SMan

David M. McKinstry

COLLABORATORS

	TITLE : SMan	

ACTION	*NAME*	*DATE*	*SIGNATURE*
WRITTEN BY	David M. McKinstry	July 31, 2024	

REVISION HISTORY

NUMBER	DATE	DESCRIPTION	NAME

Contents

Chapter 1

SMan

1.1 SMan Help

1.2 Overview of SMan

SManWOS (beta version 1.0) is a program that will generate images from the Julia Sets of the form (zˆn + z) -> z, where z = x + iy. Values of n are from 2 through 7. An alternate approach uses z = R*exp(i*Theta) and will work with non-integer powers of z and for powers of z greater than 7. For n = 2, the Mandelbrot calculations are done in assembly language using the FPU. If n is greater than 2, all calculations are done using the IEEE math library. Although it is possible to execute this program on an Amiga without a floating point processor, it is entirely impractical to do so.

Unlike an earlier version, 'SMan' is designed to work only under AmigaDOS 2.1 or later (in fact, I no longer guarantee it to work with 2.1), and no attempt will be made to support earlier versions of AmigaDOS. (It may even work under 2.04, but I do not currently have 2.x installed on any Amiga.) The primary reason for insisting on the newer versions of the operating system is that the images are drawn on a window on the Workbench (or other Public Screen), rather than on a custom screen. There are nearly as many colors as in the palette selected for the public screen chosen. This permits a maximum of nearly 256 colors if you have an Amiga 4000 or up to 16 million colors if you have third party graphics card (such as the Picasso II, CyberVision64, etc.) with CyberGraphics, which properly supports RTG on the Amiga. All graphics functions come directly from the Graphics and Intuition libraries (and for screen depths greater than 8, the CyberGraphics counterparts), so this program should work with any graphics card that does properly support RTG. Of course, it should also work on the normal Amiga without AGA, except that the palette is limited to 16 high resolution colors or 32 low resolution colors. With 32 or more colors, a custom palette will be created. The actual number of colors used in the image window will be 7 less than the total palette size, since the lowest 4 (used for menus, etc.) are left unchanged, and 3 others are left intact for the mouse pointer.

The original palette is restored when SMan is terminated. If you run multiple instances of SMan, be certain to terminate them, so that the first one started is the last one terminated. Otherwise, the original palette will probably not be restored.

Note that it's to your advantage to get AmigaDOS 3.1, as graphics speed will be significantly increased and you can have a Workbench with up to 16 millions colors(with the appropriate graphics card), not to mention a great many other features making it far superior to AmigaDOS 2.x.

One big advantage of doing the drawing in a window on a public screen, rather than a custom screen, is that the window can be resized and moved about the screen at the user's discretion. This was not very practical until the higher resolution displays became available. Furthermore, MultiView is available with AmigaDOS 3.x, so any images that have been generated and saved can be easily viewed with that program (which is in your Utilities Drawer). Also, the Bit Map Editor (BME from SoftLogik) can load, manipulate and save such images in a variety of other graphics formats. BME's palette handling is generally better than that of MultiView, but MultiView has the advantange that it comes as a part of AmigaDOS 3.x.

Earlier development was done on an Amiga 3000 with a Picasso II card and a CyberVision64 card, but I am now using the CyberVisionPPC card. I have been working in resolutions of 1024 x 768 and greater with great success. My default Workbench is currently 1024 x 800 with 24 bit color.

1.3 Using SMan

SMan can be run from either the CLI or the Workbench. Except for debugging purposes, I normally do this from its icon.

When SMan is started up, it checks to see if any public screens other than the Workbench are present. If not, it opens automatically on the Workbench. Otherwise, a list box is provided showing all public screens available. Select the screen on which you wish SMan to draw the Mandelbrot images. The palette available for the Mandelbrot images is displayed. To start the default image, just press the left mouse button as indicated. Note that the menus are not turned on until after this is done. If the image window ('Exploring the Julia Sets') is not on the Workbench screen, the Workbench screen will be brought forward, and the information window ('Information about this Fractal') also brought to the front. Otherwise, the information window will just be brought forward. This window displays a variety of information including image dimensions, magnification, maximum count, the algorithm for calculating the Mandelbrots, and the coordinates for the center of the image. Note that this window accepts no inputs, except from the Close Gadget. Clicking on this gadget or the CloseGadge on the image window terminates the program. Nearly all inputs for the program are made on the image window via menus or their command key combinations.

Read about Menu Selections for further operating instructions.

1.4 Selections

The following Menu Selections are present:

Project

Maximum Count

Changes

Fractional Power

Note that all menu selections have a command key combination equivalent. That is, the selection can be accomplished by holding down A (the Right Amiga key) and pressing the appropriate character key.

1.5 Copyright Information

any reason whatever. There is no reason to think this software can damage any machine properly used, and the author accepts no responsibility for claims to the contrary.

4) Of course, hard disk maintenance is always prudent. Don't attempt to save a file, unless you know there is sufficient space available on your hard drive. SMan makes no attempt to see if space is available, although AmigaDOS does. Nevertheless, if you want to avoid repeated clicks on a cancel requestor, or cleaning up your directory while SMan is running, don't save an image (especially a bmp image), unless you know you have enough space.

Note that a 16-bit version of SMan is available for Intel based machines running 'MicroSoft Windows'. It can be

located on my web page at http://www.ior.com/~dmm/FWFiles/Mandel.html

1.6 Project

The Project Menu has the following four menu items:

About

Redraw(Same P)

Save Image (bmp)

Save Image (iff)

Save Parm

Load Parm

Quit

1.7 Author

David M. McKinstry

M.S. #68

Physics Department

Eastern Washington University

526 5th Street

Cheney, WA 99004-2431

My work phone is 509-359-6958. I can also be contacted via BIX as DIMMCK, or on Internet as DMCKINSTRY@EWU.EDU.

I'm certainly willing to listen to comments and suggests but make no promises as to implementing any of them.

Note that I'd like to express my thanks to Joanne Dow (jdow on Bix) for beta testing and suggestions. I haven't had time to implement all those suggestions yet, but may do so in the future. At this time, there has no beta testing of the CyberGraphics specific features (except what I've done myself), and I welcome any bug reports.

1.8 About

When 'About' is selected from the Project Menu (or ' A A', the window titled 'Information about this Fractal' is brought forward. Information included is CPU and FPU, Available Chip and Fast Memory, the width and height of the image in pixels, the magnification, the maximum count, the x and y coordinates within the complex plane that correspond to the center of the window, and the current value of n used in the algorithm zˆn + z -> z.

Note that although a 'CLOSE' gadget is visible on this window, selecting it will not close the window or terminate the program, but will bring forward the window titled 'Exploring the Julia Sets'.

The only way to terminate the program is to select Quit from the Project Menu.

1.9 Maximum Count

The maximum count can be changed on the fly. This count represents the number of loops through which the algorithm passes before it is assumed that the point (x,y) is within the Mandelbrot set. Of course, it is the points that are not within the Mandelbrot set that provide the interesting images, since the count at which it is determined that a point is not within the set determines the color displayed.

The options include increasing by 8, decreasing by 8, doubling, or halving. The lower limit on the Maximum Count is 8. There is no practical upper limit, but if you are using a 256 color public screen, the colors after the maximum useable palette size (249 colors with a 256 color screen) will be repeated. Also, keep in mind that if you have a large number of points on your selected region that are within the Mandelbrot set, calculation times increase dramatically.

1.10 Changes

There are a number of changes that can be made in the way the images are produced. These involve changing the coordinates of the image's center, changing the effective magnification, and changing the power used in the algorithm that generates the images.

There are seven menu items under Changes. They are as follows:

Zoom

Restore

Power Down

Power Up

Magnify

Reduce

Palette

1.11 Zoom

The procedure for zooming in on an area for a closer look is to move the mouse pointer to the upper-left corner of the new region to be viewed and pressing the left mouse button. With the mouse button pressed, drag the pointer toward the right. A box will be displayed around the new region to display. Release the button when satisfied with the region. Note that this region is only determined by the inital x and y coordinates of the mouse pointer, and the final x position. The box is drawn based on the dimensions of the original window. If you make a mistake in selection, you may use the Restore menu item to redraw the previous image, so that you can try again.

You can repeat the selection process until you reach magnifications of close to 10 to the 18th for n = 2, or slightly lower for n > 2. At this point the accuracy of the FPU is no longer sufficient for greater magnification.

1.12 Redraw(Same P)

Selecting 'Redraw(Same P)' from the Project Menu, or using ' A P', forces a redraw of the image, keeping the basic parameters (i.e. the center coordinates and magnification) the same. This redraw is done automatically when a change in magnification or coordinates is made. However, if you've changed the power in the algorithm used, a redraw is not done until you've selected this item. The times it would be suitable to select this item is if you had changed the maximum count(and/or power) and wished to have the image completely redrawn with the new maximum count(and/or power).

1.13 Save

Selecting 'Save Image (bmp)' from the Project Menu, or using ' A S', results in a file named Mand.bmp (or Mand8.bmp, if the image depth is only 8 bits) being saved to the current directory (i.e. the directory from which SMan is being executed). The file is a bmp file with no compression. If you are doing a large image, the file may be about 3 Meg in size. Be certain you have adequate space before you attempt to save, as SMan makes no attempt to check on space available. If you want to keep the image saved, rename it before using the 'Save Image' menuitem again. The file created can be viewed using SoftLogik's bitmap editor (BME), and can be used as a background image for MicroSoft Windows. SoftLogik's "BME" can convert this to other common file formats.

Note that this menu item is disabled if the screen depth is less than 8. In that case, you must instead select Save Image (iff).

1.14 Save IFF

Selecting 'Save Image (iff)' from the Project Menu, or using ' A I', results in a file named Mand.iff being saved to the current directory (i.e. the directory from which SMan is being executed). The file is an IFF file with the image body compressed using the one byte run compression algorithm. If you want to keep the image saved, rename it before using the 'Save Image' menuitem again. The file created can be viewed using MultiView, or any other sufficiently versatile iff viewing program.

Note that this menu item is disabled if the screen depth is greater than 8. In that case, you must instead select Save Image (bmp).

1.15 Save Parm

Selecting 'Save Parm' from the Project Menu, or using ' A M', results in a file named Mand.prm being saved to the current directory (i.e. the directory from which SMan is being executed). Mand.prm will be a short file containing the image information displayed in the information window (i.e. center coordinates, magnification, maximum count, and power used in the Mandelbrot algorithm). If you want to keep these paramaters saved, rename the file before using the 'Save Parm' menuitem again. Of course, the reason you might want to save your parameters is if you had need of terminating SMan after having zoomed through a number of images, but wanted to pick up where you left off at a later time. Just use Load Parm to get back the parameters.

Note that this selection is disabled if there are more than 256 colors, in which case you must use 'Save Image (bmp)'.

1.16 Load Parm

Selecting 'Load Parm' from the Project Menu, or using ' A L', results in loading a file named 'Mand.prm' from the current directory. This file contains all the information needed to redraw the image at a location previously saved. Be certain that such a file is in the current directory. If the name has been changed, change it back to Mand.prm before attempting to use it. Using 'Load Parm' does not require using the same window size, or screen mode. For example, you might have worked with high-resolution interlace at an earlier time, and wish to redraw it on a higher resolution screen using a third party graphics card. If you have a Picasso II card, you might choose regions of interest on a public screen using only 256 colors, save the parameters, and then load them while using a HiColor or TrueColor custom Picasso screen.

1.17 Quit

When 'Quit' is selected from the Project Menu the program will terminate. Remember that the window 'Exploring the Julia Sets' must be active for any menu inputs to work. As is common practice, 'A Q' will also terminate the program.

1.18 Restore

Selecting 'Restore' from the Zoom menu, or using ' A R', forces a redraw of the image to the previously used center and magnification. This would be used if you had made a poor choice in selection of the region to be zoomed, and wanted to try again. Another reason you might want to use this is if you had changed the power of z in the calculation, moving you away from the region you had been displaying. Keep in mind that as the power is changed, the location of the points within the Mandelbrot set will be altered.

1.19 Power Down

'Power Down' decrements the value of n used in the z^n + z -> z calculation. The minimum value of n accepted will be 2, so if the current value is 2 and Power Down is selected, there will be no change in n. However, if Fractional Power has been selected, the effective power used can be as low as 1.0.... plus 10 to the negative 14th. This is not very interesting though. The command key combination for this selection is ' A >'. Remember that for '>' to be recognized, the shift key must be held down.

1.20 Power Up

'Power Up' increments the value of n used in the z^n + z -> z calculation. The maximum value of n accepted will be 9, so if the current value is 9 and Power Up is selected, there will be no change in n. The command key combination for this selection is ' A <'. Remember that for '<' to be recognized, the shift key must be held down.

If 'Fractional Power' has been selected the total power can be as large as 10.0.... - 10^-14 (i.e. 10 to the negative 14th less than 10).

1.21 Magnify

Selecting 'Magnify' provides an easy way to double the magnification, without changing the coordinates of the center of the image being displayed. Simply select 'Magnify' from the 'Changes' menu, or use the command key combination ' A U'

1.22 Reduce

The Menu selection 'Reduce' provides an easy way to halve the magnification, without changing the coordinates of the center of the image being displayed. Simply select 'Reduce' from the 'Changes' menu, or use the command key combination ' A E'

1.23 Palette

The Menu selection 'Palette' cycles through 6 possible palette options. The basic palette remains unchanged, but the order from the palette in which red, green and blue are used changes. This option only works if more that 256 colors are used. Everytime the menu item 'Palette' is selected, or the key combination ' A Y', the order changes, until all 6 possibilities have been used.

1.24 Features

The Sizing Gadget and the Drag Bar is present on the window in which the images are drawn. For this reason, you can move the window anywhere you wish on the public screen being used, and change it to any reasonable size. This includes as large as your screen, or as small 320 x 150. Of course, the image area will be smaller because of the borders on the window. Whenever the window is resized, the parameters are adjusted so that the previous window center coincides with the new center. One reason you might wish to resize the window is that if you at zoomed in on a region that excluded some parts you wished to display, you

could enlarge the window until those parts are included. Of course, this would be only possible, if the parts missing were close to the border of the window.

Note that when any change in sizing is made, either with the Sizing gadget, or by zooming, the image will be completely redrawn.

There are no bugs in this program, only features! Of course, some of the features may not do what you or I want yet. Please report any discrepancies between the documentation in SMan.guide and the way in which SMan actually works to me.

1.25 CyberGraphics

If you have a good quality 3rd party graphics card and are using CyberGraphics, SMan will produce images in a window on the Workbench or other public screen using CyberGraphics resolutions and depths. Note that the number of colors used by SMan will be consistent with the depth, and not the selected number of colors if you use a Workbench screen. For example, if you've used the ScreenMode in Prefs to select a 16 bit CyberGraphics workbench, the number of colors will be 65536, even if you've only set the number of colors at 256.

The real advantage of CyberGraphics resides in the HiColor and TrueColor modes. These provide the option of a much larger palette size. However, they are currently restricted by SMan to 64 K for both of these modes. This was done so that the palette could be stored in a table, rather than calculated during real time. In both cases, the palette requires 3 bytes for each table entry, so the entire table requires 192 K of contiguous free memory, which is allocated just before the palette is set up. Nevertheless, even a 32 K palette is more than adequate. Although I have rarely selected a region requiring 8 or more K to prevent repetition of color, it takes an incredibly long time to complete an image. I did one that took all night. The palette displayed at the start of the program only shows the first 4096 colors.

All features for the HiColor and TrueColor modes work exactly as for lower depth modes, except for saving (which produces the iff files for 256 or fewer colors). For the higher color modes, the image is saved in bmp format. These files can be loaded and viewed using SoftLogik's BME, and a variety of viewers for Intel-based microcomputers.

1.26 Fractional Power

The procedure used in generating the Mandelbrot images is based on the operation of taking an integer power of the complex number z = x + iy, and adding it to the original number. Of course, i is the square root of - 1. This process is repeated until |z| {i.e.(x + iy)(x - iy)] exceeds the value of 2.0.... For example, with a power of n = 2 starting at the coordinates (x,y), the real part of z*z is x*x - y*y, and the imaginary part is 2xy. Thus, the new real part is x + x*x - y*y and the new imaginary part is y + 2xy. This process is repeated until the limit for |z| is exceeded. The values of the integer powers are controlled using the Menu Selections Power Up and Power Down.

However, an arbitrary non-integer power may also be selected by using the selections under 'Fractional Power'. This requires using a variation in the above algorithm. An alternate expression for a number in the complex plane is z = R*exp(i*Theta), where R = x*x + y*y, and Theta = arctan(y/x). This provides a simple way of taking non-integer powers of a complex number. That is, if the power is p = n + f, where n is an integer, and f a fraction between 0 and 1, z^p = (R^p)*exp(i*p*Theta). This alternate approach is used when a non-zero value is selected for a fractional power.

Note that if a fractional power is selected, the algorithm is slower, in part because of the fact that it takes much longer to calculate an arctangent function than most other calculations involved. When I'm convinced that there are no errors in the algorithm being used, I'll rewrite it in assembler.

There are six menu items under Fractional Power. They are as follows:

Set Increment Size to 0.1

Set Increment Size to 0

Divide Increment Size by 10

Multiply Increment Size by 10

Increment Fraction by Size

Decrement Fraction by Size

1.27 Setting to 0.1

The Menu selection 'Set Increment Size to 0.1' sets the size by which the fractional power changes to 0.1. The actual fractional power does not change until 'Increment by Size' or 'Decrement by Size' is selected. The command key combination ' A .' may be used in place of the menu selection.

1.28 Setting to Integer

This sets the increment size and the fractional power back to 0, so that the power used is an integer. The command key combination ' A 0' may be used in place of the menu selection.

1.29 Multipying Increment Size by 10

To obtain larger increment sizes, select 'Multiply Increment Size by 10' or use the command key combination ' A x'. As with 'Set Increment Size to 0.1', the change doesn't occur for the actual power until a selection of increment or decrement fraction by size is made. Of course, this selection can only be made if the division selection had been previously used. Note that the largest permitted increment size is 0.1.

1.30 Dividing Increment Size by 10

Selecting 'Set Increment Size to 0.1' defines the largest amount by which the fractional power can change. To obtain smaller increment sizes, select 'Divide Increment Size by 10' or use the command key combination ' A /'. The smallest increment size is 10 to the negative 14th. As with 'Set Increment Size to 0.1', the change doesn't occur for the actual power until a selection of increment or decrement fraction by size is made.

1.31 Incrementing Fraction by Size

Making this menu selection results in the fractional power being increased by the size previously determined using one of the 4 previous menu selections. This incrementing may be accomplished by using ' A ^'. Remember that the shift key must be used with '^'.

1.32 Decrementing Fraction by Size

Making this menu selection results in the fractional power being decreased by the size previously determined using one of the first 4 menu selections described above. This decrementing may be accomplished by using ' A back slash'.

1.33 SoftLogik

SoftLogik Publishing Corporation is probably best known for its desktop publishing software for the Atari, Amiga and now for MacIntosh. Information can be found about its products on the web page http://www.softlogik.com/.

SoftLogik's mail address and phones are as follows:

315 Consort Drive

St. Louis, MO 63011 USA

Sales: 1-800-829-8608 or 314-256-9595

Fax: 1-314-256-7773.

BME comes with PageStream 3.x for the Amiga and also for the MacIntosh. Graphics files can be converted by it between the following formats:

GIF

IFF ILBM

BMP

PCX

PICT bitmap

TIFF

1.34 MicroSoft Windows

Anyone who has been using computers, knows about MicroSoft and it Windows products. Bitmap (bmp) files can be viewed by 'PaintBrush' from Windows 3.1, 'Paint' from Windows 95, and can be used as a wallpaper for either of these. I sometimes use Mandelbrot images created on the Amiga as wallpaper for the Windows OSes.