

MisterM

Luc Railhac

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COLLABORATORS

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WRITTEN BY	Luc Railhac	August 15, 2024	

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Chapter 1

MisterM

1.1 MisterM

MisterM 3.1

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DISCLAIMER
INTRODUCTION
MAIN FEATURES
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QUICK TUTORIAL
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HOW TO QUIT MisterM
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1.2 MisterM : Disclaimer

DISCLAIMER

Please keep in mind that English is not my native language, so this doc should contain many mistakes. In order to improve it for the next release, I wait for your comments, corrections and suggestions. Thank you !

This software has passed numerous quality tests. Anyway, in no event will the author be liable for any physical, psychological or even virtual damage that can occur before (!), during or after the use of this program.

A long exposure to Mandelbrot Set Pictures can lead to various diseases like the Fractalization of Vision, the Dizziness of Infinite or the Madness of the

Furious Spiral. You have been warned !

1.3 MisterM : Introduction

INTRODUCTION

When you want to explore a vast territory, do you take your bike or a fast and comfortable vehicle ?

Well ... the Mandelbrot set is an immense territory and MisterM is not a bicycle !

Short (?) : "Fast Easy To Use AGA 3D Mandelbrot Set Exploration Program".

Note that there are numerous other programs of this type, different in many aspects, some of them of very good quality. I wrote MisterM because none of them suited my needs exactly (classic motivation...), but I want to thank their authors for their ideas which gave me a starting point in the conception of this software.

To start up quickly, see the QUICK TUTORIAL, but don't forget to read the REQUIRED CONFIGURATION chapter.

1.4 MisterM : Main features

MAIN FEATURES

- Online context sensitive help : more than 1600 lines of documentation can be accessed directly through the program.
 - 3 different rendering methods :
 - Level Set (LSM)
 - Continuous Potential (CPM)
 - 3D Continuous Potential (CPM 3D)
 - The 3D representation is fully parametrized (view angle, lighting model, linear and non-linear scales, smoothing, etc...). Fast rendering.
 - Generation of transition sequences between 2 random regions of the set (animation) for the 3 methods.
 - Fast computation : 68020+/68881+ asm routines optimized for large numbers of iterations associated with a plane cutting algorithm allowing the detection of constant regions.
 - Pictures quality : all computations are done in double precision; NO calculation trick that can alter the picture quality (computing 1 point out of 2, interpolation, ...) is used.
 - Z-Buffer : after a picture is computed, any of the graphic parameters can be modified and its effect visualised immediately (the complete recomputing
-

of the picture is avoided).

- Several color map functions.
- Supports any 3.0+ screen mode and any picture size starting with 64 x 64, whatever the mode chosen; automatic scrolling for pictures larger than screen.
- Full featured palette editor which adapts automatically to the size and type of screen used.
- Data saved with IFF pictures or separately.
- 2.0 style interface following the "Style Guide" and taking into account user preferences (fonts, locale, etc...).
- Main program written in C, compiled with SAS/C version 6.5.

1.5 MisterM : Required configuration

REQUIRED CONFIGURATION

- 68020 + 68881 + System 3.0 (V39).

Typically, this means you must have a :

- A1200 WITH A MATH COPROCESSOR (68881 or 68882).
- A4000/30 WITH A MATH COPROCESSOR (68881 or 68882).
- A4000/40.

Note that the AA CHIPSET is recommended but not required (MisterM can work on a A500 or A2000 with a 68020 + 68881 based accelerator board and the 3.0 system software installed).

- ReqTools 2.0 (c) Nico François.
- Required memory : depends on the size of generated pictures. The Z-Buffer which contains compressed informations (the number of iterations per point and the potential value), needs anyway one LONG INTEGER (4 BYTES) PER PIXEL (it was difficult to do better; a raw storage of the data would have required 10 bytes per pixel).

So if you want to compute a 320 x 256 picture, you will need at least :
 $(320 \times 256 \times 4) / 1024 = 320$ K more memory, whatever the number of colors used to render it, 640 K for a 320 x 512 picture, 1.25 M for a 640 x 512 picture, etc...

If you don't have enough memory, try generating smaller pictures : MisterM accepts any picture size starting with 64 x 64.

1.6 MisterM : Distribution, Shareware

DISTRIBUTION, SHAREWARE

This program is freely distributable, provided :

- a) you don't ask for more than a nominal fee to cover copy and distribution costs.
- b) you distribute ALL files in their ORIGINAL UNMODIFIED FORM, including the documentation and examples.

The following files MUST be present in the distribution :

MisterM/MisterM_020_881	- Main program, 68020/881 version
MisterM/MisterM_020_881.info	- Program icon
MisterM/MisterM_040	- Main program, 68040 version
MisterM/MisterM_040.info	- Program icon
MisterM/MM.guide	- International guide
MisterM/Help/English/MisterM.guide	- English guide
MisterM/Help/Français/MisterM.guide	- French guide
MisterM/Catalogs/Empty.ct	- Empty catalog translation file
MisterM/Catalogs/Français/MisterM.catalog	- French catalog file
MisterM/Examples/BackLight.3D	- Example 1
MisterM/Examples/IceStar.3D	- Example 2
MisterM/Examples/Inferno.3D	- Example 3

MisterM is SHAREWARE : if you use it and like it, be aware that the best way to support the further development of this program is to register !

All you have to do is send 100 F (French Francs) by EuroCheck or postal money order (see address below). You can also send cash; however, make sure it is impossible to see that the envelope contains money (for example, put the money between two sheets of paper) or I may never receive it !

When you become a registered user,

- a) you receive the last registered version of the program (not released in the public domain) with great pictures and example files.
- b) you are notified when the next major release comes out, then you can obtain it at a very low price. If you purchase it, go to a).

For registrations, remarks, suggestions, ... write to :

Luc Railhac
20 rue de Roux
13004 Marseille
France

1.7 MisterM : Installation

INSTALLATION

To install MisterM on your hard drive, simply copy the DRAWER which contains

it to the place you have chosen.

NOTE : MisterM drawer contain the files :

"catalogs/<language>/MisterM.catalog" and
"help/<language>/MisterM.guide"

for one or some languages.

If you don't copy the drawer but only the program, the interface will be in English and online help will not be available.

1.8 MisterM : Tutorial

QUICK TUTORIAL

To start MisterM, double click on its icon or type "MisterM" after a shell prompt. 3 things can happen (go directly to the case that concerns you - and hope it's case 3 !) :

CASE 1 : The computer crashes (RED alert) !

CASE 2 : A YELLOW alert of the form MisterM - <error> is displayed.

CASE 3 : The main window opens and a copyright message is displayed.

1.9 MisterM : Tutorial

CASE 1 : RED ALERT !

Probable cause : your machine is not 68020/68881 (or better) equipped.

If it is, please send me a letter describing your configuration and the alert number !

1.10 MisterM : Tutorial

CASE 2 : YELLOW ALERT.

It should be of the form :

"MisterM - <error message>"

If not, see CASE 1.

The error message should be explicit :

- you don't have the required libraries, or
 - you don't have enough memory, or
 - MisterM can't open its window on your Workbench (or default public screen). This happens only if your preferred fonts are very large.
-

In any case, MisterM exits cleanly and lets you continue using your Amiga.

1.11 MisterM : Tutorial

CASE 3 : LET'S GO !

a) Click on "OK" to make the message disappear.

The window is subdivided into 3 boxes : "DATA", "PICT" and "CALC".

b) Look into the "CALC" box and click on GO ! (or press the "G" key).

You can see the plane cutting algorithm drawing the "skeleton" of the Mandelbrot set, then the filling algorithm produces the final picture (it should be fast).

Don't be disappointed by what you see, MisterM can do a lot better !

c) Click on the picture (or press the "ESC" key) to come back to the main window.

d) Click on View in the "PICT" box, or type "V".

e) Click on the picture again.

f) Click on Palette or type "T".

The palette editor is displayed at the bottom of the picture. It allows you to alter picture colors in many ways. For now, click on "CANCEL" or type "E".

g) Click on Screen in the "PICT" box, or type "E".

Here, you can choose the display mode, the number of colors and overscan of the picture.

You will certainly want to select 256 colors immediately...
OK, no one can prevent you from doing so.

h) Without modifying the display mode or overscan, select 256 colors and click on "OK" to close the requester.

i) Click on GO ! in the "CALC" box.

What an awful picture ! The 32 color picture was best.

Don't be bothered, it's normal and comes from 3 factors :

- The number of iterations (see gadget "Iter.") is set at 32 at start, so you can't have more than 32 colors in your picture.
 - The 256 color palette contains much more intermediate shades, that's why the picture is all blue.
 - We are very far from the boundary of the Mandelbrot set to distinguish details. You will need to Zoom into the picture later...
-

I guess you have seen that the picture HAS NOT BEEN RECOMPUTED but simply redisplayed with a different number of colors.
That's the Z-Buffer effect : you can modify any graphic parameter WHICH DO NOT CHANGE THE SIZE OF THE PICTURE and view its influence immediately.

Change the number of colors a few times to be convinced.

Go back to 32 colors (please be patient... nice 256 color pictures are not far, but if you want to use MisterM features correctly, read on).

j) Click on "Level Set" in the Method gadget ("DATA" box), or type "M".

"Continuous Potential" is displayed : it's another generation method.

k) Click on GO !.

You can see the second picture type MisterM can produce. The level lines are "smooth" and best distributed.

l) Click on the picture, click into Iter. ("DATA" box), or type "I".
Change the value 32 to 256. Click on GO !.

You can see that the 32 color palette is used several times in order to assign one color to each requested iteration.
MisterM allows to specify HOW the palette must be reused :

m) Click on Graphic Parameters in the "DATA" box, or type "P".

The graphic parameters window opens.
The Color Map gadget shows "Flip-Flop" which means that the palette is used one time forwards, one time backwards in a cycle.

n) Click on "Flip-Flop".

"Linear" is displayed.

o) Click on GO !.

Now, the palette is used only one time (and the distribution of colors is linear).

Try also "Log" (in this case, very similar to "Linear") and "Loop" (use the Color Map and GO ! gadgets).

p) Close the graphic parameters window.

q) Click on Screen in the "PICT" box and select 256 colors.
Click on "OK", then GO !.

This time, the whole 256 color palette is used (we have exactly one color per iteration).

r) Click on the picture, click on the Method gadget to display "3D Continuous Potential". Click on GO !.

You see the 3D version of the previous picture.

The palette has been changed automatically because MisterM keeps a separated palette for the 3D pictures (the default is a shading from black to white). Of course, this can be changed.

s) Click on the picture, click on Palette in the "PICT" box.

IF SOMETHING GOES WRONG DURING THE FOLLOWING MANIPULATION, TYPE "E" (CANCEL), AND RESTART FROM THE BEGINNING.

Click on a color square, in the middle of the selector. Its RGB (Red, Green, Blue) components are displayed on the right. Go to the color R = 127, G = 127, B = 127 using the left or right cursor, depending on the first color you selected.

Then, push the R and G sliders completely left, using the mouse or SHIFT-R and SHIFT-G (use the keyboard auto-repeat feature).

The resulting color should be a dark blue (components : 0, 0, 127).

Click on "SPREAD" or type "S". Then, click on the last color of the palette (white, lower right).

You have created a gradation from dark blue to white. Before going on, you must understand a detail :

When you edit a number of colors corresponding to the MAXIMUM number of colors displayable on your machine (at present, 256 in the standard modes), the first 4 colors are used to display the interface and replaced by : LIGHT GREY, BLACK, WHITE and BLUE. To see the real colors of the picture, you need only to click on one of these (in the upper left corner of the selector). Do it !

To restore the interface colors, simply click on any other color or press the "HELP" key.

Click now on the dark blue you created, click on "SPREAD" and click on the first color of the palette (upper left), displayed as LIGHT GRAY but being BLACK, as you know.

To exit the palette editor, you have the following choices :

- Type "A" ("ACCEPT").
- Type "HELP" to see something, then "A" (keyboard/keyboard solution).
- Click on a color out of the 4 first, then click on "ACCEPT" (mouse/mouse solution).
- Use the remaining keyboard/mouse and mouse/keyboard solutions !

t) Open the Graphic Parameters window (you can press the SPACE BAR). Change the view angle or the light vector. Click on GO ! and see the result...

u) YOU HAVE MANY OTHER THINGS TO DISCOVER ! ALL IS COVERED IN THE FOLLOWING CHAPTERS. PLEASE READ THEM IF YOU INTEND TO PRODUCE HIGH QUALITY PICTURES AND ANIMATIONS.

PARTICULARLY, SEE THE INTERFACE DESCRIPTION.

1.12 MisterM : Interface

INTERFACE

USAGE	- How to use gadgets and keys
DATA BOX	- Mandelbrot data definition
PICT BOX	- Picture options and operations
CALC BOX	- Calculation options and launching
GRAPHIC PARAMETERS	- Adjustment of picture rendering
PALETTE EDITOR	- Palette manipulation

1.13 MisterM : How to use gadgets and keys

INTERFACE USAGE

ONLINE HELP
BOUTTONS
STRING GADGETS
CYCLE GADGETS
SLIDER GADGETS
THE ESC KEY
THE SPACE BAR
THE HELP KEY

1.14 MisterM : Online help

ONLINE HELP

In order to obtain the detailed description of a command or parameter, move the mouse pointer over the corresponding gadget and press the "HELP" key.

If the mouse pointer is not over a gadget when you press the "HELP" key, the summary of the documentation is displayed.

1.15 MisterM : Buttons

BUTTONS

To perform an action, click on the corresponding button or type the underscored letter in the gadget name (case is not significant).

1.16 MisterM : String gadgets

STRING GADGETS

To select the gadget, click into it or type the underscored letter. Then you can modify the displayed value (see the keyboard shortcuts in Commodore docs : Right Amiga-X erases the string, Right Amiga-Q undoes the edition, etc...).

To go out of a string gadget, you have (at least) 5 possibilities :

- RETURN : the gadget is deselected and its value recorded.
- TAB : same as RETURN, and the NEXT gadget is selected.
- SHIFT-TAB : same as RETURN, and the PREVIOUS gadget is selected.
- You click elsewhere : same as RETURN.
- You go into a menu : idem.

TAB and SHIFT-TAB are VERY useful when you have to modify many values... Use them !

1.17 MisterM : Cycle gadgets

CYCLE GADGETS

To display the next option, click on the gadget or type the underscored letter. To display the previous option, do the same thing, holding the SHIFT key.

1.18 MisterM : Slider gadgets

SLIDER GADGETS

To increase a level, click on the knob and move it to the right using the mouse. You can also click in the container, to the right of the knob, or type the underscored letter to increase the level by one unit at a time (the keyboard auto-repeat feature can be used to add more units).

To decrease a level, swap "right" for "left" and "letter" for "SHIFT-letter".

1.19 MisterM : The ESC key

THE "ESC" KEY

Very useful for closing the graphic parameters window or to stop a computation. For other uses, look further.

1.20 MisterM : The space bar

THE SPACE BAR

Allows to switch between the main window and the graphic parameters window (if the graphic parameters window is closed, it will open).

1.21 MisterM : Main window, data box

DATA BOX

OPERATIONS

Load - Read data from disk
Save - Write data to disk
Zoom - Examine a region included in the current picture
Scale - Numerical zoom
Restore - Restore initial data

PARAMETERS

X min - Min X value
X max - Max X value
Y min - Min Y value
Y max - Max Y value
Iter. - Maximum number of iterations per pixel
Method - Select the rendering method

GRAPHIC PARAMETERS WINDOW

Graphic Parameters - Open the graphic parameters window

1.22 Load data

Load - Read data from disk.

Loads data of the "DATA" box and the "GRAPHIC PARAMETERS" window from disk. You must provide the name of a data file previously saved with the Save command of the "DATA" box, or specify the name of a picture created by MisterM (data will be extracted).

1.23 Save data

Save - Write data to disk.

Saves the data of the "DATA" box and the "GRAPHIC PARAMETERS" window to disk.

Saving data uses much less disk space than saving a picture !

If you save your data to the file "MM_Data" IN THE SAME DIRECTORY as the program, they will be loaded automatically each time you start MisterM (see also the Save command in the "PICT" box).

1.24 Zoom

Zoom - Examine a region included in the current picture.

If there is no picture, this gadget is deactivated.

Click on the CENTER of the region to examine, and move the mouse holding the left mouse button. Release the button when the region which you are interested in is boxed. MisterM keeps the aspect ratio of the picture automatically.

When the picture is displayed, you can abort the operation using the "ESC" key.

IMPORTANT NOTE : The Scale and Zoom functions update the display of X min, X max, Y min, Y max. Anyway, these values are validated only when you launch the computation (GO ! command). You can always go back doing a new Zoom, clicking on Restore or selecting Scale with a factor of 1.

ZOOMING INTO A 3D PICTURE : The 3D zoom is very inaccurate, especially when the view angle is low (that is, not close to 90 !). You are advised to produce a 2D picture of the region using a different method (this is instantaneous if you just computed the 3D picture), zoom, and then come back to the 3D method.

1.25 Scale

Scale - Numerical zoom.

The width and height of the region are multiplied by the number you type (use a number greater than 1.0 to widen it and a number less than 1.0 to shrink it). The center is preserved in any case.

1.26 Restore

Restore - Restore initial data.

The initial data or data used in the last computation are restored when you click on this gadget.

1.27 Region to draw

X min - min X value
X max - max X value
Y min - min Y value
Y max - max Y value

These values define the region of the plane MisterM will draw. You can modify them by hand if you know an interesting region (you can find some very nice examples in [2]).

They are automatically modified by the Load, Scale, Zoom and Restore functions.

1.28 Iter.

Iter. - Maximum number of iterations per pixel.

THIS PARAMETER HAS A GREAT INFLUENCE ON THE QUALITY OF THE GENERATED PICTURE : it's the maximum number of iterations to do FOR EVERY PIXEL of the picture, in order to determine if the corresponding point belongs to the Mandelbrot set or not.

Usually, the nearest you are from the boundary of the set, the more iterations you need to obtain a satisfying picture :

- if your picture lacks details (the boundary between the background color and the others is "blurred"), increase the number of iterations.
- if too many colors are stuck near the boundary of the set, decrease the number of iterations.

This parameter has also a great influence on the COMPUTATION TIME (the plane cutting algorithm allows to avoid a direct proportionality, anyway).

Please see [2] and [3] for details. For a more general discussion on fractals and iterations, see [1].

1.29 Method

Method - Select the rendering method.

- LEVEL SET : it's the fastest. Its main drawback is that it's incompatible with the others. This means that if you want to switch to another method, the current region will need to be recomputed.
It is the only method that supports INTEGER calculation (see the INT/REAL gadget below).
 - CONTINUOUS POTENTIAL : instead of drawing level lines, this method draws equipotential curves around the Mandelbrot set. These curves are more equally distributed and the resulting picture is "smoother". If you use this method, don't forget to adjust the Slope parameter which has a great influence on the rendering of the picture.
-

- 3D CONTINUOUS POTENTIAL : the same thing as CONTINUOUS POTENTIAL, but in 3D.

1.30 MisterM : Graphic parameters

GRAPHIC PARAMETERS

This window contains parameters that determine HOW TO DISPLAY the currently examined region. You can modify any of them WITHOUT NEEDING TO RECOMPUTE the region (thanks the Z-Buffer). So you can try many different settings and watch the effect achieved almost immediately (only the 3D rendering may take some time).

Gadgets are activated or deactivated depending on the chosen rendering method (see the Method gadget).

Color Map - How to use the palette
Slope - Non linear scaling of the height
Angle - View angle in degrees
Stretch - Vertical stretching of the picture
Smoothing - Determine if the surface is "smoothed"
X Light - X coordinate of the light vector
Y Light - Y coordinate of the light vector
Z Light - Z coordinate of the light vector
Ambient - Proportion of ambient light
Diffuse - Proportion of diffuse (and reflected) light

You can use the "ESC" key to close this window.

NOTE : It is possible, starting with version 3.0, to let this window open permanently (drag it so that it doesn't hide parts of the main window). This is very useful while you try to find the best setting of parameters for your picture : modify them and click directly on GO ! in the main window.

If you prefer using the keyboard, the SPACE BAR allows to activate alternately the graphic parameters window and the main window, and to send them in front or behind automatically (if the graphic parameters window is closed, it will open).

KEYBOARD SHORTCUTS EXAMPLE :

The main window is activated, the used method is "3D Continuous Potential" (if not, type M or SHIFT-M until it is selected), and the graphic parameters window is open (if not, type P to open it, and the SPACE BAR to reactivate the main window).

Say you want to modify the Slope and Y Light parameters, and see what influence they have on the picture :

- Press the SPACE BAR : the graphic parameters window is activated.
- Type P : the Slope gadget is selected.
- Type Right Amiga-X to erase the current value (you may also use DEL

- or BACKSPACE).
- Type in a new value (DON'T press RETURN !).
- Press the TAB key : the Y Light gadget is selected.
- Change its value (you can change other values as well, using TAB or SHIFT-TAB).
- Press RETURN : the gadget is desactivated.
- Press the SPACE BAR : the main window is reactivated.
- Type G : if the values you entered were correct, the picture is generated.

With a little practice, that's very fast !

1.31 Color Map

Color Map - How to use the palette.

Methods : Level Set, Continuous Potential.

The Mandelbrot set is always drawn using the background color.

The Color Map gadget specify how the other colors are used :

- LINEAR : The palette is used only ONE TIME. The color of a given point is a linear function of the number of iterations needed for this point. For example, if the maximum number of iterations is 32 and there are 32 colors, there will be one color per iteration. If the number of iterations is 64, we will have the same color for 2 successive iterations, etc...
- LOG : The same thing, but the colors follow a logarithmic distribution (the nearest we are from the boundary of the set, the more iterations we need to display the next color). This option allows to move the colors away from the boundary of the set.
- LOOP : Each time the number of iterations changes, the color changes. If the number of iterations is greater than the number of colors, the palette is reused in a loop (modulo the number of colors minus one).

For example, if we have 32 colors (numbered from 0 to 31),

- a point which needs 1 iteration gets color 1	
.	.
.	.
-	31
-	32
-	33
	31
	1
	2

color 0 being reserved for points belonging to the set.

- FLIP-FLOP : The same, but the palette is used alternately from left to right (1 -> 31) and from right to left (31 -> 1). This option allows to avoid interruptions in the shading when colors 1 and 31 are very dissimilar.

1.32 Slope

Slope - Non linear scaling of the height.

Methods : Continuous Potential, 3D Continuous Potential.

IT'S THE MOST IMPORTANT PARAMETER FOR THE "CONTINUOUS POTENTIAL" AND "3D CONTINUOUS POTENTIAL" METHODS.

- If your picture contains only a few different colors (Continuous Potential) or is too flat (3D Potential), raise it.
- If your picture contains too much close colors (Continuous Potential) or if you have only "peaks" and "cliffs" (3D Potential), lower it.

DON'T FORGET THAT ALL GRAPHIC PARAMETERS ARE REAL NUMBERS ! YOU CAN MAKE VERY FINE ADJUSTMENTS TO ACHIEVE EXACTLY WHAT YOU WANT.

1.33 Angle

Angle - View angle in degrees.

Method : 3D Continuous Potential.

It must be between 1 (side view) and 90 (top view).

Generally, low values (less than 20) are not very useful because the picture is "squashed". On the other hand, values close to 90 allow to produce very interesting pictures ("bas relief" style).

1.34 Stretch

Stretch - Vertical stretching of the picture.

Method : 3D Continuous Potential.

If your picture does not fill the entire screen (there's a wide empty area above), you may use this parameter.

Its function is to artificially raise the height of points which are far from the observer.

More precisely,

- the height of the foreground points is unchanged.
- the height of the background points is multiplied by the value of the stretch.
- the height of remaining points is raised proportionally to their distance from the observer.

For example, if the stretch is 1.5,

- the height of points in the foreground is multiplied by : 1 (not changed)
- .
- .
- .
- the height of points in the middle is multiplied by : 1.25

.
.
- the height of points in the background is multiplied by : 1.5

If possible, use only low values for this parameter in order to avoid a severe distortion of the picture.

1.35 Smoothing

Smoothing - Determine if the surface must be "smoothed".

Method : 3D Continuous Potential.

Smoothing consist in simulating more colors than available, using small patterns of pixels. MisterM creates random patterns whose density is a linear function of the intensity of the simulated color.

The possible settings are :

NONE : no smoothing.
AUTO : smooth if the number of colors is less then 128.
ALWAYS : smooth whatever the number of colors is.

The difference between a smoothed and not smoothed picture is obvious if you are using 32 colors or less.

NOTE : To achieve best effects with smoothing, the screen resolution must be important. If possible, choose a high resolution and/or interlaced mode.

1.36 Light vector

X Light - X coordinate of the light vector.

Y Light - Y coordinate of the light vector.

Z Light - Z coordinate of the light vector.

Method : 3D Continuous Potential.

These parameters are used to adjust the lighting of the surface.

Simple examples :

X Y Z
1 0 0 : the light comes from left.
-1 0 0 : the light comes from right.
0 1 0 : the light comes from the front.
0 -1 0 : the light comes from the back.
0 0 1 : the light comes from below.
0 0 -1 : the light comes from above.

Combination examples :

```

1  1 -1 : the light comes from left, front and above and has the same
          intensity in all directions.
10 -1 -5 : the light coming from left is 10 times greater than
          the light coming from the back, and 2 times greater than
          the light coming from above.

```

1.37 Ambient light proportion

Ambient - Proportion of ambient light.
 Method : 3D Continuous Potential.

The ambient light is simply the constant quantity of light which will be taken into account for all points of the surface, whether they are hit by the light source (X Light, Y Light, Z Light) or not.

This parameter varies between 0 and 1. Generally, only low values are useful.

Examples :

```

0      = 0 % of maximum intensity : no ambient light.
0.01   = 1 % of maximum intensity : very low ambient light.
0.1    = 10 % of maximum intensity : low ambient light.
0.5    = 50 % of maximum intensity : heavy ambient light.
1      = 100 % of maximum intensity : the scene is SATURATED !

```

1.38 Diffuse light proportion

Diffuse - Proportion of diffuse (and reflected) light.
 Method : 3D Continuous Potential.

The diffuse light depends only on the angle at which the light rays hit the surface.

The reflected light takes into account the shininess of the surface and the position of the observer.

This parameter determines the amount of diffuse light directly and the amount of reflected light indirectly :

```

0.75 means 75 % diffuse light, 25 % reflected light,
0.5  means 50 % diffuse light, 50 % reflected light,
etc ...

```

Examples (try these !) :

```

0      = 0 % dif, 100 % réf : the surface is globally dim and locally
                              very shiny.
0.5    = 50 % dif, 50 % réf : a compromise between global lighting and
                              shininess...

```

0.75 = 75 % dif, 25 % réf : another compromise, maybe a more "natural" balance.
1 = 100 % dif, 0 % réf : the surface is globally well illuminated, but too much dull.

1.39 MisterM : Main window, pict box

PICT BOX

OPERATIONS

Load - Load a picture from disk
Save - Save the current picture to disk
Screen - Select screen characteristics
Palette - Invoke the palette editor
View - Display the picture

PARAMETERS

Width - Picture width (in pixels)
Height - Picture height (in pixels)

1.40 Load picture

Load - Load a picture from disk.

You can only load pictures created by MisterM because only them have data (from the "DATA" box and "GRAPHIC PARAMETERS" window) saved inside them, that allow computations to be resumed, starting with the region that the picture represents.

As the picture is loaded, data of the "DATA" box and "GRAPHIC PARAMETERS" window are updated.

1.41 Save picture

Save - Save the current picture to disk.

This gadget is deactivated if there is no picture.

Corresponding data are also saved into a special IFF chunk (see MisterM DATA FILE FORMAT), encapsulated in the picture file. Anyway, pictures saved by MisterM are readable by any program that supports reading IFF/ILBM files.

If you save your picture to the file "MM_Picture", IN THE SAME DIRECTORY as MisterM, it will be automatically loaded each time you start the program. If the file "MM_Data" is also present (see the Save command in the "DATA" box), it will be ignored : MisterM will instead use the data present in the picture file.

1.42 Screen

Screen - Select screen characteristics.

You can choose the mode, overscan, and number of colors of the screen on which the picture will be drawn.

The default values are :

- DEFAULT MONITOR
- LOW RESOLUTION
- TEXT OVERSCAN
- 32 COLORS

to be compatible with any Amiga.

Anyway, due to the nature of fractals, a high-resolution/interlaced mode will greatly improve the quality of generated pictures.

1.43 Palette

Palette - Invoke the palette editor.

This gadget is deactivated if there is no picture.

When the palette editor is displayed, you can :

- SELECT A COLOR : click on it IN THE SELECTOR or ON THE PICTURE. Its components are shown on the 3 sliders R, G, B (Red, Green, Blue).

You can also use the CURSORS :

- RIGHT CURSOR : go to the next color (or return to the first).
 - LEFT CURSOR : go to the previous color (or return to the last).
 - UP CURSOR : go to the first color.
 - DOWN CURSOR : go to the last color.
 - MODIFY A COLOR : move the sliders using the mouse, or the R, G, B keys to raise each component, or SHIFT-R, SHIFT-G, SHIFT-B to lower them (use the keyboard auto-repeat feature).
 - COPY A COLOR : select the color you want to copy, click on "COPY" (or type "C") and select the destination.
 - SPREAD COLORS : select the first color, click on "SPREAD" (or type "S") and select the second color.
 - SWAP 2 COLORS : select the first one, click on "SWAP" (or type "W") and select the second.
 - SCROLL THE PALETTE LEFT OR RIGHT : click on "< SCROLL" or "SCROLL >" (or type "<" or ">"; holding one of these keys provides color cycling).
 - LOAD A PALETTE : click on "LOAD" or type "L".
-

MisterM can read any palette file in the IFF/ILBM format. So, you can :

- Load palettes written by other programs using this standard.
- Extract the palette out of any IFF/ILBM picture.

After the new palette is loaded (see "TRANSITION BETWEEN DIFFERENT SIZED PALETTES" below), you can always restore the original one, using the "RESTORE" function.

- SAVE THE PALETTE : click on "SAVE" or type "V".

MisterM writes palettes to disk in the recommended form (IFF/ILBM file without bitmap).

- RESTORE THE INITIAL PALETTE : click on "RESTORE" or type "T".

Click on "ACCEPT" or type "A" (or "ESC") to exit the palette editor and accept the new palette.

Click on "CANCEL" or type "E" to cancel the operation.

NOTE : MisterM maintains 2 different palettes : one for the plane methods and another for the 3D Continuous Potential method.

TRANSITION BETWEEN DIFFERENT SIZED PALETTES :

(this happens when the number of colors of the screen is changed, or when a palette is loaded from disk)

- BIG PALETTE -> SMALL ONE : the smallest is built of equally spaced samples of the big one.
- SMALL PALETTE -> BIG ONE : the colors of the small one are equally distributed in the big one so that you can create shadings between the initial colors (using the "SPREAD" function).

IMPORTANT NOTE :

When the number of edited colors is the maximum of colors the machine can display (currently, 256 in standard modes), the palette editor uses the 4 first colors to display its interface. To reveal the true colors used in the picture, simply click on one of these.

If you don't see anything then (for instance, because the 4 first colors are very dim), simply click on any other color or press the "HELP" key. This will restore the colors of the interface.

If you want to modify one of the first 4 colors but you don't see the gadgets, use the keyboard shortcuts.

ABOUT THE 3D CONTINUOUS POTENTIAL METHOD :

To achieve best results, colors must be ORDERED FROM THE DARKEST TO THE BRIGHTEST, for example from black to white (use the "SPREAD" function).

1.44 View

View - Display the picture.

This gadget is deactivated if there is no picture.

When the picture is displayed, the following features are available :

- LEFT MOUSE BUTTON : returns to the main window.
- "ESC" KEY : returns to the main window
and aborts the current calculation, if any.

1.45 Picture dimensions

Width - Picture width (in pixels).

Height - Picture height (in pixels).

All picture sizes starting with 64 x 64 are accepted.

If the picture is larger than the screen it is displayed on, you will only see one part of it. To see the hidden parts, move the mouse at the edges of the screen to scroll the picture left, right, up or down.

To get the default dimensions for a given display mode, type the 3 letters "def" into the Width and/or Height gadgets.

WARNING :

When you modify these values, you may define a new aspect ratio (Width / Height) that doesn't match the aspect ratio defined by $(X_{\max} - X_{\min}) / (Y_{\max} - Y_{\min})$.

The consequence is that your picture will be distorted.

The default values :

$X_{\min} = -2.3$ $X_{\max} = 0.825$

$Y_{\min} = -1.25$ $Y_{\max} = 1.25$

are set for 1.25 aspect ratio screens ($\text{Width} / \text{Height} = 1.25$).

For example, 80 x 64, 160 x 128, 320 x 256, 640 x 512,
because $80 / 64 = 160 / 128 = 320 / 256 = 640 / 512 = 1.25$

So, always make sure that

$\text{Width} / \text{Height} = (X_{\max} - X_{\min}) / (Y_{\max} - Y_{\min})$

If not, simply modify one of the values so that this equation is verified, for example : $X_{\max} = (\text{Width} / \text{Height}) * (Y_{\max} - Y_{\min}) + X_{\min}$

If you often use screens with an aspect ratio not close to 1.25, you may save these new data as the default ones, so that they are loaded each time you start MisterM (see the Save command in the "DATA" or the Save command in the "PICT" box).

ASPECT RATIOS FOR SOME STANDARD AMIGA MONITORS AND RESOLUTIONS :

If you use standard dimensions, you can switch between the following monitors without changing any value :

PAL = 640 / 512 = 1.25 (this is the default)
VGA = 640 / 480 = 1.33 (close to PAL)
SUPER72 = 800 / 600 = 1.33 (same as VGA)

You can also switch between the following monitors, provided you gave correct values for X min or X max or Y min or Y max to match aspect ratio 1.6 (which is not close enough to the default (1.25) to avoid distortion) :

NTSC = 640 / 400 = 1.6
EURO36 = 640 / 400 = 1.6
EURO72 = 640 / 400 = 1.6

1.46 MisterM : Main window, calc box

CALC BOX

OPTIONS

INT/REAL - Select integer or real computation
PICT/ANIM - Select single picture or animation
PRIORITY - Set computing task priority

ACTIONS

GO ! - Launch the computation
STOP ! - Stop the computation

1.47 INT/REAL

INT/REAL - Select integer or real computation.

If you are using the "Level Set" method, you can choose between INTEGER and REAL (floating point) computation. INTEGER computation is, on some systems, a lot faster than REAL computation, at the expense of precision (typically, 68020/68030 + 68881/68882).

NOTE : On the 68040, the floating point routine is FASTER !

1.48 PICT/ANIM

PICT/ANIM - Select single picture or animation.

- HOW TO GENERATE A SINGLE PICTURE :
- Be sure that the PICT/ANIM cycle gadget shows "PICT".
- Click on GO !.

During the computation, you can click on the picture to send it behind.
In the main window, click on View to redisplay it.

You can also click on Palette to edit the colors, or on PRIORITY to change the computing task priority.

- To stop the computation, click on STOP ! in the main window or type "!" or "ESC".

- HOW TO GENERATE A SEQUENCE :

- If you don't have disk saved data or pictures to start from, type your data and save them or generate a picture and save it.
- Load, type or generate END sequence data (for instance, you can simply zoom into the previous picture).

Displayed data, except X min, X max, Y min, Y max, will be common to all sequence pictures, and also the initial palette.

- When you are satisfied with your data, set the PICT/ANIM cycle gadget to "ANIM" and click on GO !.
- Specify the picture or data you intend to use at the start of the sequence.

The only data taken into account will be X min, X max, Y min, Y max.

- Specify the total number of pictures you want (at least 2 !).
- Choose the directory where the sequence is to be saved and type its base name. If the base name is "picture", the successive pictures will be saved to the files "picture00001", "picture00002", etc...

Many public domain or commercial programs can generate ANIM files when given a list of individual pictures named like this. Use them !

NOTE :

Be very careful when you choose a starting and ending picture : be aware that, although these pictures were computed using the same precision (due to the nature of fractals), one may be actually 100 or 1000 times smaller than the other. In this case, don't hope to obtain good results with a 10 pictures animation ! Even with subtle zoom effects, an important number

of pictures is often required to understand what happens when we get closer to the boundary of the Mandelbrot set (often, the animation seems good at the beginning, but last pictures come too fast).

1.49 PRIORITY

PRIORITY - Set the computing task priority.

The calculation takes A LOT of processor time. If you intend to use your Amiga during the computation, choose at most a priority of -1 (which is the default).

1.50 GO !

GO ! - Launch the computation.

See PICT/ANIM for more details.

IMPORTANT NOTE :

When you try to draw a very tiny region, you can obtain an EMPTY PICTURE, or a picture FILLED WITH BIG COLORED RECTANGLES ! If you are sure that the region is not actually empty and that the number of iterations is sufficient, it means that the machine precision has been overflowed. If you are using INTEGER calculation, try the REAL calculation. If you are already in REAL mode... best things come to an end !

1.51 STOP !

STOP ! - Stop the computation.

You can also press the "ESC" key.
See PICT/ANIM for more details.

1.52 MisterM : Quit

HOW TO QUIT MisterM

You have 3 ways :

- click on the close gadget of the main window.
- use the "Quit" menu item.
- type Right Amiga-Q.

1.53 MisterM : Common problems

COMMON PROBLEMS

- THE PICTURE IS
 - COMPLETELY BLACK OR CONTAINS ONLY A FEW COLORS
 - NOT PRECISE ENOUGH
 - FLAT (3D CONTINUOUS POTENTIAL)

Usual causes :

- The slope should be raised ("Potential" methods) : see Slope.
- The number of iterations is not sufficient (all methods) : see Iter..
Please note that modifying this parameter causes the complete recomputing of the picture.

- MY PICTURES CONTAIN A LOT OF ISOLATED COLORED POINTS.
HOW CAN I HAVE A MORE CONTINUOUS DISTRIBUTION OF COLORS ?

Use the "Continuous Potential" instead of the "Level Set" method.
Adjust the Slope parameter to widen or shrink the color bands.
Use eventually a higher screen resolution.

- HOW TO DISPLAY THE SAME PICTURE IN DIFFERENT SCREEN MODES WITHOUT HAVING TO RECOMPUTE IT ?

You must fix its dimensions : enter values for the Width and Height gadgets before computing (not "def" !). Then, you can change the display mode, monitor, number of colors or overscan using the Screen gadget, and redisplay the picture using GO !.

- AFTER LOADING A PICTURE, ALL THE PICTURES I GENERATE HAVE THE SAME SIZE.

When MisterM loads a picture, it updates the Width and Height gadgets. You can change these values or ask for the default ones (type "def" for Width and/or Height).

1.54 MisterM : Files

MisterM DATA FILE FORMAT

MisterM saves the following structure to disk :

```
struct DiskData
{
    long    ID;           /* MUST BE 'M','N','D','L' */
    double  Xmin,
           Ymin,
           Xmax,
           Ymax,
           Slope,
```

```

        Phi,          /* View angle */
        Stretch,
        Xl,           /* X Light */
        Yl,           /* Y Light */
        Zl,           /* Z Light */
        Ambient,
        Diffuse;
WORD   MaxIter;      /* Maximum number of iterations per point */
UBYTE  Method,       /* See METHOD_... below */
ColorMap,            /* See MAP_... below */
Smoothing,           /* See SMOOTH_... below */
RealNumbers; /* TRUE = Floating Point, FALSE = Integer */
};

/* METHODS */

#define METHOD_LSM      0 /* LEVEL SET */
#define METHOD_CPM      1 /* CONTINUOUS POTENTIAL */
#define METHOD_3D       2 /* 3D CONTINUOUS POTENTIAL */

/* COLOR MAPS */

#define MAP_LIN         0 /* LINEAR */
#define MAP_LOG         1 /* LOGARITHMIC */
#define MAP_SAWTOOTH    2 /* LOOP */
#define MAP_TRIANGLE    3 /* FLIP-FLOP */

/* SMOOTHING */

#define SMOOTH_NONE     0
#define SMOOTH_AUTO     1
#define SMOOTH_ALWAYS   2

```

The same structure is embedded in IFF/ILBM pictures saved by MisterM. You can find it in the "MNDL" IFF chunk.

1.55 MisterM : Translation

TRANSLATING MisterM INTO OTHER LANGUAGES

For now, only the French translation is available (software and documentation). If you want other languages to be supported, please send me your translations : you should fill the empty lines in the file "Catalogs/Empty.ct", providing one translation for each line of text (this is not very difficult). Translating the doc really takes more time and energy (as I can see !).

1.56 MisterM : Explorers

A SPECIAL NOTE FOR EXPERIENCED MANDELBROT SET EXPLORERS

If you obtain fantastic pictures or animations, please don't hesitate to send them to me. I could include them in the next distribution. Also, I plan to maintain a hall of fame of Mandelbrot Set Explorers, based on the originality and quality of pictures they send !
It could be published and updated with each release...
Think about it, and have a good trip !

1.57 MisterM : Bibliography

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"The Science of Fractal Images"
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1.58 MisterM : History

PROGRAM HISTORY

US = User Suggestion (maybe one of yours !)
UB = Bug found by a User (maybe you !!!)

Version 1.0 (30/03/93)
Version 1.1 (22/04/93)
Version 2.0 (28/05/93)
Version 2.1 (12/06/93)
Version 2.2 (08/11/93)
Version 2.3 (21/11/93)
Version 2.4 (22/12/93)
Version 3.0 (06/02/94)
Version 3.1 (23/05/94)

1.59 version1.0

Version 1.0 (30/03/93)

No comment...

1.60 version1.1

Version 1.1 (22/04/93)

CORRECTED BUGS :

UB - Saving pictures smaller than screen didn't work.

MODIFICATIONS :

US - Added the sequence generation.

US - When a picture is completed, it stays on screen until the user clicks on it.

- Call to DisplayBeep() when a picture is completed.

- Added a short menu.

- Best error handling.

1.61 version2.0

Version 2.0 (28/05/93)

MODIFICATIONS :

- New rendering methods : Continuous and 3D Continuous Potential.

US - Z-Buffer :

Rendering is now done in two phases : MisterM fills the Z-Buffer, showing the progression on screen, then displays the picture. When computing is not necessary, only the display is updated. Time savings are obviously enormous and enable free experimentation with most of the parameters.

- The "Level Set" method has been improved and is faster.

- User interface :

- Added the "Graphic Parameters" and "Method" gadgets.

- New "Graphic Parameters" window.

- The "Color Map" gadget has been moved from the main window to the new one.

- New data and picture file formats compatible with the 1.0/1.1 formats that take into account new parameters.

US - Some error messages clarified.

US - DisplayBeep() is not called anymore after each frame during sequence generation, but only at the end (this was very annoying !).

1.62 version2.1

Version 2.1 (12/06/93)

CORRECTED BUGS :

UB - The Z-Buffer allocate/free algorithm sometimes crashed the machine (after a very obscure combination of actions).

UB - The sequence generation didn't work with the potential methods.

MODIFICATIONS :

- Optimization of the 3D rendering : it is now 2 times faster !
- US - Added keyboard shortcuts for most of the gadgets.
- Some gadget names have changed.
- A requester now notify old (1.0 and 1.1) file formats and allows the user to initialize the new parameters not present in these files.

1.63 version2.2

Version 2.2 (08/11/93)

MODIFICATIONS :

- Computation is now achieved by a subtask created by MisterM, so that the user can continue to use the interface while MisterM is computing.

1.64 version2.3

Version 2.3 (21/11/93)

CORRECTED BUGS :

- UB - If the user raised the computing task priority, the interface was locked because its priority was always 0. Now, the interface priority is always one unit higher.
- Different problems related to the communication between the two tasks have been solved. A high priority port has been added for urgent messages.

MODIFICATIONS :

- Added the "Restore", "Screen" and "STOP !" gadgets :
- US
 - "Restore" is used to restore initial data or data of the last generated picture.
 - "Screen" is used to choose screen characteristics separately (before, the user had to specify them each time he launched a computation).
 - "STOP !" is used to stop the current computation (before, the user had to click on the picture; now, this action has the same effect whether MisterM is computing or not : the picture is sent to the back).

1.65 version2.4

Version 2.4 (22/12/93)

MODIFICATIONS :

- Locale library support :

The interface default language is now English, which is required for an

international diffusion. Anyway, English is not my native language, so if you find any errors, please contact me and they will be corrected in the next release.

1.66 version3.0

Version 3.0 (06/02/94)

CORRECTED BUGS :

- If the user modified the data before saving the current picture, these data were saved within the picture but weren't describing it any more. Now, MisterM keeps and saves correctly the parameters which were used.
- UB - The "Restore" command didn't restore the method and its associated parameters.

MODIFICATIONS :

US - AA(A?) CHIPSET support :

- ALL the hardware related limitations (colors, screen size, type, ...) have been removed.
- New palette editor !

Main features :

- Uses a separate low height screen independent of the picture screen characteristics. It's a child screen (3.0 feature) that moves with its parent. Best appearance is achieved using the "BestModeID()" function.
- The interface is always displayed using standard Workbench colors :
 - if possible, a deeper screen is opened in order to load the interface colors.
 - if not, the first 4 colors of the edited palette are used by the interface and swapped with real colors when necessary.
- Functions : Copy, Spread, Swap, Scroll left, Scroll right, Load, Save, Restore.
- IFF/ILBM routines updated.

- MisterM now requires System 3.0 (V39).

- Lighting model enhanced : added "Ambient", "Diffuse" and "Smoothing".

US - MisterM now maintains 2 independent palettes : one for 2D methods and another for the 3D method.

- The transition between different sized palettes has changed (see the "Palette" chapter).

US - Great news ! The graphic parameters window can now stay open permanently and switching between windows is possible using the space bar.

US - No more "picture complete BEEP" which was very annoying and not useful anymore (since the separation of processes in version 2.2). Now, the "BEEP" is used only at the end of sequence generation (because it can take a long time) or to signal little errors (bad keys, etc...).

- asl.library V38+ support : removed direct calls to reqtools file and screen mode requesters (if you prefer reqtools requesters, use the "RTPatch" program).
 - Downcoding of many interface routines.
-

1.67 version3.1

Version 3.1 (23/05/94)

CORRECTED BUGS :

- If the "ESC" key was pressed while a picture was displayed, a "BEEP" was generated if MisterM wasn't computing, and otherwise, the stop requester was sometimes sent behind the main window. Now, the effects produced match the documentation.

MODIFICATIONS :

- US - Attempt to translate the French documentation into English (the result is the funny thing you're reading) !
 - Clarified the French doc.
 - US - amigaguide.library support : online context sensitive help available on all program functions !
-