Lyapunovia

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Chapter 1

Lyapunovia

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                     Welcome to

                  LYAPUNOVIA V1.5

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               "Why do I have to keep reading
                  these technical manuals?"

                      -Roger Waters
```

1.2 Introduction to Lyapunovia

```
            Introduction to Lyapunovia
            ==========================
```

-Tired of zooming endlessly around the Mandelbrot set?

-Irritated by little graphic thingys daftly named "Sea of solitude", "Dragons mouth", "Mountain of magic", or even worse?

-Bored by a 1000 dull fractal programs all the same, except for small
twists concerning the "cache modes" of the "68030"?

Well, this is no cure. This is Lyapunovia V1.5.
                         --   ---------------

But what then, is Lyapunovia?

-To be brief, Lyapunovia makes pictures.

-To be more elaborate, Lyapunovia IS a fractal program, and it does allow
you to zoom.... But it is NOT a Mandelbrot program. (Everybody should be
screaming with relief at this point.) The great thing here is the
variations of the images; from cute candy-like patterns to ragged and torn
metal. Lyapunovia pictures contain depth and strange interacting,
ever-changing shapes with NO names.

-Lyapunovia is Shareware.

And what is Lyapunovia V1.5?

When I originally released Lyapunovia, I used the traditional "stingy
programmer" shareware concept: I released a _good enough_ program to the
public, but kept all the fancy functions such as AGA and FPU support to
myself and the registered users. This worked out just fine.
But after a while, a feeling of sillyness came to me: Why spend hours, days
and weeks in social isolation for the benefit of so few people?
I thought for a long time and decided to release _the full_ program this
time. This makes _me_ feel good anyway, and I hope that _you_, the user,
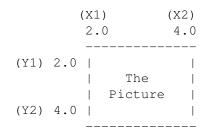will appreciate it.

From the original V1.0, a lot of things has happened; the user interface
has improved, many functions have been speeded up, support for various
chips and 24-bit output has been added. Most of the changes were suggested
by various users.
I've tried to make a program that takes advantage of AGA graphics and the
68040 internal FPU on a 4000, but still runs on an old '500.

(The mathematically disinterested should skip the following explanatory
part and go directly to "Installation" and "Getting started".)

The mathematical way

Where Mandelbrot graphics (the ones you've seen a 100 times before) are
renditions of the "Mandelbrot Set", Lyapunovia renders "Lyapunov Space"
(unsurprisingly named after the russian matematician Aleksandr M.
Lyapunov). If the Mandelbrot set is the "most complex object in
mathematics", Lyapunov Space must be the juiciest, spiciest and most
outrageous object ever found within numbers.

The specific formulas used to produce these breathtaking picures were
thought up by Mario Markus of the Max Planck institute for Nutrition. And
it all reached my mind by means of the "Mathematical Recreations" column in
the September, 1991 issue of "Scientific American".

If you're ever spent some time with the Mandelbrot set, zooming, changing
colors, etc... You'll be well off to understanding how Lyapunovia works.
Picture a square with coordinates, going horisontally from 2.0 to 4.0,
vertically from 2.0 to 4.0:

```
              (X1)        (X2)
               2.0         4.0
              --------------
      (Y1) 2.0 |            |
               |    The     |
               |  Picture   |
      (Y2) 4.0 |            |
              --------------
```

That's what you see when running the program. Lyapunovia enables you to
zoom in, to watch in closer detail whatever part of the screen appeals to
you. This is like the Mandelbrot set.

What makes Lyapunov Space perhaps so much more fascinating, is the ability
to switch between an endless amount of different domains, each possessing
an individual "personality" of sorts. And things are very strange, jagged
and torn. Very appealing to any decently deranged imagination.

Like the Mandelbrot set, Lyapunov Space is a map of chaos, meaning:
Lyapunovia calculates the "Lyapunov exponent" of each pixel; an indication
of whether the formula is order or chaos at the given X and Y-positions.
Chaos is mapped as black, order is mapped with the highest colors for the
orderliest function. The basic formula is equivalent to the one used for
making "Feigenbaum trees"; x=rx(1-x). The Lyapunov exponent is calculated
like this:

```
;A SMALL PROGRAM FOR DETERMINING A LYAPUNOV EXPONENT

X=0.5      ;JUST AN INITIAL VALUE
TOTAL=0
ITERATIONS=50
R=3.5      ;OR SOMETING ELSE BETWEEN 2 AND 4.

FOR I=1 TO ITERATIONS
 X=RX(1-X)
 TOTAL=TOTAL+LOG(ABS(R-2RX))/LOG(2)
NEXT I


TOTAL=TOTAL/ITERATIONS
```

The TOTAL variable now holds the Lyapunov Exponent for the formula
X=RX(1-X).
Now you should be asking yourself: How does one plot a two-dimensional
picture when the formula only has one parameter? Right: What we do is, for
each iteration, to replace R with either the X coordinate or the Y

coordinate of the pixel we're going to plot. The sequence parameter
determines how X & Y should alternate: An "AB" sequence does X, then Y, X,
then Y and so on... "AAB" does X,X,Y,X,X,Y... and so on and so forth.

Naturally, there are various ways to rewrite the formula to speed up
calculations as I've done, but this should give you an idea of what is
going on.

```
Reading on Lyapunov Space:
--------------------------
```
Scientific American, September 1991. A.K. Dewdney: "Leaping into Lyapunov
Space".

```
Generally on fractals & chaos:
------------------------------
```
Brian H. Kaye: A Random Walk Through Fractal Dimension. VCH, 1989.
H.O. Peitgen, P.H. Richter: The Beauty of Fractals. Springer, 1986.

1.3 installation

```
                    Installing Lyapunovia
                    =====================
```


Lyapunovia uses Nico Francois' ReqTools library for file-requesters,
information boxes, palette requesters and the like, therefore:

Before running, REQTOOLS.LIBRARY (version 2.0 or above) must be present in
your LIBS: directory. In the "Install" drawer of this distribution, you'll
find instructions as how do this.

Also make sure to have the mathtrans.library in the LIBS: directory as
well. (It comes with the computer, so don't worry.)

And be sure to use the version that suits your chips the best!


```
Program versions
----------------
```
Three different program versions are included in this distribution:
"Lyapunovia V1.5 68000" - for unaccelerated A500/A1000/A2000.
"Lyapunovia V1.5 68020+" - for accelerated Amigas, A1200,3000,4000.
"Lyapunovia V1.5 FPU"   - for Amigas with a floating point unit.
All three versions will run under 1.3-3.0, and will automatically adjust to
your computer.


```
Libraries, screens and memory allocation
----------------------------------------
```
Whenever the program is unable to open a library or a screen, or unable to
allocate some required memory, it will instantly exit and clean everything
up. An alert (the flashing thing) will then inform you of the error.
If using WB3.0+ on a non-AGA machine, trying to load a 256-color picture
will result in a "unable to open screen"-error.
Using 1.2-2.1, the picture just won't be loaded, instead calculations are

started based on the coordinates.

1.4   Getting started


```
                          Getting started
                          ===============
```

To quickly get a feel of what Lyapunovia does, do the following:
Install Lyapunovia. Double-click on the icon. The title-screen will
appear, press "OK" to continue.

(In the following, letters within {} indicate that the function can be
activated by press "right amiga" and that key.)

The program will start making a very simple Lyapunovia picture. Note that I
generally programmed Lyapunovia to automatically begin calculating every
time a parameter has been changed. You can always stop the program via the
menus or by pressing right amiga+"." (the latter being much faster).


```
Do the following:
-----------------
```

Stop the program. {.} Try choosing a new screenmode:
-On 1.2/1.3, select # of colors etc.. from the menus.
-On 2.0-3.0, press {M} to get a screenmode requester.

Let the picture finish.

That was easy enough, but you've probably noticed that the picture isn't
very interesting. So lets try loading a coordinate file: A coordinate file
is simply a little file describing a certain "place" in Lyapunov Space.
When you load a coordinate file, Lyapunovia automatically starts
calculating it in the current screenmode, with the current palette.
Load a coordinate file, say "Cross" or "ABBBBA 24 – 3". {D} (You'll find
the files in the "Coordinates" drawer of this distribution.)

While the picture is being calculated, you can experiment with different
palettes; with menus or by pressing right-amiga and 1,2,3, or 4. -Or try
bringing up the palette requester. {P}

Once the picture's done, try loading some palette files. In the "Palettes"
drawer, you'll find a lot of different palettes:
-On a 256-color AGA screen, try "256 – Shiny" or "256 R&G".
-On a 32-color screen, try "32 – lift up my nights".

Try selecting a cycle speed of 1 {Z}, then try the "cycle" function. {Y}

If you like the picture, try saving it, using "Save IFF". {S} From then
on, you can print it, edit it or whatever you want to do. At some later
time, you can also load the picture again, change the colors or zoom in
somewhere that looks interesting – this is the next point:

Zooming is very simple: You can select the area you want to see in further
detail either from corner to corner {R} or from center to corner {N}. Try

it; a requester will appear, asking if you're sure. If you were, the screen
is cleared and the image you've selected starts being drawn.

To more fully appreciate what Lyapunovia has to offer, this is how to make
some of my favorite pictures:

```
Coordinate file                 Palette (AGA / non-AGA)
------------------------------------------------------
Flash; Curve II                 256 Cycle - II / 32 Cycle - III
5A5B 50, ibd 11                 256 - Shiny / #1
5A5B 50, 'In-between, detail' #4 / #4
5A5B 50, 'In-between'           #4 / #4
5A5B 50, ibd something          256 - R&G / 32 - Light up my nights
6A6B 30, Agurk                  #4 / #4
ABABA 50, Radiant               256 - R&G / 32 Cycle, Bilal II
ABABA 50, Spider                256 - Lift my days / 32 - Lift my Days
5A5B 50, ibd 5                  256 - Shiny / #4
5A5B 50, The Big Parable        256 - Yellowie Eyes / 32 - Greenscale
AB 100, 'Indian Eyes"           #4 / #4
6A6B 30, 'CrissCross'           256 Cycle - III / 32 Cycle - III
5A5B 50, 'Loneliest Object'     #4 / #4
Flash; 6AAB, 'Cross'            256 Cycle - Seventies  / 32 Cycle - II
```

(#1 means standard palette 1; right amiga + 1.)

If you like a picture, you san always save it {S}, and then reload it at
some later time for deeper zooming.

If you want to produce a 24-bit file, just load the coordinate file, stop
{.}, press {F}. Select dimensions, select a palette file, then an output
file name.
To make sure that the color transitions are absolutely smooth, you may want
to expand a palette file first {X}: Select the palette to expand, select
the # of colors to expand to (just say 4096), then the file name of the new
palette. To avoid confusion, it can be a good idea to name the palettes the
way I've done: Thus expand "256 - Shiny" to "4096 - Shiny".

A general rule is that you should zoom on the border between black and
color. That's where the "action" usually is.

1.5 Program functions

```
                  Program functions
                  =================
```

   (NOTE: letters within {} indicate that the function can be activated
   by press "right amiga" and that key.)

   (In order to gain speed, Lyapunovia will only check for menus,
   pressed keys etc. every now and then. This is unnoticable on pictures
   with a low "iteration" value; with large values (larger than, say, 500
   on an unaccelerated Amiga), there will be a noticeable delay from
   selecting a menu till the program reacts. Don't worry, your Amiga will
   remember what you did!)

```
Menu 1: PROGRAM
-------------------------------
This concerns basic program and file options.

Stop:           Stops drawing the picture. {.}

Go:             Though  changing  almost   any   parameter  automatically
                restarts  calculations,  you  sometimes  need  a  separate
                function to do this. This is it. {G}

Save IFF:       Saves the current picture as  a  standard IFF file. {S}

Load IFF:       Loads   a   picture   saved  from  Lyapunovia,  including
                coordinates etc... This enables you to continue exploring
                where you left off... {L}

Save Prefs:     Saves     the     current     screen     settings     as
                "S:Lyapunovia.prefs". This file  is  automatically loaded
                when the program is started.

Load Prefs:     Loads the preference settings.

About:          A bit of information about Lyapunovia. {A}

Priority:       Sets the task priority of Lyapunovia. Generally speaking,
                "1" gives Lyapunovia priority  over most  other programs,
                "0" splits  the CPU  time, and "-1" makes the program run
                quietly in the background.

Quit:           Quits Lyapunovia. {Q}


Menu 2: SCREEN
--------------
This concerns screen resolution and colors.

Palette:

 Edit:          Edit palette. {P}

 Palette 1-4:   Four different standard palettes. {1,2,3,4}

 Cycle:         Performs a standard color cycle on the current picture. I
                realise  that  this  is  probably  the  oldest  and least
                original effect on  the  Amiga, but boy! it  does look
                great. Anyway, press mouse button or any key to stop. {Y}

 Cycle speed:   Some people  asked for  a faster  cycle, some asked for a
                slower. This function allows you to select the  delay (in
                screen frames) between each step of a cycle. {Z}

 Save:          Saves the current palette in a standard format. {V}

 Load:          Loads a  new palette.  Note that it is possible to load a
```

palette from any standard IFF file.
Loading a palette with a different number of colors than
the the current will delete the current image. A prompt
appears, asking you to confirm. {O}

Rotate: When you perform a cycle, sometimes you'll notice some
                     unexpectedly good-looking color-combination that you want
                     to keep. This function moves through a standard cycle
                     step by step, allowing you to save the good-looking
                     colors when they appear.

Title bar: Toggles the title bar. {T}

Screenmode: Users with WB2.0+ can change screen resolution and # of
                     colors using a single menu. This replaces the below-
                     mentioned menus. Lyapunovia supports ALL resolutions
                     supported by the system software. If you seem to be able
                     to a select a mode that causes strange flickering or the
                     like, please note that this is due to a faulty preference
                     setting, not a faulty program!
                     As standard, the program assumes the screen size
                     specified as "Text overscan" in the preferences. To
                     produce pictures bigger than the screen, enter the
                     desired dimensions in the "width" and "height" gadgets.
                     If the screen requires more chipram than avaliable,
                     you'll be returned to the previous resolution. On an
                     oversize picture, the screen will automatically scroll
                     when you move your pointer around. {M}

Hires: Turns high resolution on/off. (640 pixels per line,
                     rather than 320.) * Under WB1.3 only!

Interlace: Turns interlace mode on/off. (PAL: 512 lines rather than
                     256. NTSC: 400 lines rather than 200.) * Under WB1.3
                     only!

2-32 Colors: Selects the number of colours on screen. (2, 4, 8, 16 or
                     32.) See "Chipram" note. * Under WB1.3 only!

Menu 3: IMAGE

For moving around in Lyapunov Space.

Coordinates: Alters the specifications of the current image.
                     See "In-depth explanations" for elaboration.

Zoom in:

 Center/corner: To zoom with the mouse. Point at the center of the
                     "place" you want to view, hold left mouse button and move
                     mouse to the corner of the square. Release button.
                     Lyapunovia will ask you if you're sure. {N}

 Corner/corner: Same as above, except that you select from corner to
                     corner. {R}

Zoom out:

 All the way: Returns you to the initial coordinates.

 2 times: Zooms out two times.

 4 times: Zooms out four times.

Save: This saves the current image setting; the settings
                 specified under the "Coordinates menu": What sequence
                 you're using, and where you're zooming, etc.. {E}

Load: This loads such a file. You can also load them from a
                 Lyapunovia IFF file. {D}

Precision:

 Half: Half precision is a special "preview" mode to quickly see
                 what a picture will look like. Faster, especially on a
                 68000 system. This mode has to be selected manually. Not
                 very useful, really.

 Single: Single precision is the default precision. Precise enough
                 for most purposes. Switching back to this mode has to be
                 done manually.

 Double: Double precision is for extra deep zooming. Lyapunovia
                 will automatically switch to this mode when it is
                 required.

24-bit output:

                 This is what a lot of people have been asking for for a
                 long time. It's fairly simple; to produce a picture you
                 just enter the dimensions (in pixels), select a palette
                 and an output file name, and away you go. The picture is
                 always drawn based on the current coordinates. Maximum
                 dimensions are 65000 x 65000 pixels. Note: The picture
                 on the screen doesn't have to be fully drawn before you
                 do the 24-bit output; the normal display should be seen
                 as a navigator to help you produce the best 24-bit
                 pictures possible, 24-bit output is independent of
                 current screen resolution etc.. But NOT from precision.
                 {F}

24-bit palette expansion:

                 Since a lot of people don't have AGA, and since even with
                 AGA it can be hard to manipulate colormaps with over 256
                 colors, this is a small tool to help you: What it does is
                 that it takes a previously existing palette file and then
                 "expands it", smoothing any jumpy color-differences along
                 the way, allowing you to get smooth color transitions in
                 your 24-bit output. (Incidentally: This can also be used
                 to turn old 16/32 color palettes into 256-color palettes
                 for use on AGA machines.) {X}

1.6 Tips & Tricks

```
                              Tips & Tricks
                              =============
```

```
Cycle
-----
For optimum results, use a palette  where color  1 is  nearly equivalent to
the last  color. That  way, cycling is less "jumpy". The "32 color cycle I"
palette is a good example thereof, so is "256 - shiny".
```

```
Where do i zoom?
----------------
Well, in the end you should let your own tastes decide:
```

```
Do you like the soft &  smooth quality  of "Candy"  with palette  #1? -Then
focus on  pictures with  a low  "iteration" value;  don't zoom to deep, but
experiment with "color-divide" and palettes instead.
```

```
If you prefer the  spaced-out  metallic  of  "AAB 100,  Indian  eyes" with
palette #4,  then stick  to fairly high iteration values and always zoom on
the edges between black and color, in places that seem layered.
```

```
For the rather moving, "loneliest  mathematical  object  in  the universe"-
feeling of  "5a5b 50,  zoom1", zoom  on the  little islands of color in the
blackness.
```

```
Note that all images change  appearance  radically  when  changing palette.
Try the "X-ray" palettes!
```

```
Sometimes, but  seldomly, you  may experience the feeling that the pictures
you get tend towards the repetitive.
The official advice is  this:  Zoom  where  you  don't  usually  zoom! That
usually does  the job. After having played with Lyapunov Space for nearly a
year, I still get a lot of surprises. The possibilities are endless.....
```

1.7 In-depth explanations

```
                    In-depth explanation of a few points:
                    =====================================
```

```
Coordinates, the short explanation:
-----------------------------------
```

```
If you're not that  interested in  mathematics, you  only need  to know one
thing: The "coordinates" menu decides what your picture should look like:
"Sequence" make the picture ...... different.
"Color-divide" changes the brightness of the picture.
"Iterations": The  bigger the  number, the stranger the picture, the slower
the program.
"Plot repeat": Repeats the palette.
```

Coordinates, the in-depth explanation:

Sequence

Selects the general formula you want to look at. Not as complicated as it
sounds: Lyapunovia works by - at each point on the screen - running
through a basic formula as many times as you specify in the field
"Iterations".
In this field, only the letters "A" or "B" are legal. "A" runs through the
formula using the X coordinate of the current point, "B" uses the Y
coordinate. To give an example: A sequence of "ABABB" and 7 iterations
will repeat the formula like this:

A,B,A,B,B,A,B   -The "sequence", repeated.
X Y X Y Y X Y   -Its' X or Y partner.
1 2 3 4 5 6 7   -The current iteration.

That is to say that sequences are wrap-around.

Color-divide

Determines the general brightness of the picture. When using default
palette #1, a high color-divide makes the picture light, a low one will
make the picture dark. I can't tell you what color-divide should be set to
at all times - rather you should experiment from picture to picture,
adjusting this number along with the palette. Nevertheless, a good rule is
to stay between 1500 and 5000.

Iterations

This determines how many times the basic formula should be repeated - for
each iteration, the program moves to the next step of the "sequence". Thus,
if you specify fewer iterations than the sequence is long, only part of the
sequence will be executed.
The more iterations, the more weird the picture... And the longer time to
do calculations.

Plot repeat

With a value of 1, the palette is distributed evenly by mathematical means.
Higher "plot repeat" values will distribute the palette _several_
consecutive times. If you then alter the palette so color 1 and the last
color are close, and then cycle, you'll have a great effect of moving bars.
Check out the "Curve x4 II" with different cycle-palettes to see what I
mean. Do try it with a cycle speed of 1!

Only 1-4 are valid plot repeat values.

Errors

When pressing "OK" in coordinates, the program will inform you of any

faulty values..... Respond accordingly. If you're lost, just press
"UNDO" or "CANCEL".

1.8 Contacting the author

```
                    Contacting the author
                    =====================
```

Contacting me

First of all, you're always welcome to contacting me with any suggestion,
bug report (aargh!) or comment that springs into your mind.

If you've found somewhere nice in Lyapunov Space; a great palette or a
great picture or some great coordinates, please mail them to me. You will
then .... be mentioned in the next doc. file!

The serious part

And now the serious part: Since the last release of the program, I decided
not to keep a speciel registered version of the program to myself and a few
registered users, but rather to share it with as many people as possible.

In return for that, I'd like _you_ to share something with me:

The suggested shareware fee for this program is 50 DKR, 15 DM, US$ 10, or
the equivalent in any other currency. If you think I deserve it, this can
be communicated in several ways:

* By mail: Wrap the bills in some dark paper and write me letter and give
me a few comments, tell me a bit about your Amiga and what you're doing
with it.
* By EuroCheque, addressed to "Jesper Juul". Remember to write the card
number at the back of the cheque.
* In most countries, you can pay at the post office via my Giro account:
Girobank Denmark, 1-205-3207.
* But no national cheques, not even Bank-signed ones.

If you don't feel like sending money, you can mail me something else:

* Records, tapes and CDs! (Keywords: Pixies, Stravinsky, Jethro Tull,
Living Colour.)
* Good books! (Keywords: Paul Auster, Jonathan Culler, Douglas Adams, Jorge
Luis Borges.)
* Or some (preferably good) software you've written.
* Or if you make something like t-shirts or posters or videos or demos or
anything from the program, I'd like a copy.
* Or whatever you think.

* No matter what you do, be sure to mail me some comments and/or
suggestions!

Anyway, this is my address:

                        Jesper Juul
                        Guldsmedgade 34, 1.
                        DK-8000 Aarhus C.
                        Denmark

E-mail: norjj@stud.hum.aau.dk

1.9 notes

                              Notes:
                              ======

The future

There are (still) a lot of things I might want to add to this program.

-Speed.
-Movie mode, letting you save animation-files.
-A color dithering mode.
-Extended rendering choices.
-More mathematical formulas to choose from.
-Whatever you can think of....... AREXX interface and SCSI support?

An animation mode is the next project, after that I'll probably try
looking at some other formulas.

                         Lighter notes:
                         ==============

    "It's too bad they don't do this covernote thing anymore, 'cause it's
    not a bad thing to say something, even if it doesn't amount to much."
         -Ian Anderson

The hard road to excess

Lyapunovia was written in 100% pure assembler. It was written late at
night, early in the morning, while cooking Spaghetti Bolognese, while
brushing my teeth, while I was supposed to be doing something else, while
half asleep, while everybody else was watching TV, while I had too many
drinks the night before, while I didn't really want to, while under almost
divine inspiration, while reading, while making phonecalls, while watching
the tiny little bit of blue sky I can see from my room if I push my head
flat against the window and look directly up, while singing loudly, while
thinking 'bout the night before, while drying my hair, while eating
breakfast, while snapping my fingers, and while I was in small gaps between
everything else that my life contains. And now it's here. Makes you
wonder....

Slogans

The official slogan of this manual is, as you know, this:

    "Why do I have to keep reading these technical manuals?"
        -Roger Waters.

The official slogan of this program was suggested by Iivo Vehvilainen:

    "Way off in some indistinguishable distance was a stunning peak that
    overarched the sky, climbed and climbed and spread out in flowing
    aigrettes, agglomerates and archimandrites."
        -Douglas Adams: Mostly Harmless.

The official slogan of my entire life is this:

    "Though they may have won all the battles, we had all the good songs."
        -Tom Lehrer.

The slogans, by the way, are self-contained and have no slogans.

Laws

The official law governing the production of this program is Hofstadters
law:

    "Things always take longer time to finish than you expect, even if you
    take Hofstadters law into account."
        -Douglas R. Hofstadter.

Copyrights

Lyapunovia is © 1992-93 Jesper Juul.

ReqTools is © Nico Francois.

The rest of the copyrights belong to whoever owns them.

Thanks go to:

Nico Francois for ReqTools.
Jan van den Baard for GadgetEd.
Stefan Borberg for LhA.
Olaf "Olsen" Barthel for Term.
Fred Fish for his library.

1.10   Concerning Amigas with chipram only.

On Amigas without Fastmem, selecting 16 colors in hires mode (256 colors, a
1280 pixel screen on AGA machines) will significantly slow down program
execution. But also notice that this is only true when the Lyapunovia
screen is being displayed. Therefore, bring Workbench to front while
Lyapunovia is calculating; the screen will automatically be re-displayed
when the picture has finished.

1.11   Iff-files

When saving an IFF file, Lyapunovia will include the coordinate
parameters, thus enabling you to load the picture some other time and
continue zooming. However: If you process the picture (in a drawing
program, for example), that information will be lost, so keep a copy of the
orignal file. (For the technically interested: The information is saved as
a TEXT chunk, which is probably the best solution.)

1.12   precision

The "iteration" parameter is a source of frequent misunderstanding for
experienced Mandelbrot users. Lyapunovia is very different in that an
increased number of iterations has nothing to do with increased precision;
rather a low iteration count leads to smooth curvy pictures, a high count
leads to ragged and chaotic pictures. Precision is constant.

1.13   chips

You should of course use the program version that suits your system best.
The 68020+ version will be faster than the normal version, the FPU version
will _generally_ be faster than the 68020+ version. However: On some
systems, single precision calculations will actually be faster with the
68020+ than with the FPU version. And also: Single precision FPU

calculations are a bit less precise.
The program attemps to automatically adjust the level of precision
according to the zoom depth. With FPUs, the program may not be that good at
guessing the needed precision. With an FPU, my best advice is to select
"double precsion" at all times.