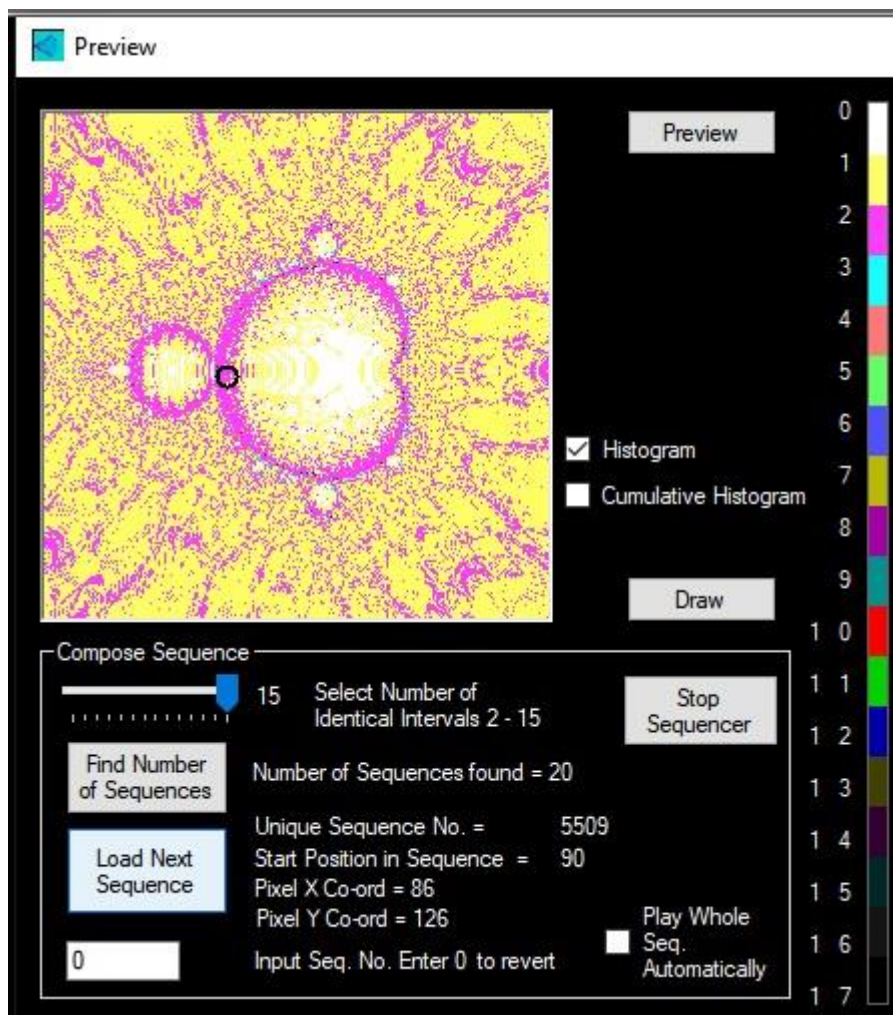
From Version 2.0 there is the option for finding sequences that the user inputs and then letting the software continue the composition. The software develops the sequence using the fractal set parameters from where the user left off! Because fractals exhibit self-similarity, not only at different scales across the image but in the iterations for each pixel human like compositions can be created. You could input your favourite melody and hear variations on how it can be extended.

Note you may not find some sequences you enter or you may have to do some hunting in the different sets.



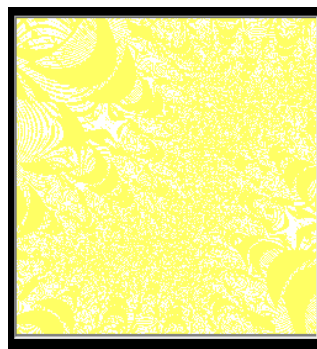
1. The first step is to decide what fractal you want to use and draw it on the main form.
2. Then click on the 'Find Seq.' radio button on the Musical Sequence Analysis form (see above).

3. Then play a sequence on the virtual piano keyboard on the MIDI form. Up to 16 consecutive notes can be saved. These will be displayed on the sequencer form. Setting a note to 0, say at note 4 will mean that the software assumes you want no further intervals checked beyond note 3 (2 intervals).
4. Decide on how many notes deep you want to allocate per pixel - ie the iteration number slider. 100 is a good starting point. 1000 will take longer to process!
5. Click Preview. You are searching on the Preview Image A sequence of 3 intervals, 100 notes deep, 256 pixels square which will take 120 seconds on a medium spec PC. So be patient. The progress bar on the main form will show progress.
- 6.

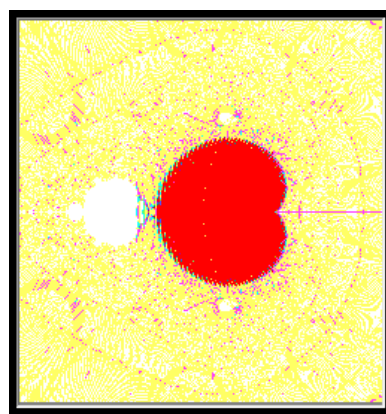


The resulting image will show how many intervals (= number of notes - 1) are found which match your melody. For instance, type in a sequence of 5 notes. There are 4 intervals. Note. For instance the interval between midi note number 65 and 67 is 2. Between 40 and 50 = 10. The analysis is musical key independent. The Software will match these intervals. If you don't get many matches try another fractal set or zoom in or out. For instance the Dendrite fractal is quite different from the Mandelbrot set in this respect.

- If only 1 matching interval is found nothing will be saved. Ie 2 notes. See image below. White no matches. Yellow 1 interval match.



- If 2 intervals (3 notes) agree the software will record the sequence parameters. Coloured cyan.
- If 3 intervals (4 notes) agree the software will record the sequence parameters again. Etc. Below 10 intervals /11 notes match = Red.



This will be repeated until 15 intervals are checked (or until a 0 is found as a note number in your sequence) for the best match for every pixel. The resulting image will then colour code the matches. White = 0 intervals match, Yellow = 1 intervals match. Magenta = 2 intervals match -

sequence parameters stored. Cyan = 3 intervals match - sequence parameters stored. etc.

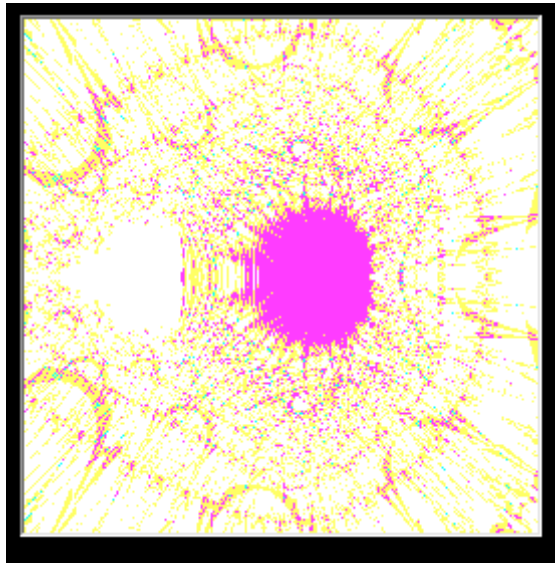
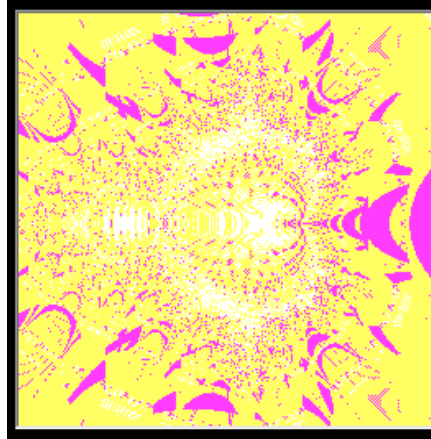


Image Above. Variations on The Blue Danube Waltz. The hidden treasures in the Mandelbrot Set. The big magenta area shows 2 intervals/3 notes match. 29,953 pixels! A smattering of cyan pixels show 3 intervals/4 notes match. 383 pixels. There are 36 matches for 4 intervals/5 notes - see image below. None higher. To get higher ones increase note depth from 100 up to 1000. Zoom out or in to regions which have high matches already.

If you change the sequence in the text boxes the resulting note matches will change.

Change Sequence - see below. More matching intervals.



You can review the matches using the Compose Sequence form below.

Preview

Preview

Histogram
 Cumulative Histogram

Draw

Compose Sequence

15 Select Number of Identical Intervals 2 - 15

Find Number of Sequences

Load Next Sequence

0

Number of Sequences found = 20

Unique Sequence No. = 5509

Start Position in Sequence = 90

Pixel X Co-ord = 86

Pixel Y Co-ord = 126

Input Seq. No. Enter 0 to revert

Stop Sequencer

Play Whole Seq. Automatically

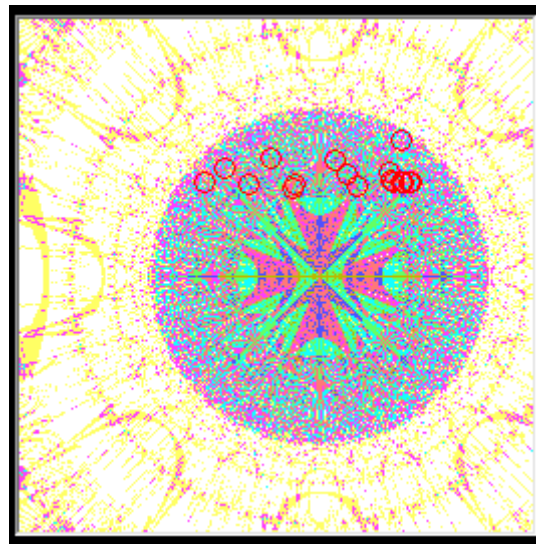
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17

Image above shows the 'Compose Sequence' controls. 20 matching sequences found out of 65,536 sequences (256^2) for 15 intervals / 16 notes for a particular sequence.

Use the slider to select the number of identical intervals then click 'find number of sequences' button.

Pressing load next sequence will put a black circle around the point and with the 'play whole sequence' check box checked. will play the whole sequence from note 0. It will send the midi data to your instrument of choice. Press 'stop' sequencer to end midi transmission. Then click load next sequence for the next one. Etc.

To go to a specific sequence, enter the sequence number in the 'input seq.' box. Enter 0 again to carry on to the next sequence.

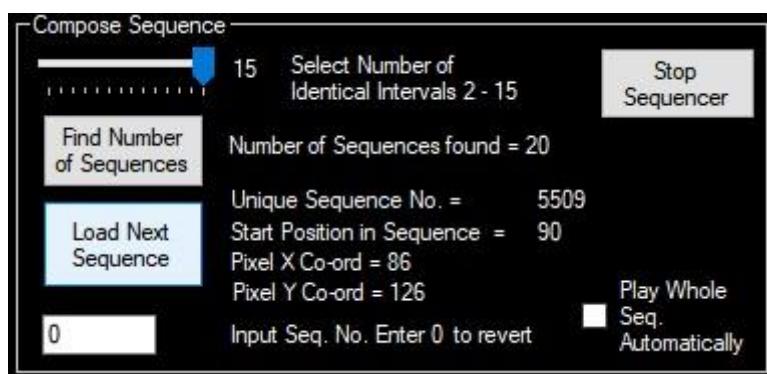


The image above is the Circle Julia set. Sequence analysed is of 8 identical notes, 20 notes deep. The best matching region for a repetitive sequence unsurprisingly is inside of the set where the series converge.

You may find you cannot find a matching sequence in the set. You can then use 'Accept Note Sequence Variance' check box. What this does is allow for variations on your sequence. If you enter say 65 66 67 as midi note numbers. This will permit a set sequence of say 65 72 66 77. Ie it will allow notes to be inserted between notes in your sequence so a set sequence can be found. Whilst strict sequence compliance is lost you will still get an interesting and similar sequence in most cases.

COMPOSING

The next step is looking at the results and hearing the alternative sequences the software comes up with.

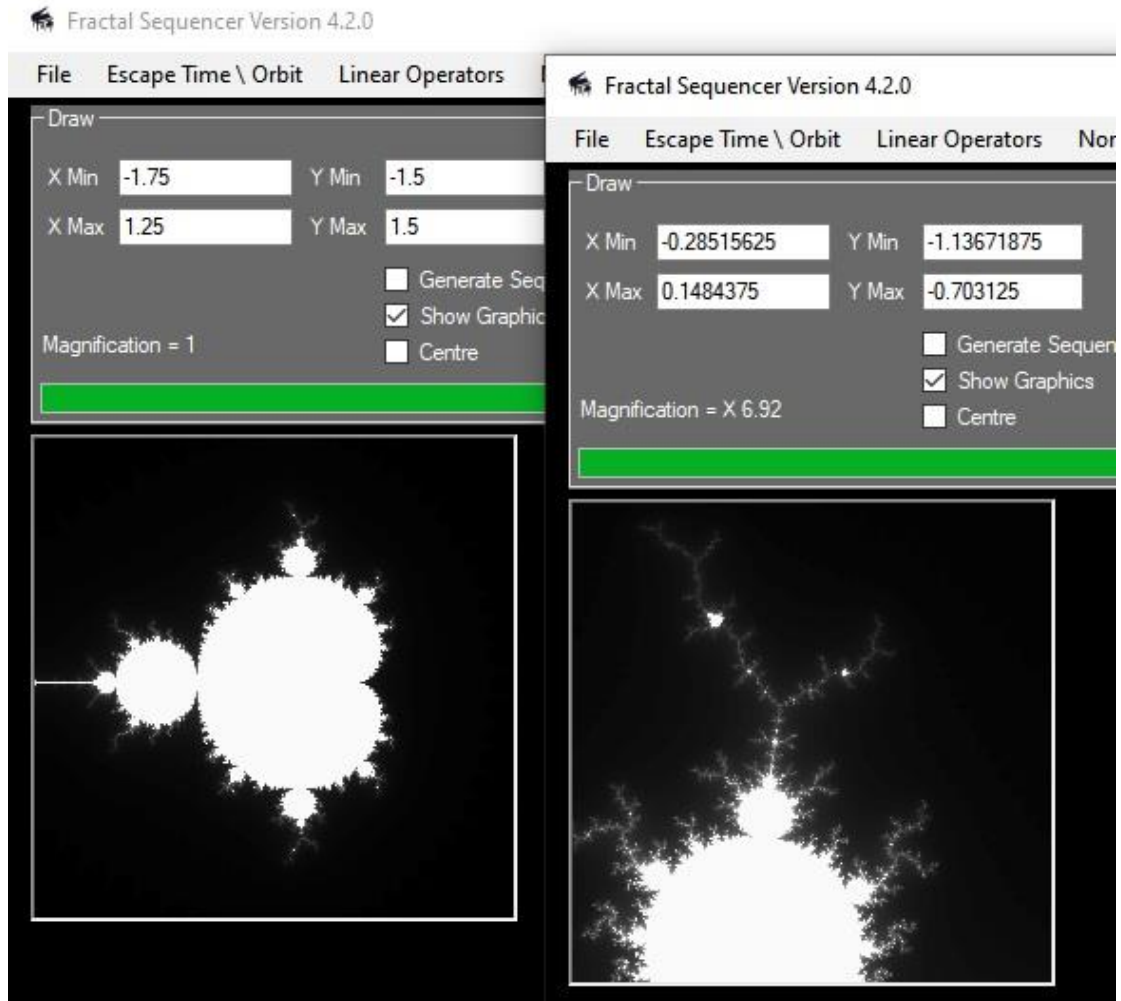


This bit is great fun!

1. Choose how many identical intervals you will accept. You may only get up to 10 matching intervals for a 256 pixel square image, analysed for 100 notes/pixel. You can see the results using the slider to change the value - say to 3. Then click 'Find Number of Sequences' to see how many sequences agree. You may get several hundred. Fewer generally, as you search for more matching intervals per pixel.
2. 'Load Next Sequence' will load the first sequence and report where in the sequence the agreement begins as well as the pixels coordinates. NB. 0, 0 is top left, and place a black circle around the point. Your sequence may not start until 5 notes in say. A black circle of 5 pixels radius, 2 pixels thick will be drawn around the pixel generating the sequence.
3. Press 'Stop Sequencer' to stop midi sequence.
4. Then click Load next sequence which will automatically start the midi stream to your instrument or VST.
5. To go to the start position where there is a match. Press 'Stop Sequencer' on the Composer Form. The press 'Replay Sequence from Note Number' on the same form. The start note will be filled in for you automatically. You may have many sequences to choose from!

RUNNING MULTIPLE INSTANCES AND MIDI CHANNELS

You can open more than one instance of the software and control multiple midi channels. The operating system will balance resources between the two. A reasonable specification PC will easily do this. So you could set one instance to play chords and the other to play the melody. A large monitor makes this easy.



THE SYNTHS

BLUE SYNTH 3 - PHASE MODULATED SYNTHESIZER

A dedicated stand-alone Phase Modulated synth. The blue2.exe file will be automatically installed in the fractal sequencer installation directory. Click on the 'Blue Synth' button on the fractal sequencer 'Synths' menu to open it from within the software. NB. Clicking twice will open another instance which is allowed. It can also be used separately from the Fractal Sequencer. A free VST version is available.



The top menu bar.

1. Midi in - allows the selection of all the available midi inputs
2. Midi out - allows the selection of all the available midi outputs including Microsoft GS wavetable synth often found on PC sound cards. Make sure midi in is different to midi out otherwise you will get a midi feedback loop.
3. Audio - allows the choice of ASIO or WDM sound drivers
4. Zoom on the executable version changes the size of the synth on the screen.

The Blue Synth is a touch sensitive, two oscillator phase modulation virtual synthesizer designed to provide a useful audio source for the

Fractal Sequencer. It can produce lush pads or powerful leads. It can run as a standalone application or run with the Fractal Sequencer.

There are two oscillators to create the carrier waves which can both be phase modulated by a sine wave. The polyphony can be adjusted between 1 and 128 notes. You can choose the carrier waveform and apply an attack, decay, sustain and release envelope whose amount can be adjusted. The Modulator knobs control the detuning of the carrier from the modulator and the large knob the amount of modulation, Oscillator 2 can be detuned. The output can be fed through two filter banks with cutoff, resonance and track as well as ADSRs' affecting the filters. There is a ping pong delay and reverb. Programs can be saved. The built in Oscilloscope allows the user to view the wave forms and ensure the signal is not clipped. If it is you will get distortion. To stop this just reduce the 'amount' knobs of the two ADSRs on the left side.

There are 10 factory sounds preloaded in the synth courtesy of Yoa out of the 20 available program slots in each program bank. Programs/banks can be saved as text files.

Please set midi and audio preferences (direct sound or ASIO) in synth menu before you use it.

All I ask is for feedback and ideas for additions or modifications. Also additional programs/banks welcome. I will host on my site.

PC Specs. Windows 7 to 10 - Laptop or PC - ideally >2gb ram and >2ghz processor. Should run on a netbook depending on specs.

Main features

1. Touch sensitive.
2. Oscillator 1 and 2 have a choice of waveforms. Sine, square, Sawtooth, triangle and noise. 1 to 128 note polyphony.
3. Osc 2 Pitch - adjust by up to +- 5 octaves, semitone and fine. Slightly detuning and enriches the sound.
4. 2 Envelopes per oscillator control volume and cut-off frequency
5. Filter - cut-off and resonance - filter type selectable.
- 5b. Polyphony 1 to 128 notes.

6. 88 note on-screen keyboard activated by mouse or use PC keyboard keys or even better your own external touch sensitive midi keyboard. Full 128 midi notes accessible.

7. A stereo ping pong delay and reverb enriches the sound.

8. See fractal sequencer which can be used with synth and midi yoke or loopbe1 freeware to connect.

Program/bank load and save.

9. There are 20 factory sounds preloaded in the synth courtesy of Yoa (see link below) out of the 40 available program slots in each program bank. Programs/banks can be saved/loaded as text files.

10. In standalone set midi in & midi out/audio/zoom feature at top of window.

For more information email me at stuartpryer@gmail.com

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Special thanks to Yoa, who helped with creating the presets and demo songs, as well as beta testing.

blog (<http://siryoa.blogspot.com/>).

VIOLET SYNTH 2 - FM VIRTUAL SYNTHESIZER



Violet Synth is a three oscillator frequency modulated virtual synthesizer. Version 2 has an inbuilt oscilloscope, a master volume control and responds to touch sensitive MIDI keyboards. The harder you strike the key the louder the note.. It can produce lush pads or powerful leads. It is available either as a standalone application or as VSTi for using in a host application such as Sonar, Cubase, Cantabile, Ambleton etc. Note. Cantabile Lite is free and has great randomising functions.

There are three oscillators to create the carrier waves which can be frequency modulated by a sine wave, sawtooth wave, triangle wave etc. You can choose the carrier waveform and apply an attack, decay, sustain and release envelope whose amount can be adjusted. The three Fine knobs and drop down arrows under the modulator section control the frequency modulation frequency, You can vary the modulation/carrier ratios. A one octave difference means the carrier is half or twice the modulator frequency which will produce tonal notes with side bands as integer ratios of the carrier frequency. Other ratios will produce atonal notes. . Oscillator 2 and 3 can be detuned. The output is fed through

three filter banks with cutoff, resonance and track as well as ADSRs' affecting the filters.

There are further effects such as reverb, chorus, ping pong delay and a low frequency - frequency modulation section (vibrato).

Programs can be saved. Programs/banks can be saved as text files or as fxp/fxb files using the host program for vsti or in the .exe version. Please set midi and audio preferences in standalone version first. In the VSTi the host settings fixes these parameters.

Finally, there is a recorder section so the MIDI generated whilst you play can be stored and replayed.

I appreciate feedback and ideas for additions or modifications. Also additional programs/banks welcome. I will host on my site. PC Specs. Windows 7 to 10 - Laptop or PC - ideally > 2gb ram and > 2ghz processor. May run on a netbook depending on specs.

Main features

1. Click on red LED to clear audio - panic button
2. Master Volume
3. Oscilloscope - Used to view waveforms and check audio does not clip. If audio clips reduce the first ADSR amount value. FM synths produce wide dynamic range signals.
4. Velocity sensitive to incoming MIDI data.
5. Oscillator 1, 2 and 3 have a choice of waveforms. Sine, square, Sawtooth, triangle and noise.
6. Osc 2/3 Pitch - adjust by up to +- 5 octaves, semitone and fine. Slightly detuning richens sound.
7. Carrier/modulator ratio can be adjusted from $r = 32$ to $r = 1/32$
8. Adjust polyphony from 1 to 128 notes
9. Two Envelopes per oscillator control volume and cut-off frequency
10. Filter - cut-off and resonance - filter type selectable. Polyphony 1 to 128 notes.
11. 88 note on-screen keyboard activated by mouse or use PC keyboard keys or even better your own external velocity sensitive midi keyboard. Full 128 midi notes accessible.
12. A stereo ping pong delay enriches the sound.

13. Stereo reverb
14. Stereo chorus
15. The fractal sequencer can be used with synth and midi yoke freeware or LoopBe1 to connect using MIDI.
16. Program/bank load and save.
17. There are 40 available program slots in each program bank. Programs/banks can be saved/loaded as text files or as fxp/fxb files using the host program or menu in standalone version. Midi enabled
18. In standalone set midi/audio/zoom feature at top of window. Direct Sound and ASIO output selectable.
19. In VSTi - host (Sonar, Cantabile, Cubase, Cantibil, Ambleton etc.) controls the parameters above.
20. Multiple instances of synth can be run.
21. There is a built in MIDI recorder.
22. For VSTi place .dll in your normal virtual instrument folder.

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RED SYNTH



Red Synth is a three oscillator subtractive virtual synthesizer. It has an inbuilt oscilloscope, a master volume control and responds to touch sensitive MIDI keyboards. The harder you strike the key the louder the note. It can produce lush pads or powerful leads. It is available either as a standalone application or as VSTi for using in a host application such as Sonar, Cubase, Cantabile, Ableton etc. Note. Cantabile Lite is free and has great randomising functions.

There are three oscillators to create the tones. Sine, Sawtooth, Square, Triangel and Noise. Oscillator 2 and 3 can be detuned. The output is fed through three filter banks with cutoff, resonance and track as well as ADSRs' affecting the filters.

There are further effects such as reverb, chorus, ping pong delay and a low frequency - frequency modulation section (vibrato).

Programs can be saved. Programs/banks can be saved as text files or as fxp/fxb files using the host program for vsti or in the .exe version. Please set midi and audio preferences in standalone version first. In the VSTi the host settings fixes these parameters.

Finally, there is a recorder section so the MIDI generated whilst you play can be stored and replayed.

I appreciate feedback and ideas for additions or modifications. Also additional programs/banks welcome. I will host on my site. PC Specs. Windows 7 to 10 - Laptop or PC - ideally > 2gb ram and > 2ghz processor. May run on a netbook depending on specs.

Main features

23. Click on red LED to clear audio - panic button
24. Master Volume
25. Oscilloscope - Used to view waveforms and check audio does not clip. If audio clips reduce the first ADSR amount value. FM synths produce wide dynamic range signals.
26. Velocity sensitive to incoming MIDI data.
27. Oscillator 1, 2 and 3 have a choice of waveforms. Sine, square, Sawtooth, triangle and noise.
28. Osc 2/3 Pitch - adjust by up to +- 5 octaves, semitone and fine. Slightly detuning richens sound.
29. Adjust polyphony from 1 to 128 notes
30. Two Envelopes per oscillator control volume and cut-off frequency
31. Filter - cut-off and resonance - filter type selectable. Polyphony 1 to 128 notes.
32. 88 note on-screen keyboard activated by mouse or use PC keyboard keys or even better your own external velocity sensitive midi keyboard. Full 128 midi notes accessible.
33. A stereo ping pong delay enriches the sound.
34. Stereo reverb
35. Stereo chorus
36. The fractal sequencer can be used with synth and midi yoke freeware or LoopBe1 to connect using MIDI.
37. Program/bank load and save.
38. There are 40 available program slots in each program bank. Programs/banks can be saved/loaded as text files or as fxp/fxb files using the host program or menu in standalone version. Midi enabled

39. In standalone set midi/audio/zoom feature at top of window.
Direct Sound and ASIO output selectable.
40. In VSTi - host (Sonar, Cantabile, Cubase, Cantabil, Ambleton etc.)
controls the parameters above.
41. Multiple instances of synth can be run.
42. There is a built in MIDI recorder.
43. For VSTi place .dll in your normal virtual instrument folder.

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YELLOW SYNTH



Yellow Synth is a three oscillator additive virtual synthesizer. It has an inbuilt oscilloscope, a master volume control and responds to touch sensitive MIDI keyboards. The harder you strike the key the louder the note. It can produce lush pads or powerful leads. It is available either as a standalone application or as VSTi for using in a host application such as Sonar, Cubase, Cantabile, Ambleton etc. Note. Cantabile Lite is free and has great randomising functions.

There are three oscillators to create the tones. . The user can use the mouse to change the mix of the harmonics on the blue graphs. Oscillator 2 and 3 can be detuned. The output is fed through three filter banks with cutoff, resonance and track as well as ADSRs' affecting the filters.

There are further effects such as reverb, chorus, ping pong delay and a low frequency - frequency modulation section (vibrato).

Programs can be saved. Programs/banks can be saved as text files or as fxp/fxb files using the host program for vsti or in the .exe version.

Please set midi and audio preferences in standalone version first. In the VSTi the host settings fixes these parameters.

Finally, there is a recorder section so the MIDI generated whilst you play can be stored and replayed.

I appreciate feedback and ideas for additions or modifications. Also additional programs/banks welcome. I will host on my site. PC Specs. Windows 7 to 10 - Laptop or PC - ideally > 2gb ram and > 2ghz processor. May run on a netbook depending on specs.

Main features

44. Click on red LED to clear audio - panic button
45. Master Volume
46. Oscilloscope - Used to view waveforms and check audio does not clip. If audio clips reduce the first ADSR amount value. FM synths produce wide dynamic range signals.
47. Velocity sensitive to incoming MIDI data.
48. Oscillator 1, 2 and 3 are harmonic generators. User can pick harmonic content. Settings can be saved per oscillator and reloaded.
49. Osc 2/3 Pitch - adjust by up to +- 5 octaves, semitone and fine. Slightly detuning richens sound.
50. Adjust polyphony from 1 to 128 notes
51. Two Envelopes per oscillator control volume and cut-off frequency
52. Filter - cut-off and resonance - filter type selectable. Polyphony 1 to 128 notes.
53. 88 note on-screen keyboard activated by mouse or use PC keyboard keys or even better your own external velocity sensitive midi keyboard. Full 128 midi notes accessible.
54. A stereo ping pong delay enriches the sound.
55. Stereo reverb
56. Stereo chorus
57. The fractal sequencer can be used with synth and midi yoke freeware or LoopBe1 to connect using MIDI.
58. Program/bank load and save.

59. There are 40 available program slots in each program bank.
Programs/banks can be saved/loaded as text files or as fxp/fxb files using the host program or menu in standalone version. Midi enabled
60. In standalone set midi/audio/zoom feature at top of window.
Direct Sound and ASIO output selectable.
61. In VSTi - host (Sonar, Cantabile, Cubase, Cantabil, Ambleton etc.) controls the parameters above.
62. Multiple instances of synth can be run.
63. There is a built in MIDI recorder.
64. For VSTi place .dll in your normal virtual instrument folder.

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SH-1000 VIRTUAL SYNTHESIZER VER 2.1



The SH-1000 is an emulation of the Roland SH-1000 synthesizer first released in 1973 and which was Rolands first synth. Its successor was the SH-2000 but that was designed to be more of a preset instrument and had far less flexibility. The SH-1000 was used by Blondie, The Band, Jethrow Tull, The Human League and Eddie Johnson (Roxy Music) as well as many others. This was also the first synth I owned.

It is available either as a VSTi for use within a host such as Sonar, Cantabile, Cubase, Ambleton etc. or as a stand alone application.

PC Specs. Windows 7 to 10 - Laptop or PC - ideally >2gb ram and >2ghz processor. May run on a netbook depending on specs and polyphony and ADSR release time chosen.

Main features of full version

1. Click on red LED to clear audio - panic button
2. Tremolo - cyclic variation in volume - choose waveform, depth and speed
3. Noise - adjust cut off frequency and resonance of noise generator. Originally just white/pink option.

4. Pitch - adjust by up to +- 5 octaves, semitone and fine. Original just had option to raise or lower by 1 octave.
5. Vibrato - cyclic variation in frequency. Choose waveform depth and speed. Original had only 2 waveforms.
6. Growl - phase modulation. Waw cut off frequency modulation
7. Portamento - when polyphony set to 1 notes glide in frequency. When polyphony set higher say 2. When third note played first note glides to it. Original SH-1000 was monophonic.
8. Envelope controls volume and cut-off frequency
9. Filter - cut-off and resonance - filter type selectable. Original was just low pass.
10. Volume controls output amp
11. Polyphony 1 to 128 notes. Original monophonic
12. Waveform mixer - adjusts each waveform volume. Original on/off only.
13. Ability to detune oscillators to produce a richer sound.
14. Pitch bend wheel. Original glide button
15. 3 octave on-screen keyboard activated by mouse or use PC keyboard keys or even better your own external midi keyboard. Full 128 midi notes accessible. Original limited to 3 octaves with pitch raise/lower by 1 octave.
16. Stereo Reverb. Original just had hold note until next note played.
17. See Fractal Sequencer for advanced sequencer features which can be used with SH-1000 and midi yoke freeware or LoopBe to connect. Original had simple Random Note generator.
18. Program/bank load and save. There are 64 available program slots in each program bank. Programs/banks can be saved/loaded as text files or as fxp/fxb files using the host program or menu in standalone version. Original had no option to save or load settings.
19. Midi enabled - Original no midi.
20. In standalone set midi/audio/zoom feature at top of window.
21. In VSTi - host (Sonar, Cubase, Cantabile, Ambleton etc.) controls the parameters above.
22. In VSTi multiple instances of synth can be run.
23. Ver 2 has updated routines for Pulse Waveform reducing CPU load. If the load is still too high reduce release time of the ADSR

envelope to the 9 o'clock position and/or Polyphony. I run it on a netbook!

24.A VSTi is available. Place sh1000vxx.dll in your normal virtual instrument folder.

Copyright Stuart Pryer - 9th March 2015

Special thanks to Yoa, who helped with creating the demo song, as well as beta testing. blog (<http://siryoa.blogspot.com/>).

MIDI RECORDER



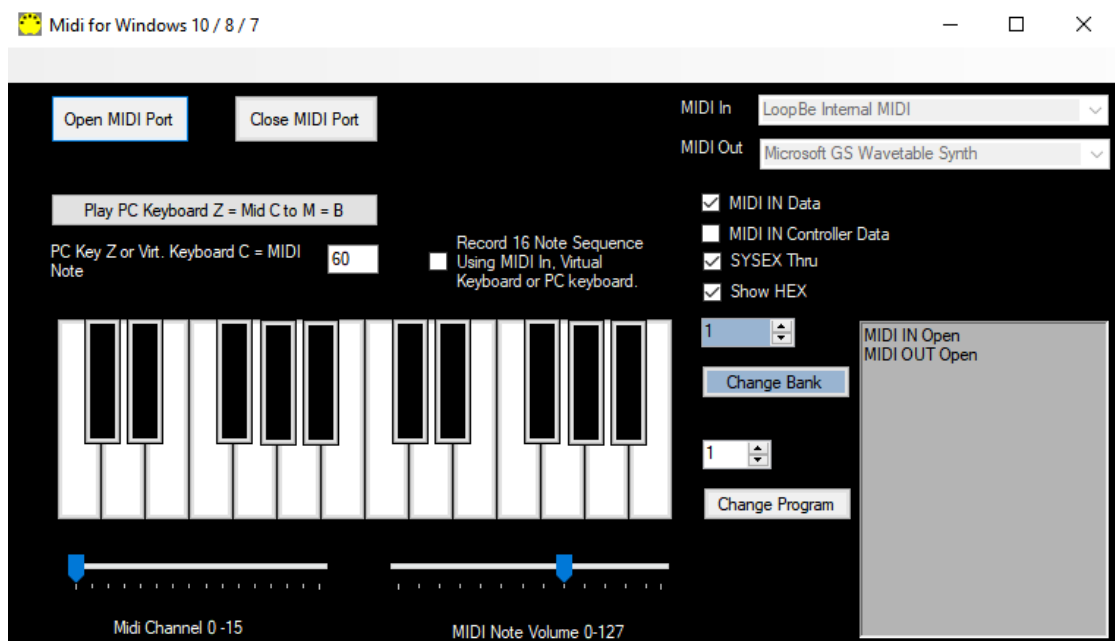
The MIDI Recorder does three things

- You can record any midi signal coming into the recorder and play it back to its midi output.
- You can play standard MIDI files
- You can add an arpeggiator to any incoming MIDI note and send to its MIDI output. The arpeggio pattern can be designed by the user or a random patten can be generated. The speed and number of steps can be varied.

TUTORIAL 1 - IMPROVISING AROUND A USER'S MELODY

This Tutorial describes how to get the software to develop a melody around one a user has composed or one the user likes.

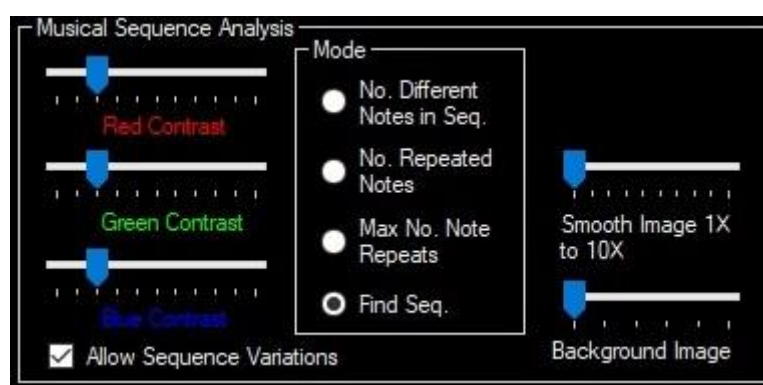
1. Load the software. Click on the Composer menu button at the top of the screen. Then click on the Random Composer tab.
2. Connect your instrument or VST of choice. Then play the virtual keyboard and enter up to 16 notes. Timing is not important at this stage. After the last note, if you don't require all 16 just enter 0s' in the boxes in the sequencer module.



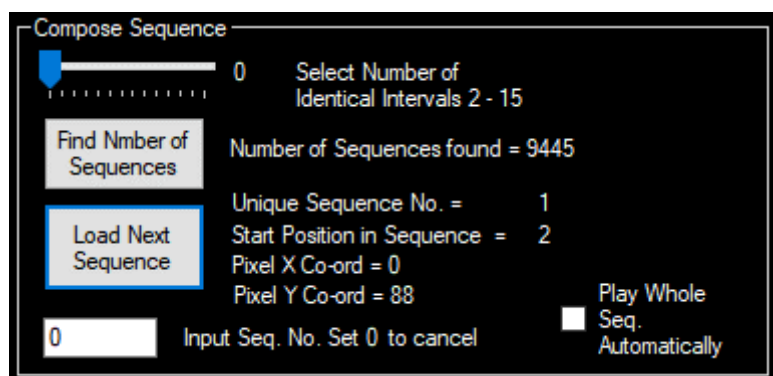
3. Now enter the Rhythm manually by checking both boxes - Tap Space bar to input Rhythm + Play Sequencer Note. You will hear the notes played as you tap the space bar. Enter 0s' in any unused time on boxes.

16 Note Sequencer		
MIDI Note	Time On	Time Off
67	1	0.1
69	1	0.1
65	1	0.1
53	1	0.1
60	2	0.1
65	1	0.1

4. You have now stored the rhythm and melody. Click on the Fractal Sequencer tab. 'Use Manual Rhythm' radio button will be set as default for you already.
5. Click on the Draw Button menu button at the top of the screen. Click 'Draw'. The Mandelbrot set will appear after a short time - a second or two depending on your PC specification.
6. Click on the 'Analysis' menu button at the top of the screen. Then select 'Musical Sequence Analysis' from the menu bar. Check the 'Allow Note Sequence Variance' box. Set the 'Number of iterations slider' to 100. Click Preview.



7. After a minute or two a 256 pixel square Image will appear. This is the image representing how the software has matched your melody with ones 'hidden' in the Fractal set.
8. Now select from the menu at the top of the Main Form - Analysis - Compose Sequence. Here you can decide on how many matching intervals you will accept. Select a number with the up/down arrows. Say 4. Click 'Find Number of Sequences Found'. Then Check 'Play Whole Sequence Automatically' and finally press - Load Next Sequence. You First melody variation will play on your instrument.



1.

If you don't like it press Load Next Sequence again for another version etc. You can also explore larger or smaller identical intervals.

TUTORIAL 2 - TIPS FOR COMPOSING

Once you have found a sequence you like you can use many of the features in the composer section to refine it:

1. Listen carefully as it's all about music!
2. Use 'Accept Note Sequence Variance' check box if you cannot find a perfect match for your sequence
3. Check note distribution in the Graph tab and midi note list in the arranger tab.
4. In the Random Composer engine force the note range - say 2 octaves by specifying min and max midi note numbers, timing range and your choice of chord types.
5. Manual input of tempo is normally the best way of giving the sequence its rhythm.
6. On the Fractal Sequencer form. Check ' Force Notes to Scale Keyboard'
7. On the Scales tab - click ' Force to Scales' checkbox and select a suitable scale. For orchestral music you might want to use predominately minor scales. For Rock music it may be a mixture of major and minor. For traditional or folk music you will probably use major scales. For jazz probably pentatonic scales etc. You can input your own by checking the Scale Keyboard check boxes.
8. Use chords when playing a sequence. Use the slider to permit Random Chord shells.

Once the sequence is created then:-

9. Use a separate recording package to manipulate the composition further and record them.
10. Pick suitable instruments and multi-track different sequences.
11. The more you experiment the more you will discover!

TUTORIAL 3 -UPGRADING FROM VERSION 3 OR EARLIER

Version 4 has been totally rewritten in Microsoft Visual Studio 2022.

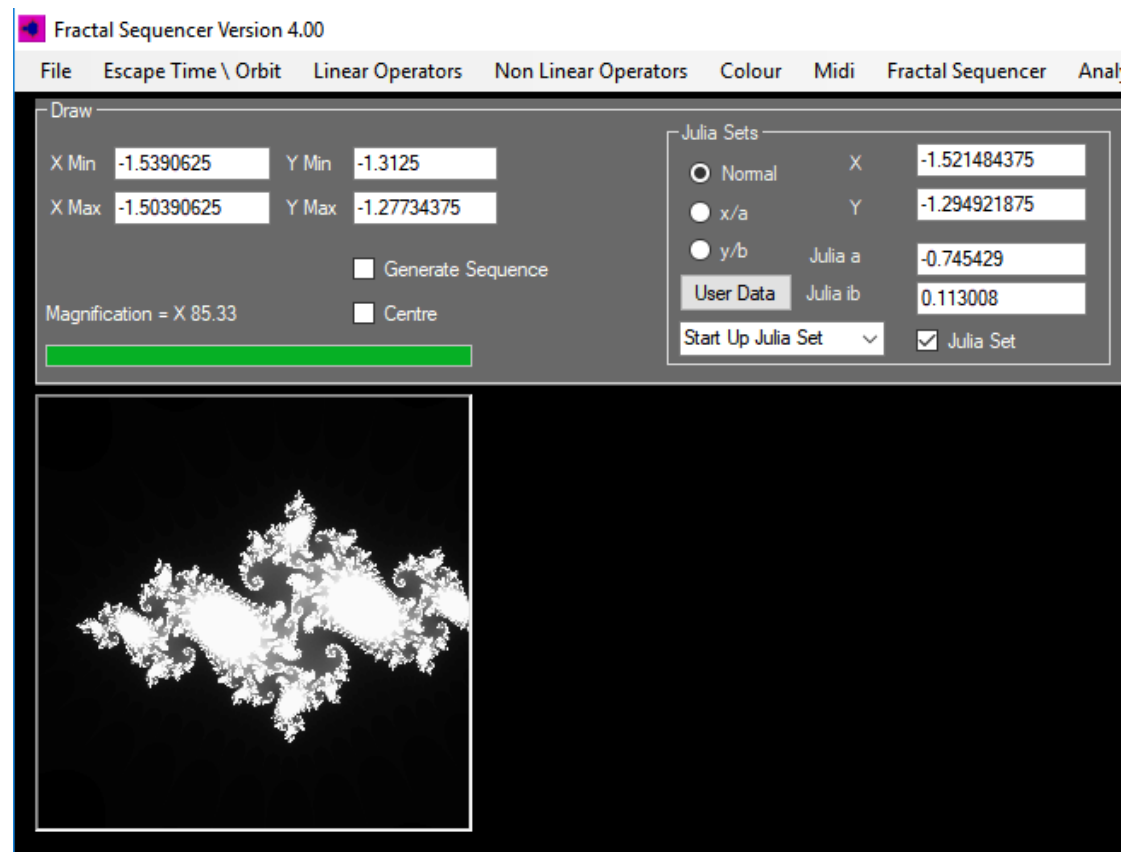
The differences to earlier versions are:-

1. The software and installer are fully compatible with Windows 10. It is installed using a msi installer. There is also a setup.exe file to check the .net framework on the pc is up to date and the installation is properly managed.
2. It runs much faster
3. It is more stable
4. Most features have been included in version 4.xx. A few like random and fractal note timings have been dropped as manually input rhythm produces better results. Note timings are set by user programming.
5. Three virtual synths Blue, Violet and SH1000 and a MIDI recorder/MIDI file player/arpeggiator are included.
6. The layout is more logical especially the sequencer engine.
7. The code is more optimised.
8. You can run multiple instances of the program.
9. You can record midi notes and timings from MIDI in using you midi instrument
10. There is a checkbox on the MIDI form to turn on/off the pass through of Sysex midi data.
11. You can change the General MIDI instrument on the MIDI form.

TUTORIAL 4 - DRAWING FRACTALS

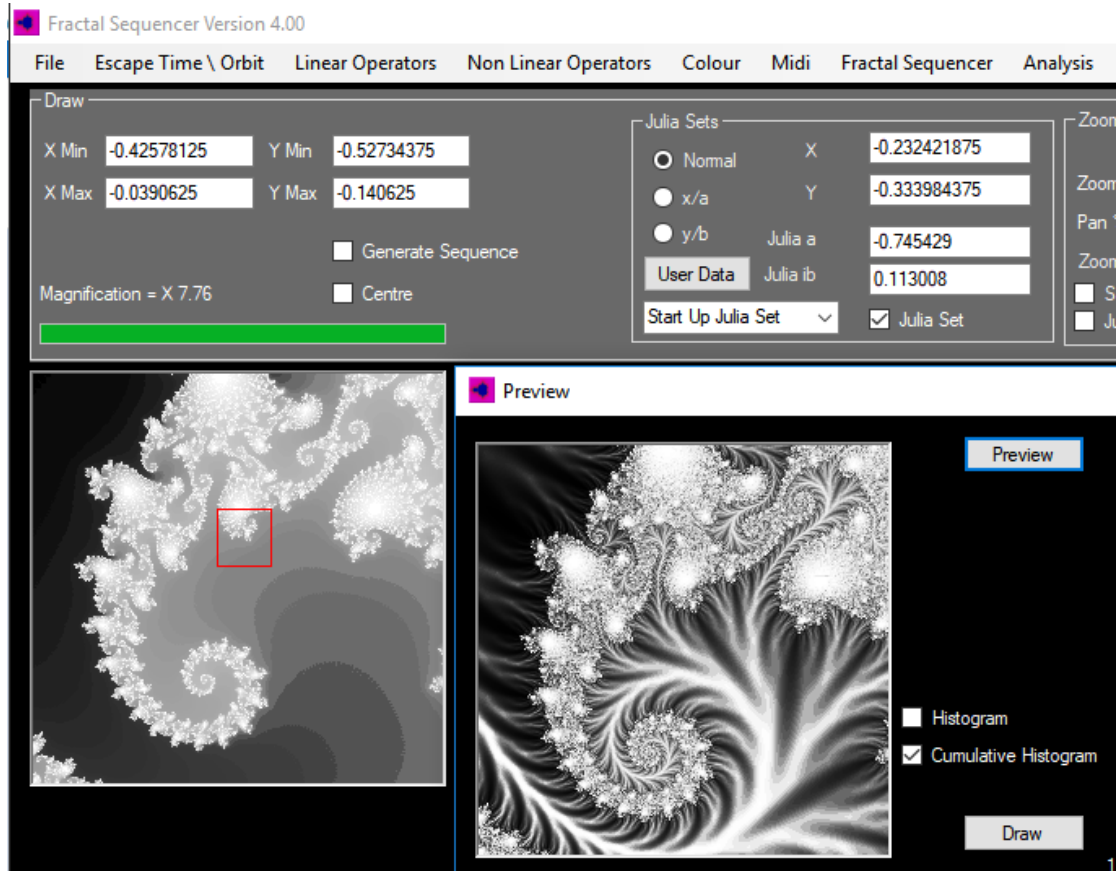
With a modern a PC it is easy to draw fractals. So here is how to do it!

- Open the software and click on the main form Fractal Sequencer \ settings menu item at the top of the main form.
- Select the fractal you want to draw - so for example check Julia set check box and select 'start up' fractal - and click the other 'Draw' button on the draw form - top right.
- The Julia set will be drawn in monochrome.
- Using your mouse left button draw a rectangle around a region of interest. See below.

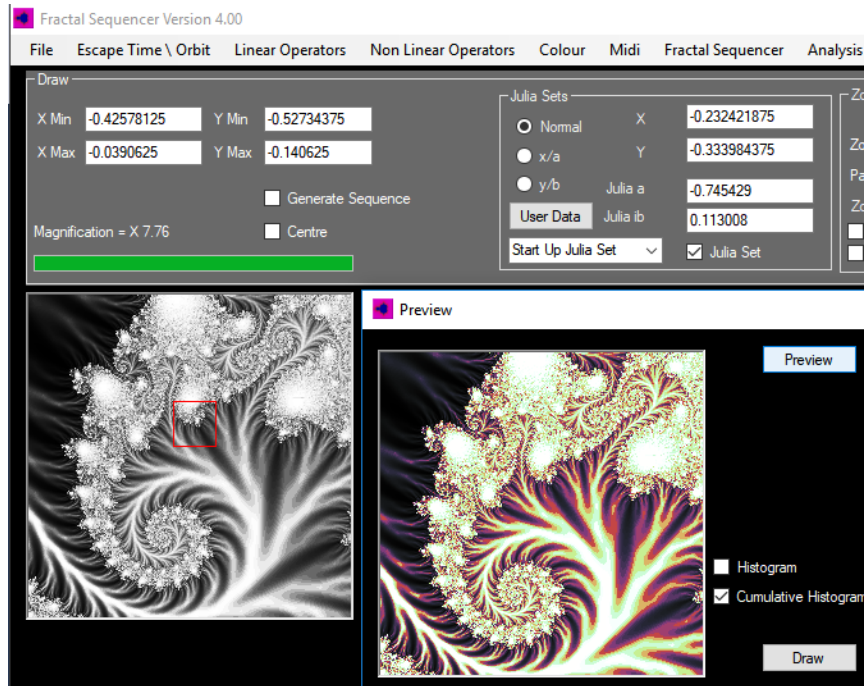


- Click 'Draw' (Preview form) This time it will take a little longer as the series in this area converges on average more slowly. Remember billion of calculations are required to generate this image.
- Zoom in again using the left mouse button to draw a rectangle. Now click TIA and Smoothing check boxes. Move iteration slider to 800 and bail out slider to 10^6 . Click 'Draw'

- You can see the result below. The main image is on the left and the Preview form shows TIA averaged image which has then been linearly equalised.



- Now choose an image processing option. Say add colour / HSL. Say HSL. Click Preview. See below and then if you are happy click 'Draw'. That's it. You can now File/Save the image or process it further.



The finished image 256 pixels square with a magnification of 13.2X. You can of course output the image up to 4000 pixels square by moving the Image Size slider. The processing will just take longer. $(4000/256)^2 = 244$ times longer.

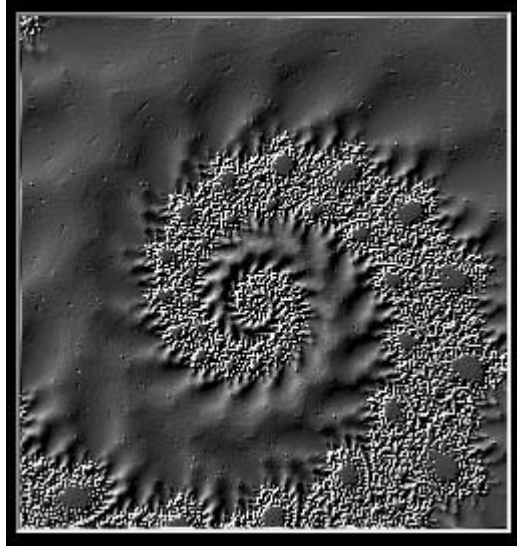
Let's assume we wanted to explore deeper and see what lies at the centre of the spiral. We need to uncheck enable HSL. This avoids repeating colourisation and affecting the contrast. Draw another box around the centre of the spiral with the left mouse button on the Draw form image. Now click Redraw on the Draw form, rather than OK on the Preview form. At magnification 315X we get the image below.



We can now zoom in further. Just draw another box with your mouse on the Draw form window around the centre of the spiral and click Redraw again. The magnified image at 3666X is shown below.



As might be expected the spiral continues - in fact to infinity! If you see any errant pixels or you need the image smoother, then slightly increase the bailout and iteration number slider values. To finish the image this time I have applied a Bas Relief filter. See below.



TUTORIAL 5 - DRAWING TIPS

The main differences between Draw and the Draw button in Preview are:-

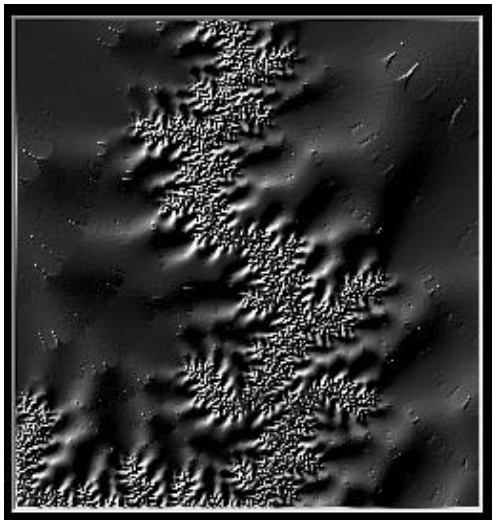
Draw - Main form

- Calculates image from scratch - slower
- You can use TIA and smooth iteration count.

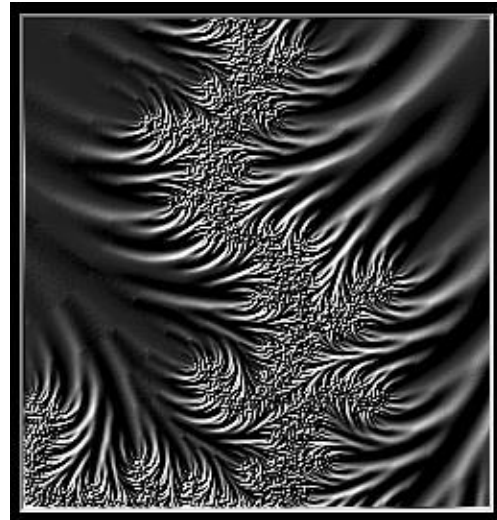
Draw - Preview

- Operates on previously stored image array from Draw (above). So its quicker

Sometimes when you draw an image you will get artefacts' produced by the iterations being cut too short. Just increase the bailout and iteration limit sliders to remove them. Of course the choice of what is better is yours. See the two images below of a dendrite Julia set. The left hand image has 'crater's and 'splash' marks. Same processing for both TIA, Smooth iteration count, linear equalisation and emboss filter except for bailout and iteration limit values which are higher in the right image.



bailout = 10^8 iteration limit 400

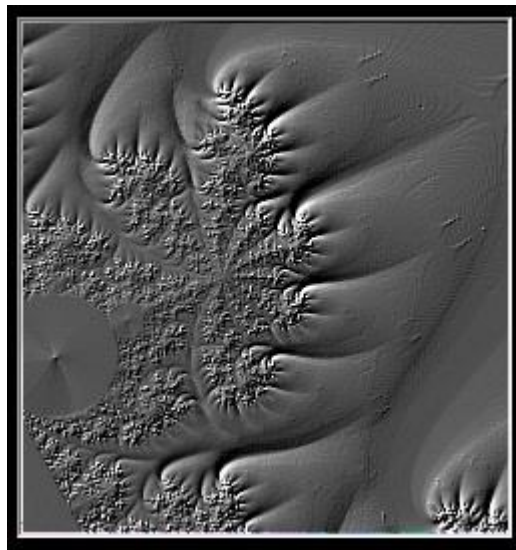


bailout = 10^{20} iteration limit 800

Composition

The principals of photography apply.

- Have a focal point - avoid too much distracting detail away from the focal point.
- Centre the most important detail or place it at the third points in the image
- If you can, lead the eye into the image
- Use colour sparingly. I prefer subtle colour although my favourite is monochrome.
- Use Preview to explore different processing options
- Correctly 'expose' the image - use histogram
- Create an image large enough for printing or viewing on a screen. I use 200 dpi for printing. So if you want an 8" (200mm) square image you need 8x200 pixels = 1600 square pixel image.
- Place a border around the image



The edge of the Mandelbrot Set plateau. Stripe average freq 1, smooth iteration count and linear equalisation. Bas Relief filter. Magnification 42.6. 256 pixels square.

FINALLY

My website details are <http://stuartpryer.co.uk> - the web site contains updates from time to time so keep checking. It also has my e-mail address. Please contact me if you find bugs or have suggestions on how to improve the software.

REVISION HISTORY - VERSION NUMBERS

1.6 - First standalone version - Based upon the Korg Oasys Companion module. - June 2006.

1.7 - 20th February 2013.

- Added major module - Draw
- Bug fixes to save and load sequence.
- Enabled the saving of arrangements and re loading arrangements.
- Added print what is in text box to menu.
- Improved close program routine to include stopping sequence first.
- Changed code as some midi software/devices did not recognise 'all notes off midi message'. Added 'force notes off' checkbox.
- Improved 'Find Text' routine for comma and space separated data files.
- Changed background graphics for main form to a stunning depiction of the Mandelbrot Set.

1.71 - 25th February 2013

- Various bug fixes to co-ordinate system
- Improved layout of Draw Screen

1.80 - 25th April 2013

- Added facility to produce Julia set 'elevations'. That is the ability to take a vertical slice in the x/a or x/b planes.
- Fixed bug which prevented drawing the set accurately at the edge of the image. Spike to left of Mandelbrot set now properly shown.
- Provided individual invert RGB colour check boxes.
- Corrected start-up x/y coordinates.
- Added HD button for HD TV output.
- Added pan buttons and zoom buttons. Pan % and Zoom factor.
- Provided facility to save a sequence of frames automatically.

- Added update button for user to manually enter x,y,a,b parameters.
- Provided convergent series colour selection option.
- Added facility to see crosshairs to show exact centre of image.
- Added Preview form for fast evaluation of image processing adjustments.
- Added RGB and HSL Colourise, Convolution kernels, Orbit mapping, Escape Time mapping, Topographic operator and Rank Order operator.

Version 2.00 - 12th May 2013

- Improved escape time and orbit vector mapping. Added cyclic colour feature.
- Added Musical Sequence Analysis - added this major module
- Musical sequence analysis - Numbers in key now update with smooth slider. Smooth slider range increased to 10.
- Compose feature added to continue composition from user input sequence.
- Added ability to tap in tempo using space bar and also hear notes whilst tapping.
- Increased range of virtual keyboard to 2 octaves.

Version 2.10 - 7th June 2013

- Added Swap Sets - so you can swap between the associated Julia Set for a point on the Mandelbrot Set and vice versa. A great way to explore Julia Sets!
- Fixed a bug which resulted in occasional hanging notes when chords played back in a sequence.
- Various small bug fixes.
- Improved midi out routine to lessen load on midi output devices. Useful for very fast passages.
- Improved Random Composer random seed algorithm and added ability to record random sequence. See Random Composer section.
- When using manual rhythm - you can see the progress of the sequencer as the 'note on times' on the Random Composer tab are coloured grey in a marquee fashion as they are applied.

Version 2.20 - 24th October 2013

- Fixed bug which stopped sequence data being saved and opened.
- Renamed Number of Unique notes to Number of Different Notes in Preview - Musical Sequence Analysis to correct syntax
- Fixed bug when new sequence selected on Draw window - old sequence now stopped. New sequence Started
- Fixed bug in Preview - different notes/repeated notes/max repeated notes so correct values reported.
- Improved background image algorithm - musical sequence analysis to make effect clearer.
- Fixed occasional 'division by zero' bug after 'draw' button on draw form pressed

Version 3.0 - 10th November 2013

- Note. Users must install the latest demo version from my website first to get the latest runtime files.!
- Added Midi In - User can use software for midi through or record a sequence from an external midi controller/ keyboard /device/midi player with a monophonic track.
- Provided midi File (type 0 and 1) Player , Editor and Recorder
- Provided Blue Synth version 2.0 as an audio source for the Fractal Sequencer. Note. this is if you have not got any virtual synths handy or don't want to load up a DAW.
- Added +1/-1 semitone buttons to easily change scale - composer/scale keyboard tab
- Improved logic when switching between single note, fixed chords and random chords. Virtual keyboard chord /fractal sequencer replay chord check boxes.
- Bug fix. Image array did not update for further image processing after 'OK' clicked.
- Triangular Inequality Average, Stripe Average and Curvature Average with Smooth iteration Count
- Added Bailout value slider
- Increased range of colour - brightness sliders +/- 255
- Added pixel brightness Histogram and Transfer functions
- Added linear equalisation
- Added Cumulative histogram.
- Increased range of contrast sliders 0.1 to 10. Previously 1 to 10.
- Open previously saved Images - bitmaps
- Added horizontal and vertical scroll bars to move around large images in draw form.
- Added correction of non square pixels
- Added Zoom window on Draw form.

VERSION 4.00 - 2018

2018. Software completely rewritten in the latest version of Visual Studio 2017

VERSION 4.10 - 2019

- Facility to record a 16 note sequence from midi in. So you can use a MIDI instrument to record notes and note timings.
- Ability to invert RGB colour channels in Preview
- Added MIDI program and Bank change facility on MIDI form.
- Added 'Hold Note' check box to MIDI form so that adjustments can be made to MIDI instrument sounds without having to manually hold a key down.
- Fixed double midi note off when keyboard on SH1000, Violet and Blue synths are used to send midi out.
- Improved cut-off, resonance and track filters on SH1000 ver 2.1, Violet Synth ver 1.5 and Blue Synth ver 2.1
- Added individual detuning to oscillators for SH 1000 ver 2.1
- Added Chord Arpeggio slider to stop all chord notes being sent at once. Also enables individual notes being added to the chord at higher values.
- Added Red Synth - Virtual Subtractive synth
- Added Yellow Synth - Virtual additive synth

VERSION 4.2 - February 2021

- Built using the latest version of Visual Studio 2019
- Updated documentation
- Improved Topographic Lighting operator and fixed bugs.
- Fixed bug in note Evolution Graph playback
- Find Next Sequence - a black circle is now drawn around the point of interest.
- Improved Centre display and Show/hide graphics boxes drawn by the user.
- Fixed bug in 'Find Next Sequence' after user specifies going to a user specified sequence number.
- Progress bar on main form now shows calculation progress for Find Sequence which can take several minutes, so keeps the user informed.
- Fixed bug with contrast sliders on sequence analysis form

- Iteration limit now controls number of notes sampled for find repeated notes and sequence.
- Added 88 note keyboard - under Midi menu
- Added Clear and Copy buttons to the sequencer note list box.
- Added tooltips to Main Form and Sequencer form

VERSION 4.3.0 - July 2022

- Updated installer and compiled in Visual Studio 2022
- Software now requires .net framework 4.8.0 - windows update will install it.
- Updated documentation
- Swapped left and right arrows for zoom section as they both operated in reverse. Now consistent with up/down.
- Corrected initial Bailout value text to 10^6 . (1000000)
- On Midi Settings form - changed text to show conventional midi channels used by hardware instruments and music software. Text is under Midi slider and now shows midi channels 1 to 16 (was 0 to 15).
- Settings when saved now save x/a and y/b state
- Fixed crash when loading images larger than picture box size.
- Various bug fixes
- Improved Histogram display so all pixels are sampled. Also pixels at brightness of 255 are shown correctly.
- Increased range of Luminance slider for HSL.
- Improved topographic operator.
- Improved cumulative histogram to sample the average of the three colour channels - RGB.
- Added local Colourise menu item under RGB\HSL colourise.
- Added auto scroll bars on main form for large images
- Ability to load images in colour for colourise option if colourise form is open.
- Added a Zoom menu item so you can inspect the main image in more detail at 2X, 4X and 8X with or without bicubic interpolation.
- Added the ability to merge images and colour merge.
- Improved routines for Escape Time and Orbit Vector analysis.
- Added ability to create different sets from the normal Mandelbrot and Julia sets.
- Added Dodge and Burn to Colorise form.
- Added the 'Burning Ship' Set option

4.3.2 Improved topographic lighting routines

4.3.3 December 2023 - Corrected bug in sequence analysis and Topographic lighting routines.

- 1.3.4 28 December 2023 - Fractal Sequencer form now shows what note is being played on scale keyboard. Improved note generation routine. Corrected bug in midi out short messages such as change bank and program and playing very low note numbers from virtual keyboard. Various minor bug fixes.
- 1.3.5 3rd January 2024 - Updated bounds for musical sequence note generation values to 10^{115} before constraining to midi notes 0 to 127.

CUSTOMER COMMENTS

UNTAMED Spirit

"I'm really enjoying exploring this app. Just scratching the surface right now. Looking forward to whatever is in the works for it, but it already is very usable. Great work Stuart! I hope enough people get on board to make it worthwhile for you, it really is worth it."

FABIAN

"Fractal Sequencer is a Windows application that uses fractal images or calculations to generate MIDI note sequences. It is possible to end up with endless variations of themes. You can let it play the General MIDI synth of your sound card or use virtual MIDI cables to connect it to your favorite VSTi and DAW.

Features are added regularly, users' feature requests are taken into consideration. The program can be used to create beautiful fractal images as well as melodies for which there are a good number of user-selectable scales if you want to confine the musical notes to a certain scale.

The musical output (and to a degree the images) that make this software what it is - a nice inspirational tool for melodies and riffs you might not have thought of yourself.

But not only that, you can have it do variations of melodies that you did in fact come up with yourself. The user manual is updated regularly, also at the request of users, which is a big plus in my book.

If I have to nitpick then I have to say that I miss the ability to create multiple melodies at once on different MIDI channels. So far it only outputs one MIDI channel, but multiple instances of the program can be run to circumvent this. And a VST version would have been nice, but virtual MIDI cables, as mentioned above, work just fine.

In the end at its price point you can't really go wrong if you are into non-conventional ways or conventional ways of creating MIDI melodies."

SO THAT'S IT?

If there are features you would like to add, let me know and if it is possible I will add them. Feedback and a wish list for additional functions are always welcome, together with suggestions for improving the documentation!

Have Fun ☺ !!!!

Stuart

Copyright 2013 - 2021

[Return to Index](#)

LINKS TO SOME OTHER SITES

1. For updates and a free virtual synth, Roland RD2000 editor and midi file player/ arpeggiator visit my site
2. Wikipedia for a great introduction to Fractals.
3. For a great Midi utility try Midi Ox at <http://www.midiox.com/> this also has scripting facilities. For internal PC midi routing I recommend Midi Yoke or LoopBe1 <http://www.nerds.de> which is also excellent.
4. KVR Forum - a great place for electronic music information <http://www.kvraudio.com/>
5. Great sites for Korg updates etc. Korg UK - <http://www.korg.co.uk/> and Korg USA <http://www.korg.com/>. Korg Japan www.Korg.co.jp .
6. For Korg Forums goto - 'Irish Acts'. <http://www.irishacts.com/>
7. For DAW's - Windows: Cantabile a light DAW, Bitwig, Ableton and BandLab formerly Cakewalk.
8. For DAW's - Mac: Logic, Mainstage, Bitwig.
9. Roland UK, <http://www.Roland.co.uk>
10. For Roland forums visit Roland Clan

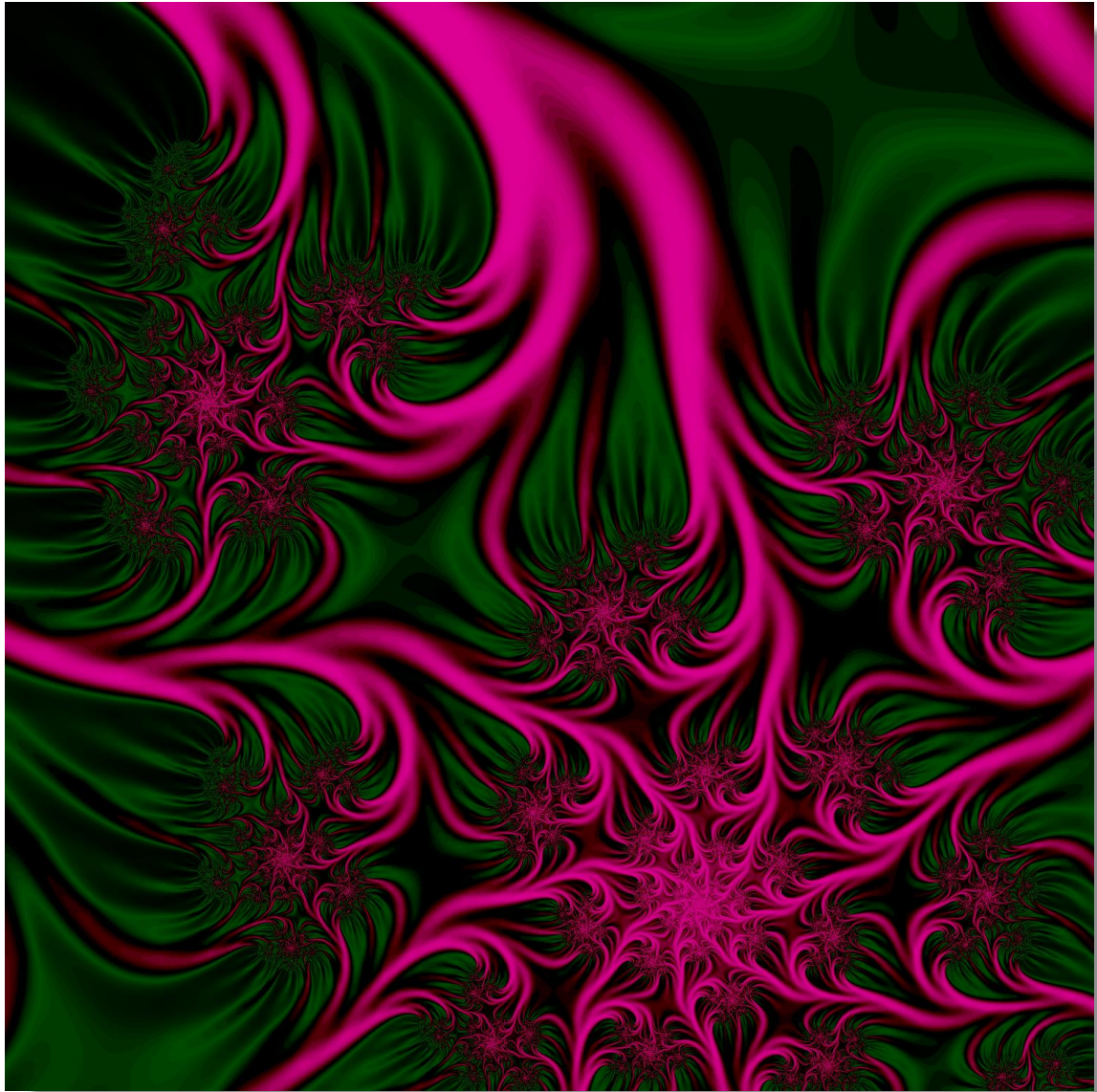
RECOMMENDED BOOKS

1. *Introducing Fractals - A Graphical Guide*. Nigel Lesmoir-Gordon, Will Rood & Ralph Edney. Gutenberg Press 2007 reprint.
2. *The Fractal Geometry of Nature* - Benoit B. Mandelbrot. W.H.Freeman 1983
3. *Fractal Geometry - Second Edition* - Kenneth Falconer. Wiley 2003
4. *Getting Acquainted with Fractals* - Gilbert Helmbert - Walter de Gruyter 2007

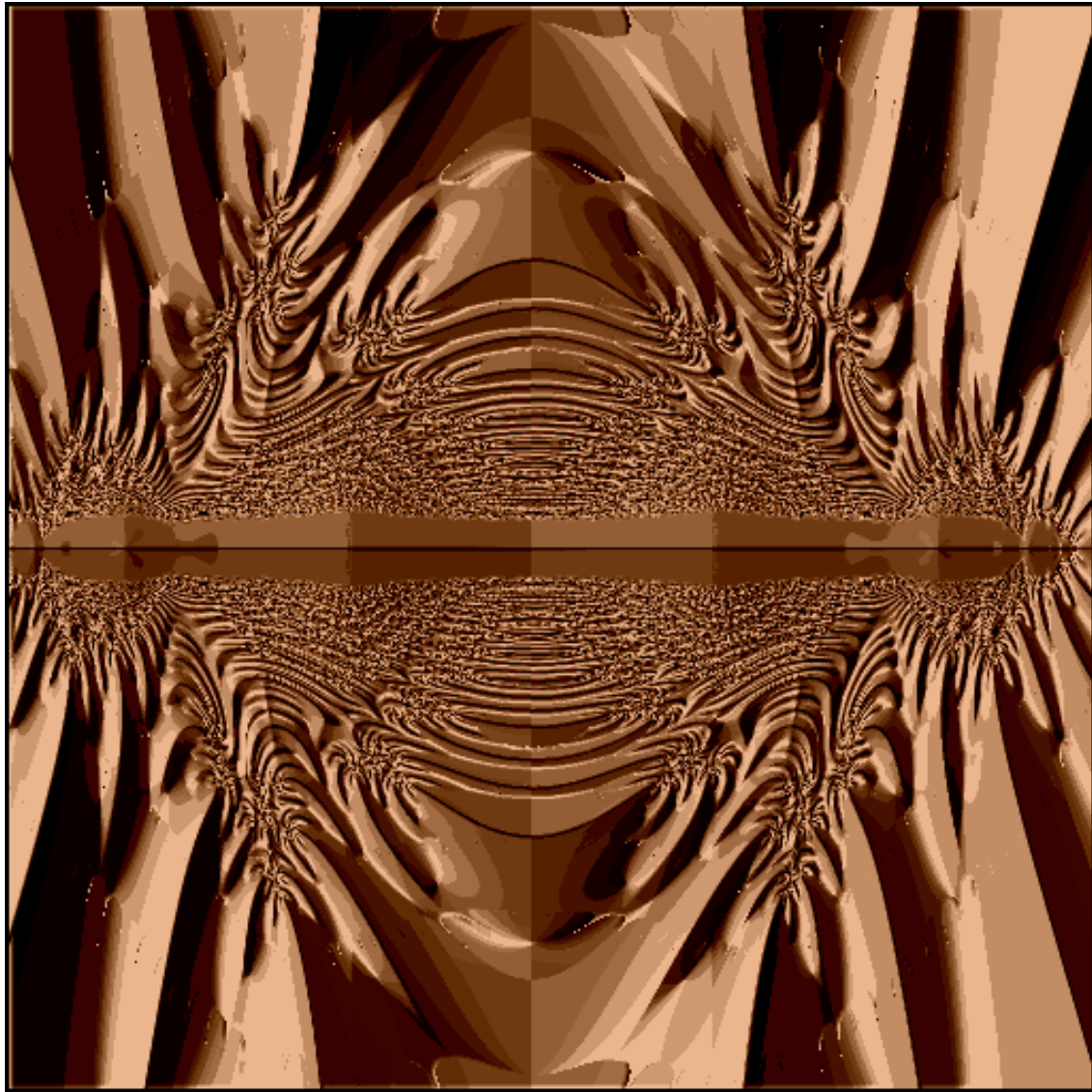
GALLERY

Here is a collection of some more images which will hopefully give you ideas and inspire you to make your own unique creations. They are produced at 512 pixels square.

Each image reminds me of something in our world. But the difference can sometimes be unsettling. Whether it be flowers, a coat of arms, a seascape, or a modern painting. A 19th century pen and ink drawing, blue and white porcelain, trees, a cluster of galaxies or standing on the beach at dusk or looking across the waves to a horizon in the infinite distance.

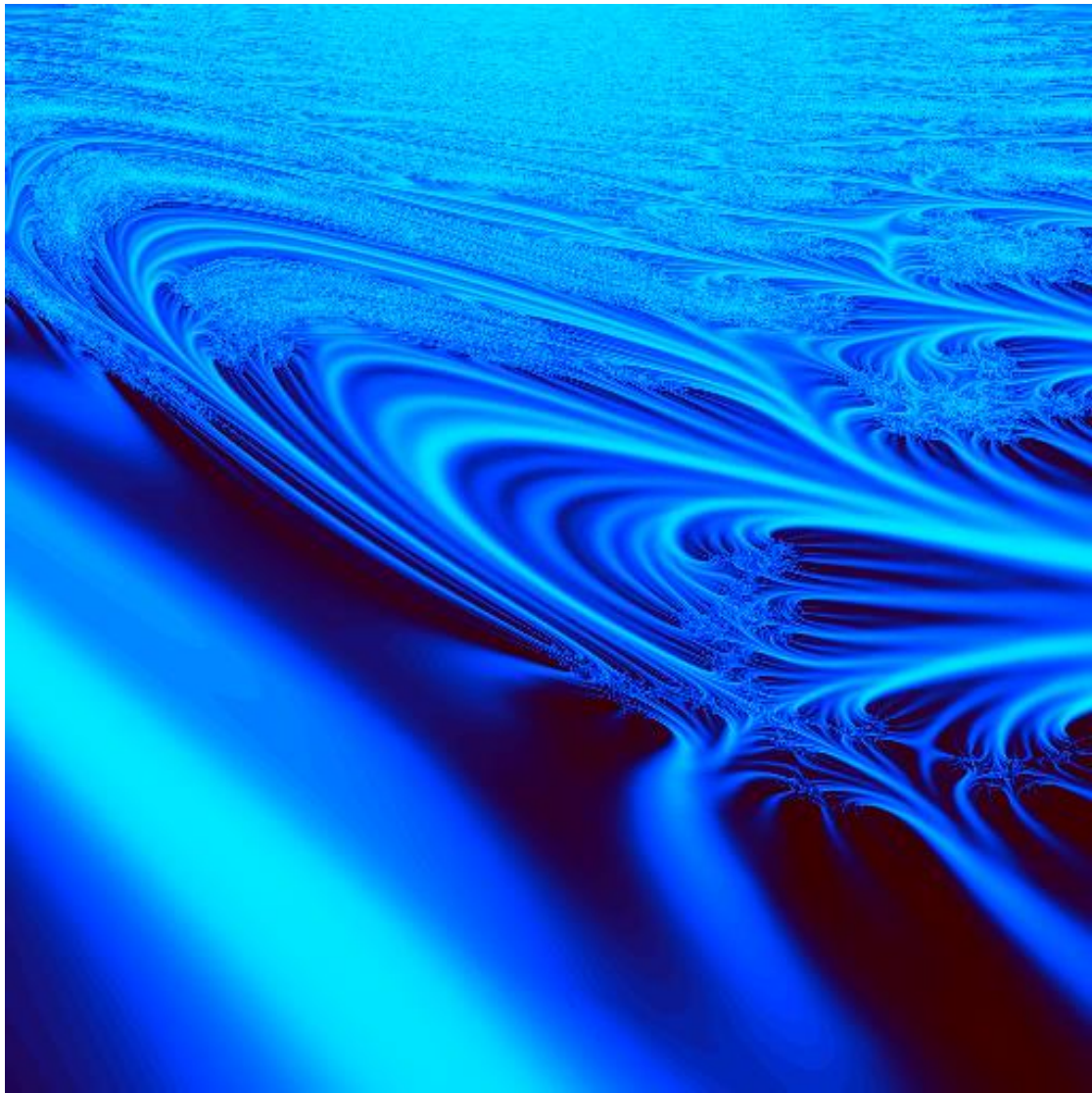


"STRANGE FLOWERS"

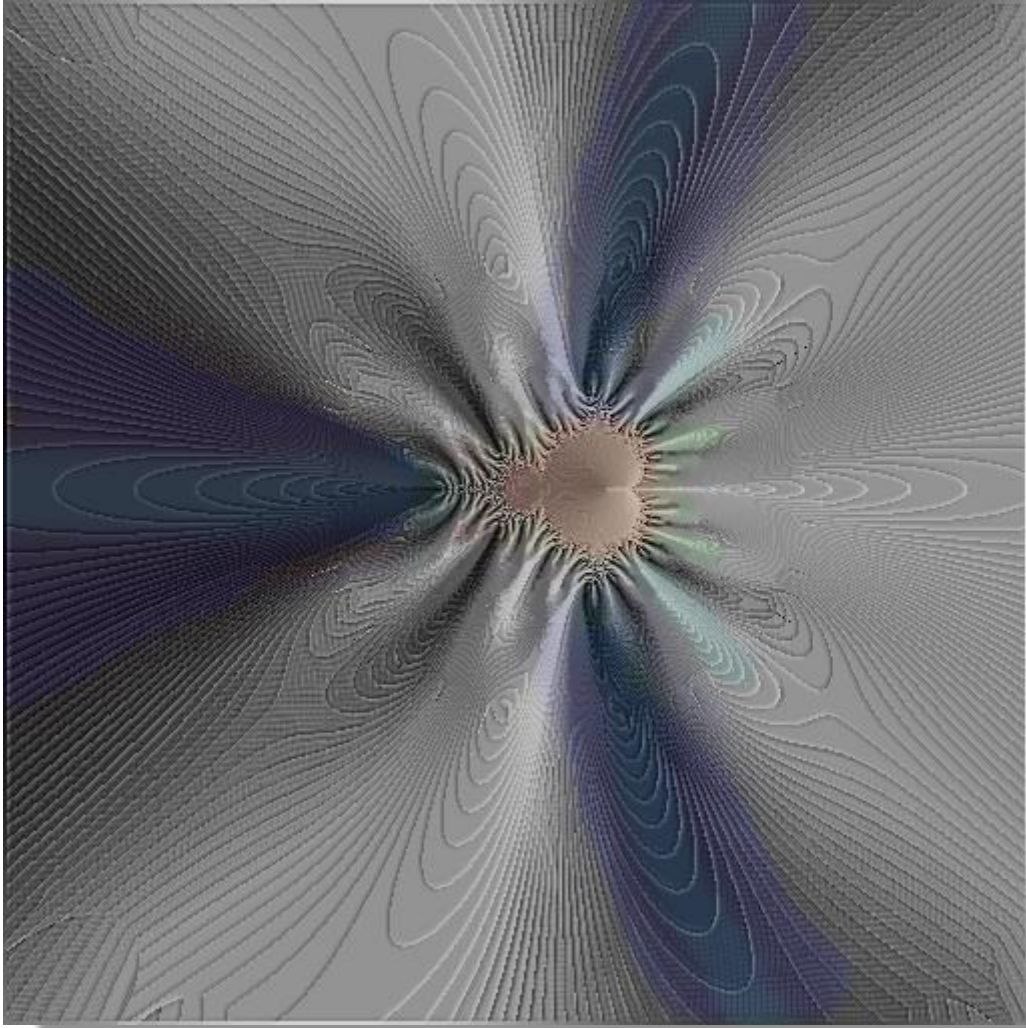


"THE SHIELD"

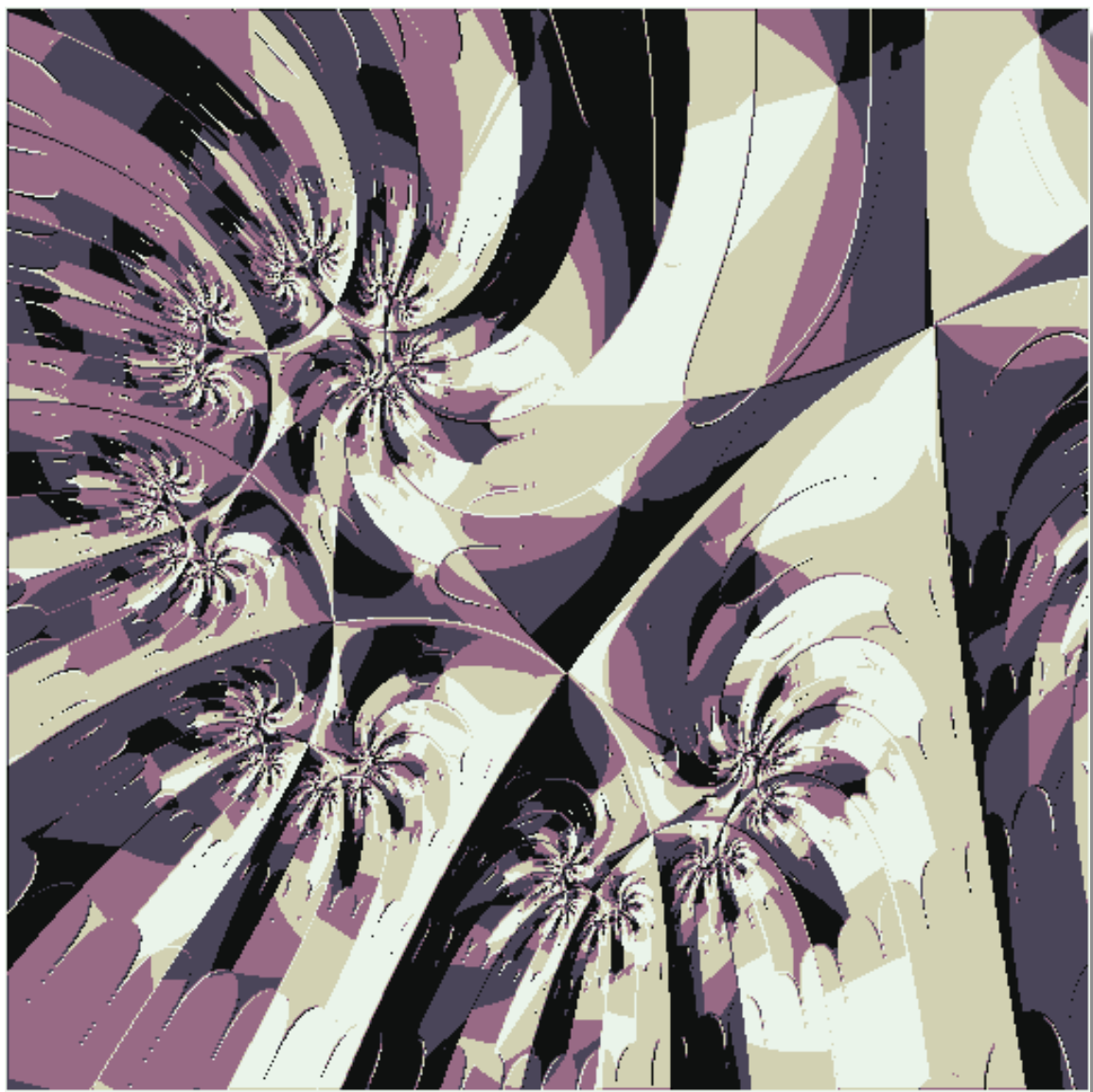
The Start Up Julia set in the y/b plan with Stripe TIA and Rank Order processing.



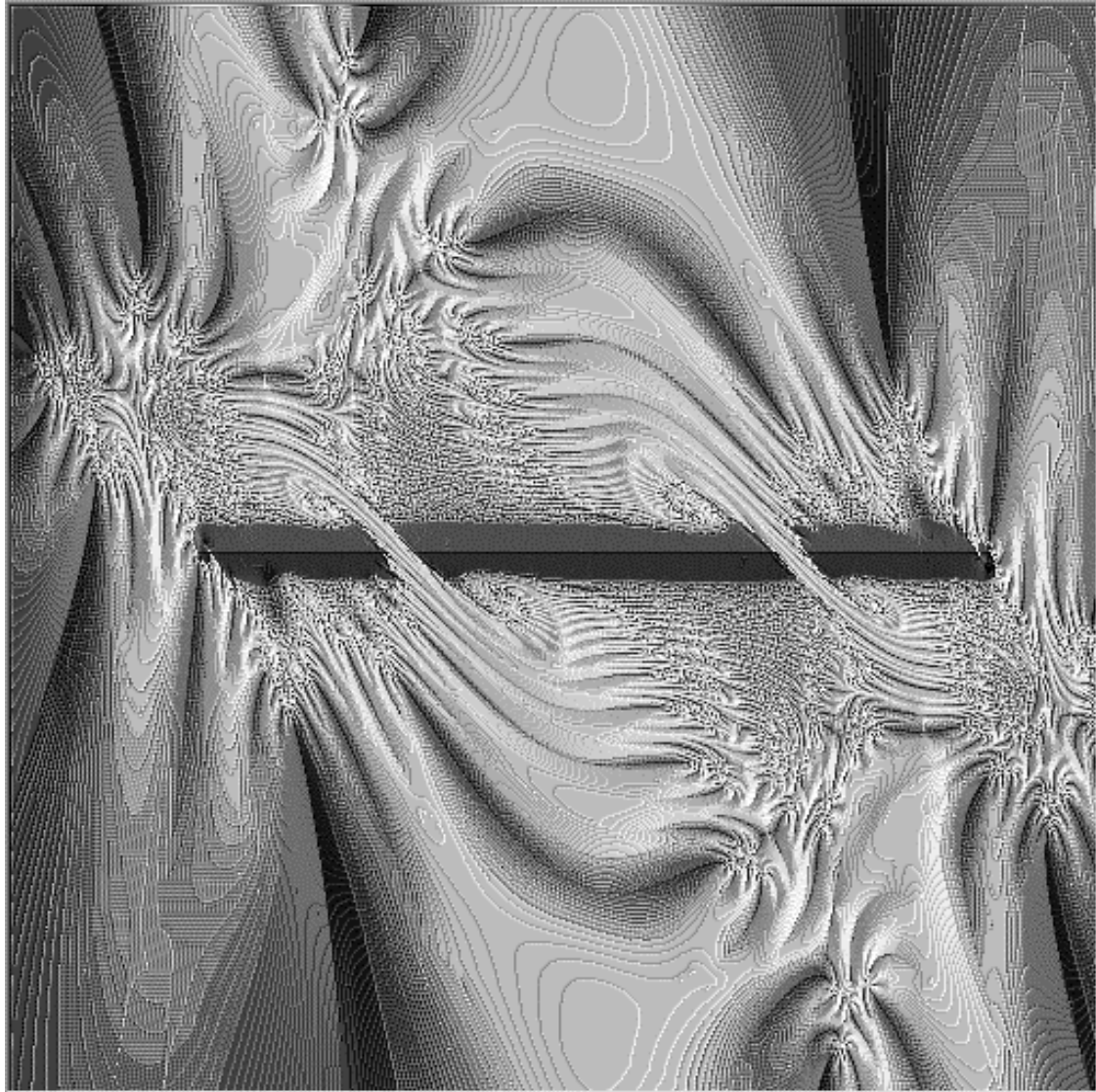
"A DIFFERENT SEA"



"THE DRAGONFLY"

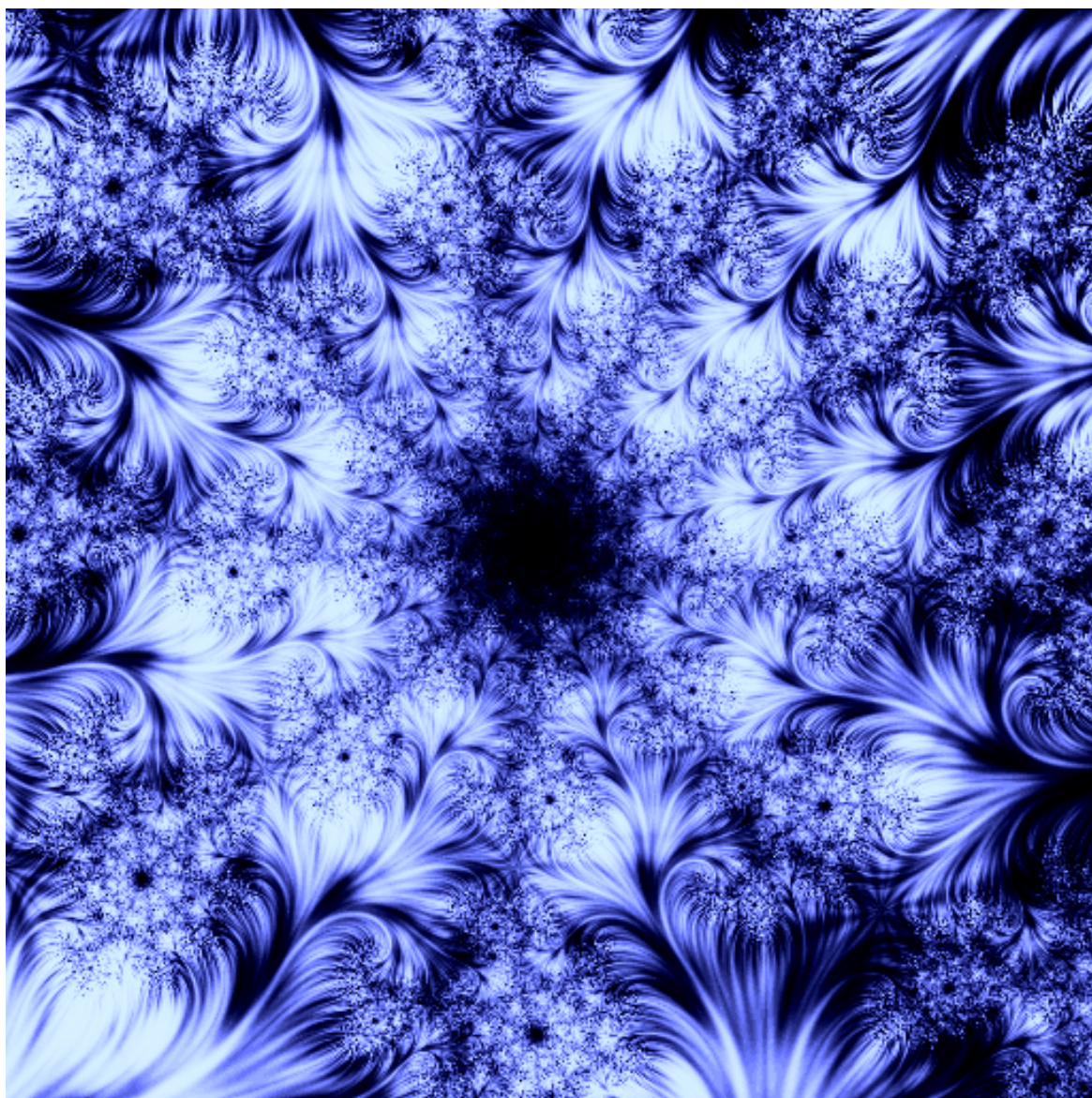


"POLLOCK"

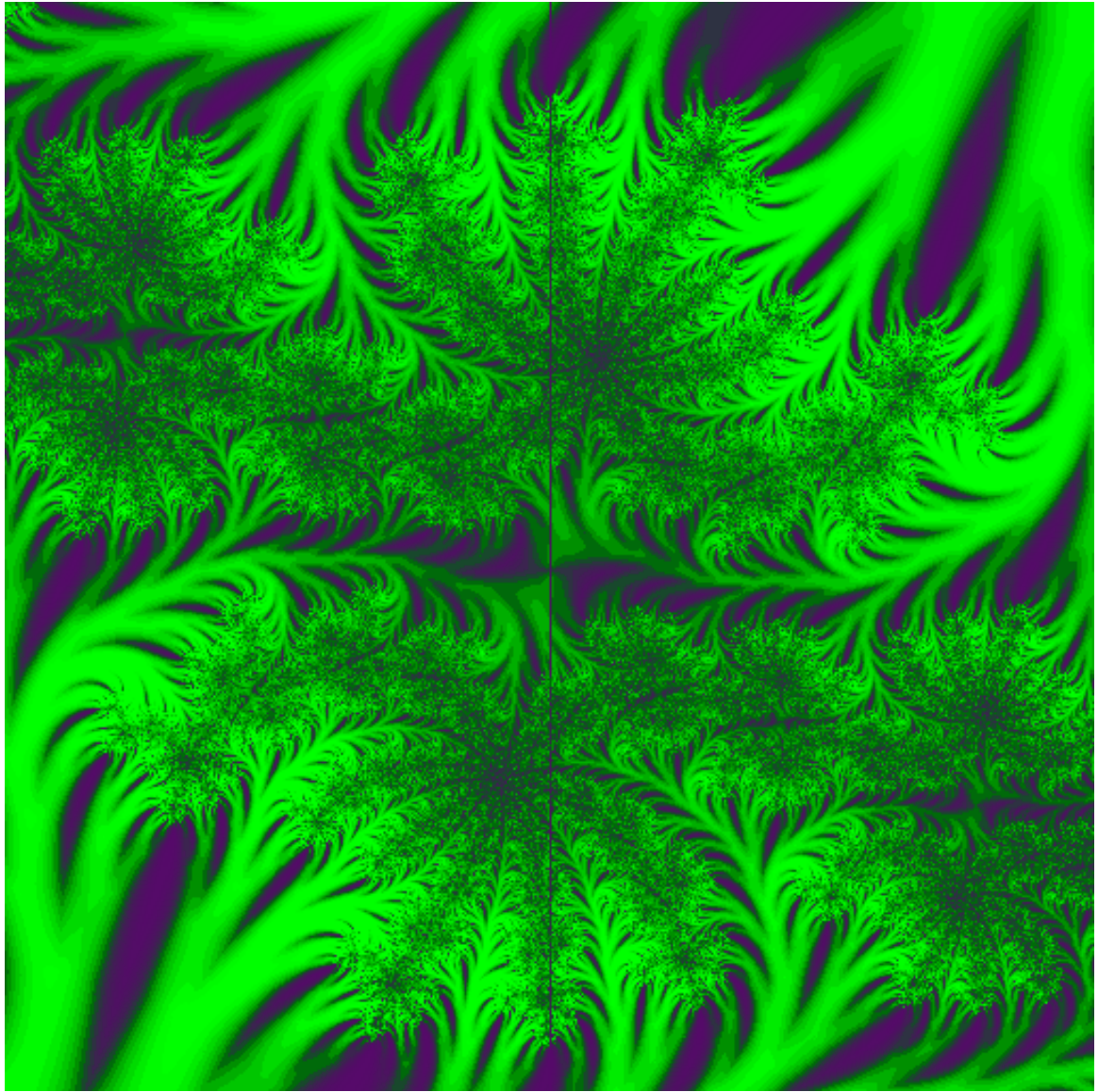


"THREAD"

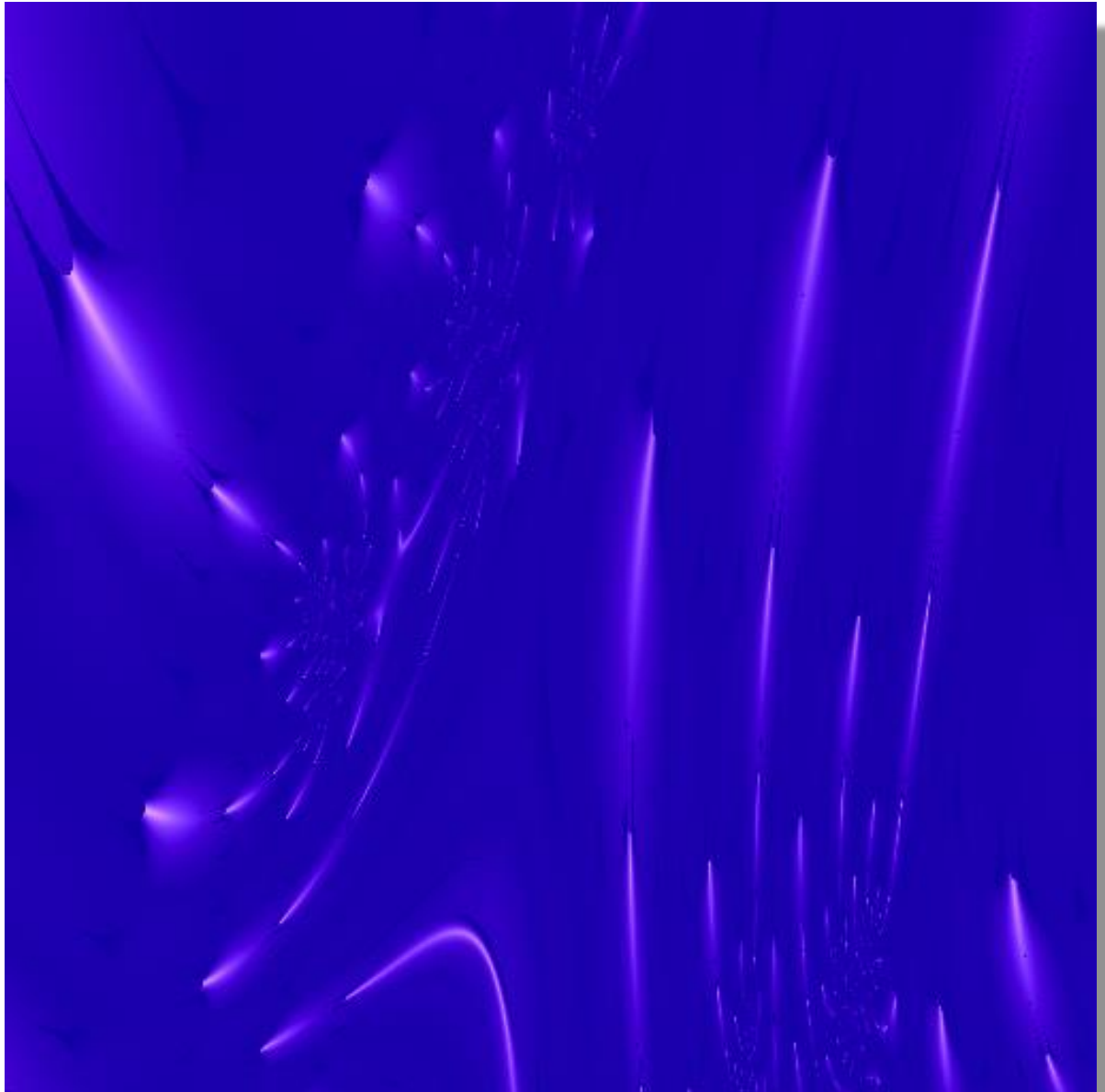
Part of the start-up Julia set in x/b plane, Stripe TIA with Rank Order Processing.



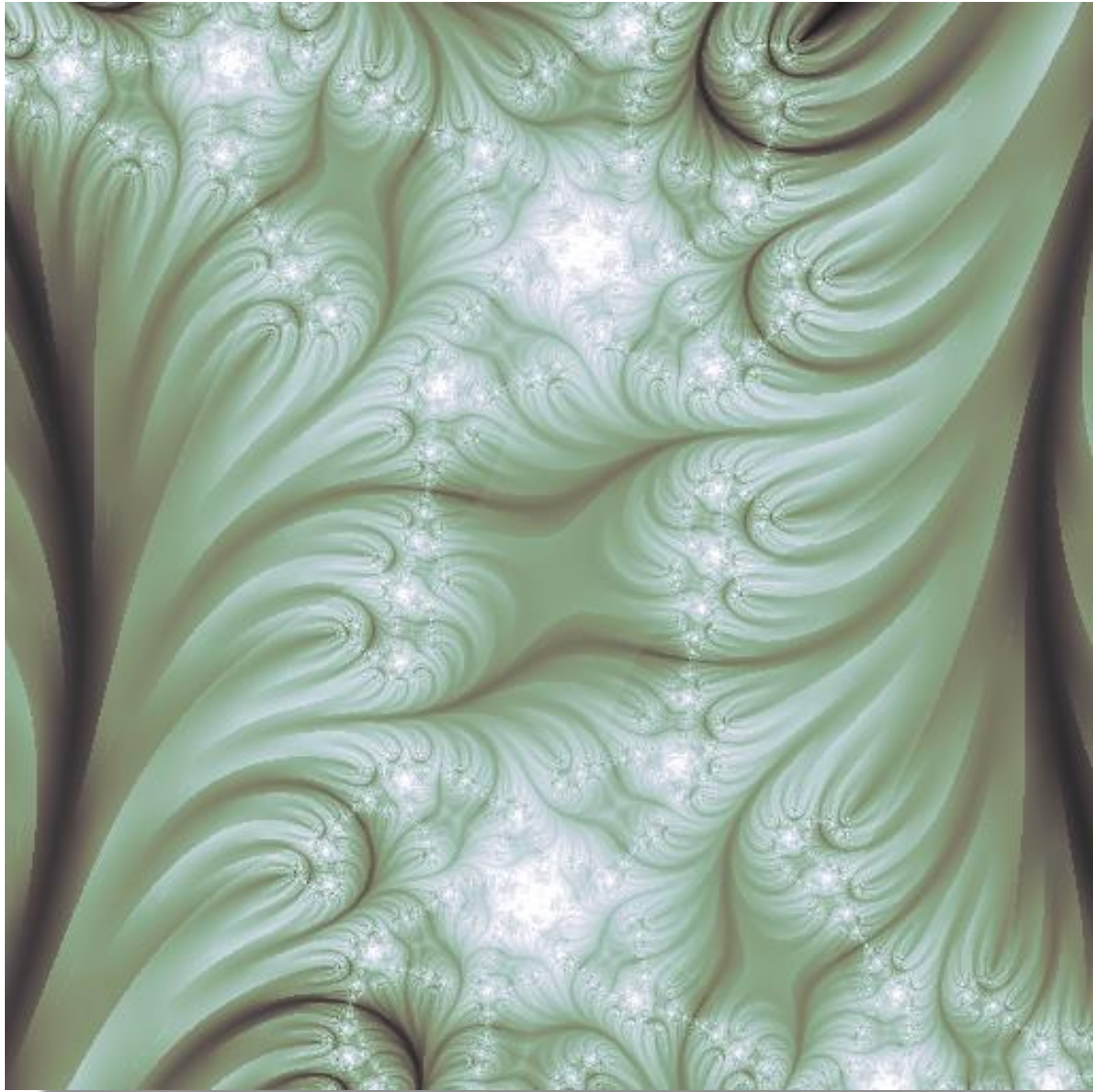
"PORCELAIN"



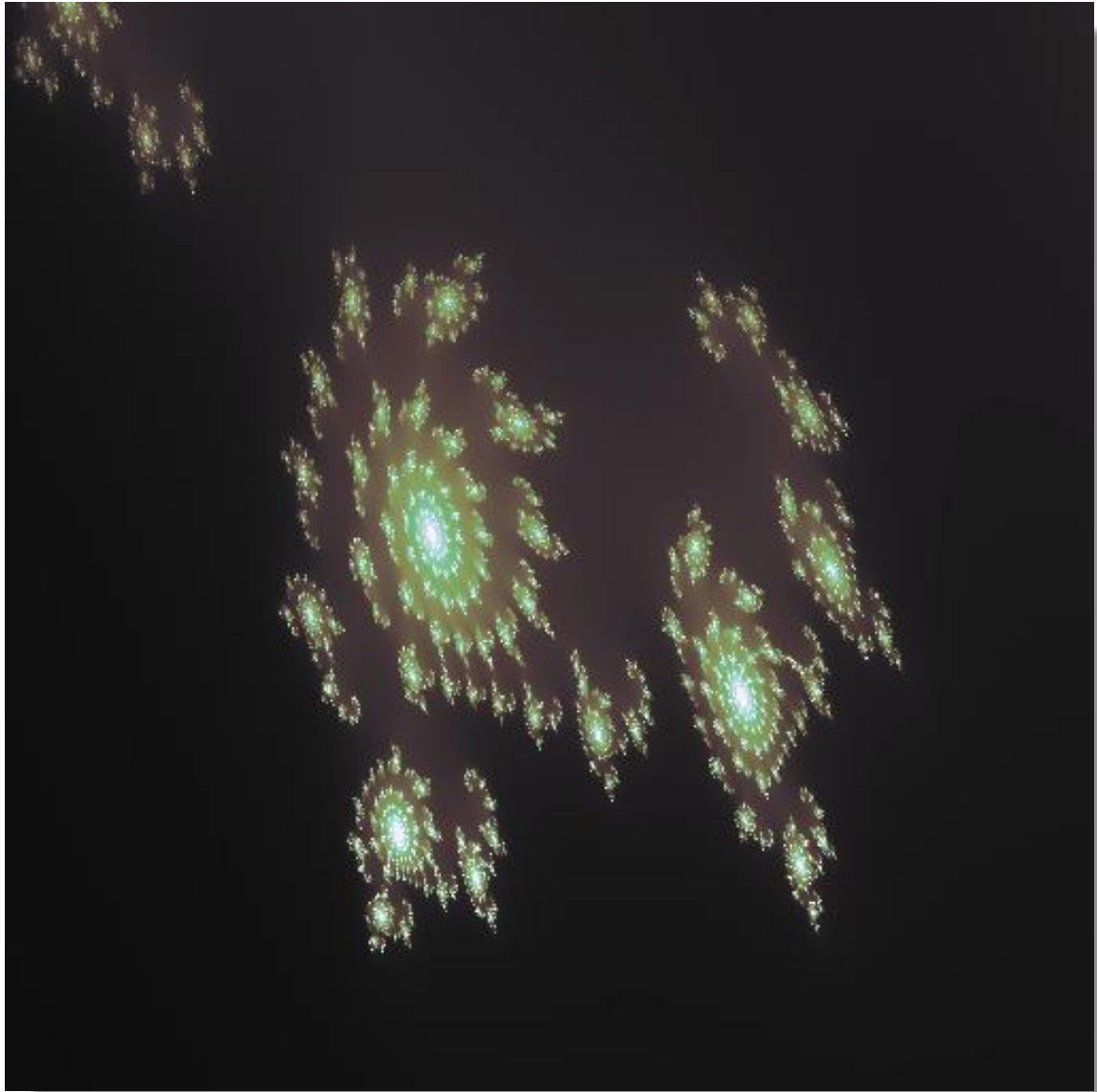
"THE TREES"



"SUBMARINERS"



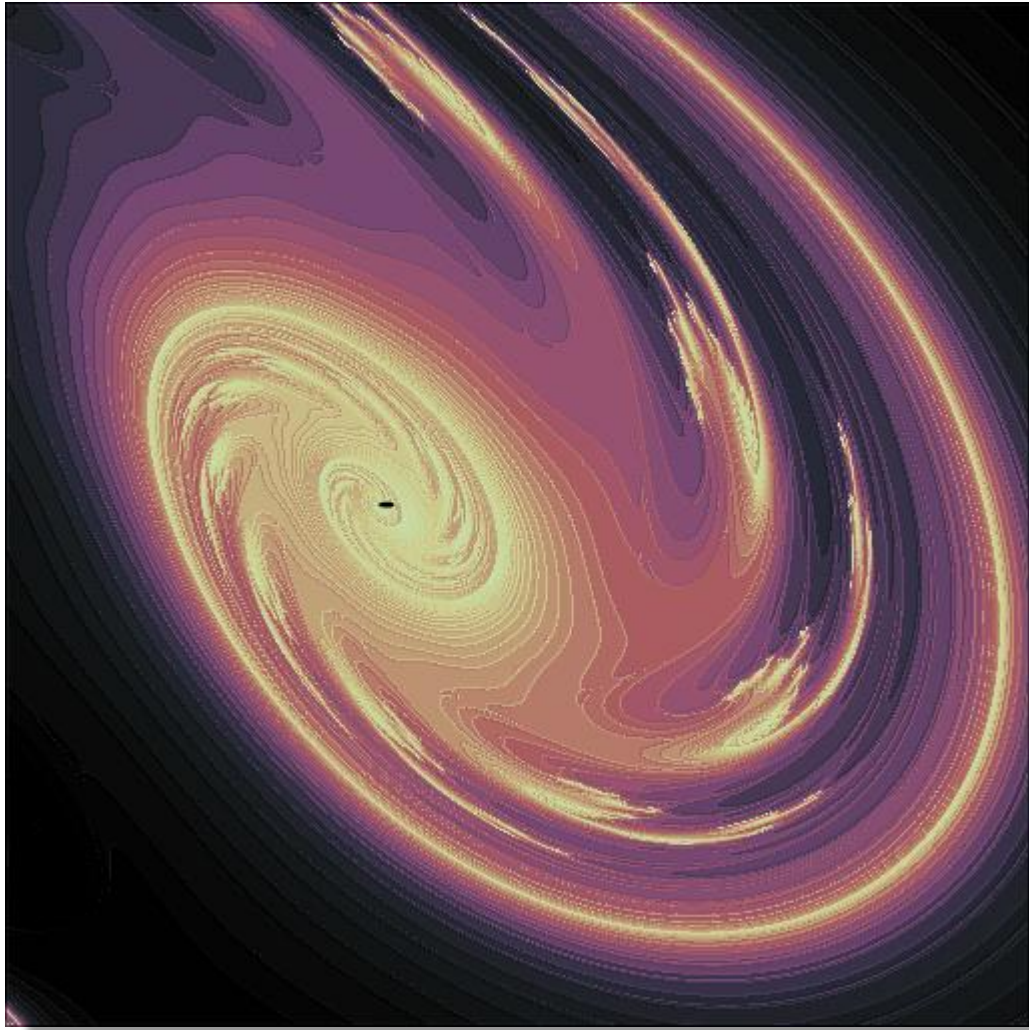
"THORACIC CAT SCAN"



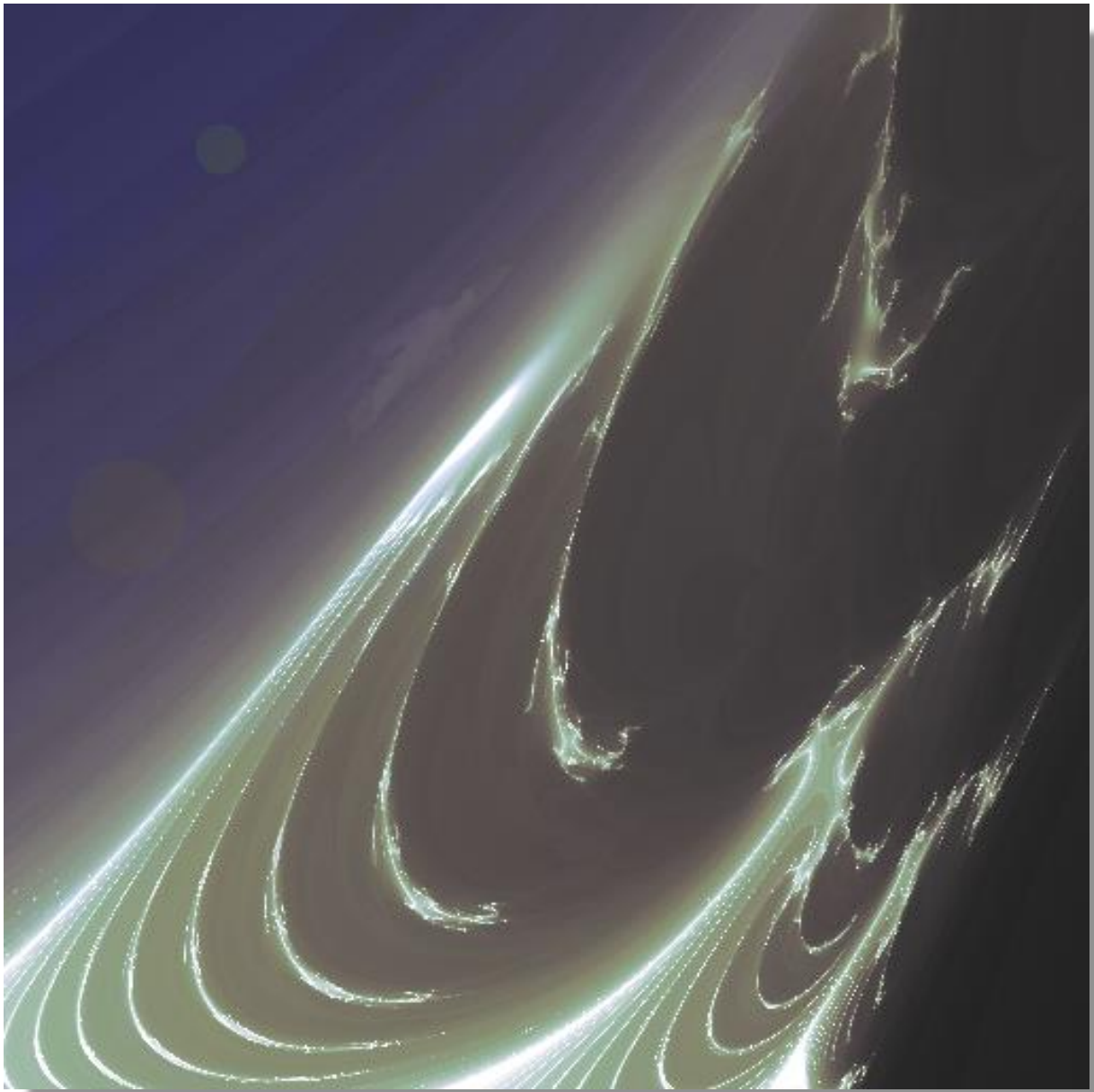
"GALAXIES"



"THE ENDLESS SEA"



"BLACKHOLE"



"FINAL DESCENT"

BACK COVER