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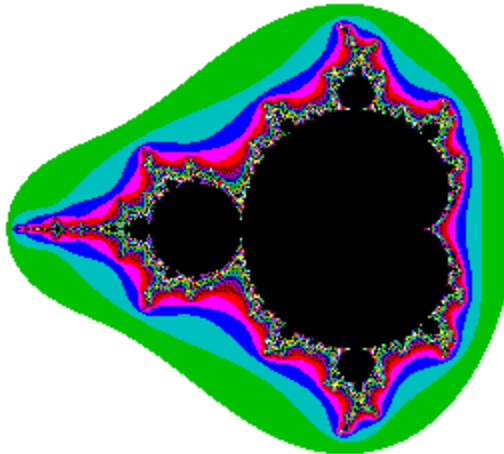
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Introduction

The Mandel program produces a display of the Mandelbrot set, named for Benoît Mandelbrot who "discovered" it. The program produces a visual representation of the set by iterating $z^2 + c$ over each point of the complex plane and determining whether or not iterations for that point are bounded. Points for which the iterations are bounded are members of the set. To provide a pleasing display, points for which the iterations are unbounded are displayed in color based on the number of iterations before the absolute value passes the boundary limit of 2. In the example below, the black area is the set itself.



This image is interesting but wait until you zoom into the set, using either the mouse or the keyboard. Concentrate on areas that appear complicated or random on the display.

Mandel can use 32 or 64-bit fixed-point arithmetic to considerably speed the computations. Also, 386 instructions and "fast area fill" may be used to speed the calculations even further. The retail version includes server software for Unix-based computations, transferring the results to the PC via Wollongong TCP/IP. See Compute Options for additional information on computation; see Server Setup about setting up a compute server.

Mandel includes several brilliant and a few mundane color schemes (palettes) for displaying the set. For most palettes, a 256 color palette-based Super VGA display is required. For more interesting effects, colors may be rotated, sorted, shuffled, inverted, reversed and animated. You can paste palettes from images copied to the clipboard from other graphics programs. You can edit the current palette, create new palettes, and save them to use later. Some of these options are available only on palette based displays; these are marked in the help file with **256**.

Mandel can create images larger than the window size, up to 2000 x 2000 pixels. You can set the size of the image and various other display options in the Display Options dialog box. Mandel also supports a Full Screen mode, where no borders, captions or menu bar clutter the view.

Mandel images may be saved to disk files. If saved in the midst of computations, opening the saved file will continue right where they left off. Mandel will save files as complete images (compressed), image descriptions (which will be completely recomputed when opened, but require much less disk space) or Windows bitmap files, which can be used as desktop wallpaper or as input to other graphics applications.

The Coördinates dialog box displays where you are in the set and allows you to enter specific coördinates to compute. The Statistics window shows how computations are going, providing comparisons between computational methods and the efficiency of fast area fill.

Mandel can apply special effects, such as perspective (with 3-D) and edge tracing to a completed image. These effects may be saved or printed.

You can print Mandel images to just about any graphics-capable printer. By using the page setup dialog box, you can specify text to print with the image and specify what information about the image should print.

Whats New in 3.0

There are quite a few enhancements in version 3, including:

Image Preview in the Open... dialog box, showing a thumbnail view of the selected .MND or .MNI file. This required the file format to be updated; version 2 files may be converted to the new format from the Open dialog box also.

Special Effects options for Perspective, 3-D, and edge-tracing of completed images. These use the computed pixel values to perform special effects. You can rotate, tilt, depth-cue, zoom and specify the type of 3-D effect. You can trace the boundaries between colors. I use the edge-tracing to print Mandelbrot pictures for the kids to color. All of these effects are quite fast.

Many additional palettes. Version 2.5 added the palette editor; with version 3.0, palettes may be deleted from the Color Options dialog box. The new palette file is MANDEL3.PAL. The format of this file has not changed; if you prefer to use the palettes you created with 2.5, rename your MANDEL.PAL to MANDEL3.PAL.

Printing. The image may be printed, along with much information about it (Coordinates, Parameters, Statistics). You can format your own header and footer from the Page Setup dialog box. Mandel prints in landscape or portrait mode. Mandel will stretch the image, or print at the printers resolution.

Floating Toolbar. From the Display Options dialog box, you can select a floating toolbar, which can be positioned anywhere on the screen. Additional items are present on the toolbar also.

Enhanced selection modes. By using the CONTROL key, you can copy an arbitrary rectangle to the clipboard (rather than just rectangles similar to the current set x:y ratio). By using the SHIFT key, you can select from the center out, making it easier to center a specific area on the screen. Also, the current selection size, in pixels, displays in the center of the selection rectangle.

The ability to set or use sets of startup parameters, grouped by the dialog box associated with them. Most dialog boxes have "Use defaults" and "Set defaults" buttons. The .INI file itself has changed; when you first start Mandel 3.0, you will have to re-specify your favorite startup parameters.

Lots of minor bug fixes and enhancements. Explore and find them.

Menus

File

Edit

Colors

Options

Effects

Help

File Menu

Open...

Save As...

Save

Page Setup

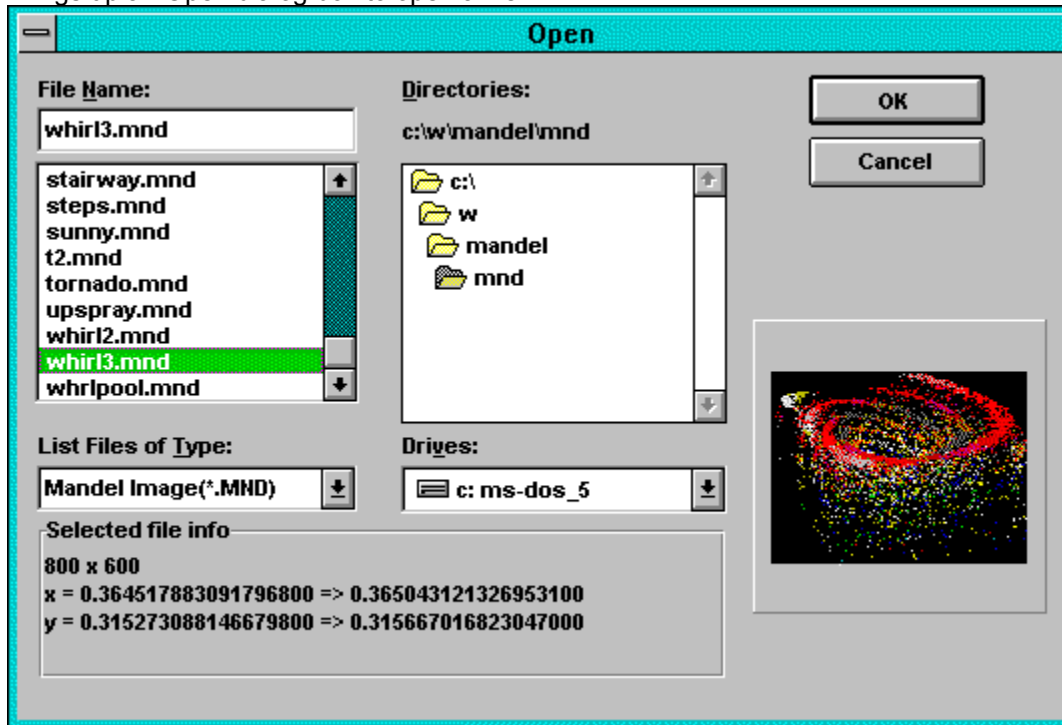
Print

Save Setup

Revert

Open...

Brings up an Open dialog box to open a file.

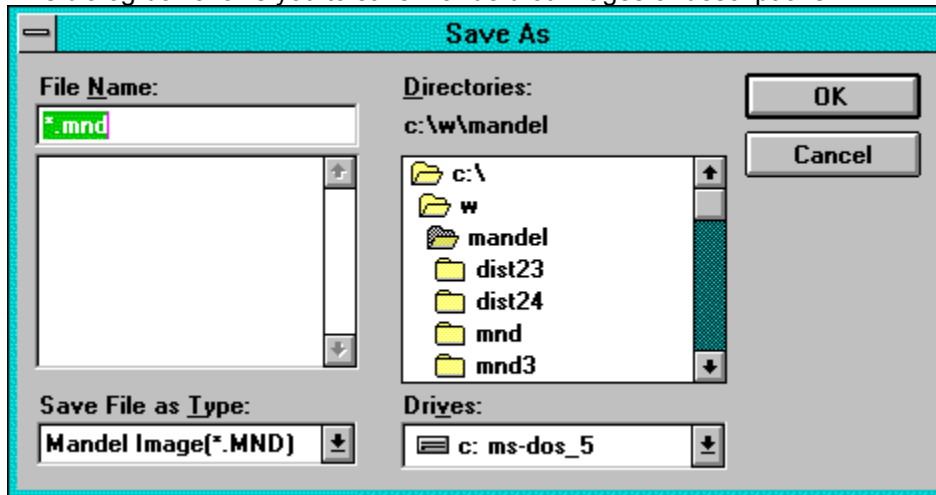


Mandel can open two file formats: .MND and .MNI. More information on these file types is provided in the **Save As...** section. For both types of files, display, compute and color options are set to the values from the saved file.

A small "thumbnail" image appears whenever you select a file. You can convert version 2.x .MND and .MNI files to version 3 by selecting the "Convert" button when it displays.

Save As...

This dialog box allows you to save Mandelbrot images or descriptions.



Mandel supports three file formats for saving:

- | | |
|-------------|--|
| .MND | Mandelbrot set files. Both the description of the current area (coördinates, display and compute options, colors) and the set itself are written to the file. The set is run-length encoded to decrease disk usage. A thumbnail image is stored in the file for the image preview in the <u>O</u> pen dialog box.

If a .MND file is saved while computing, it will pick up where it left off when opened. |
| .MNI | Mandelbrot description files. Only the description of the current area is written to the file. When opened, all points are re-computed from this description. |
| .BMP | Writes a 256-color Windows bitmap file, which may be used as wallpaper or imported into various graphics programs. |

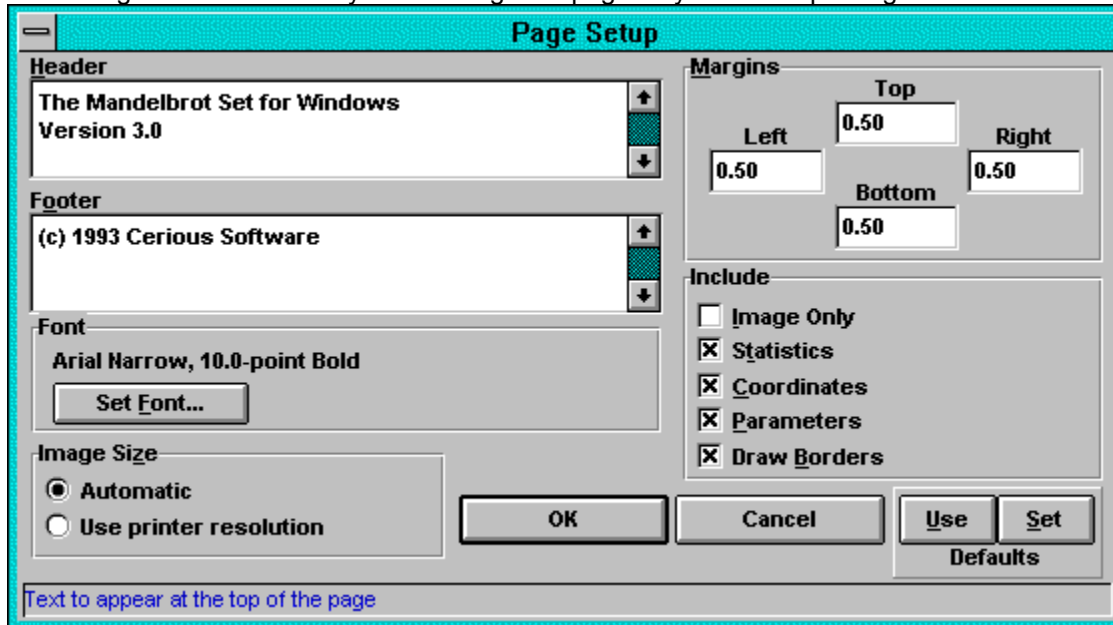
Save

Ctrl+S

This selection saves the current area to the last file opened or saved, in the same format as that file.

Page Setup

The dialog box below allows you to arrange the page as you like for printing:



Header

Text to print above the Mandelbrot image. You may enter up to 10 lines. Use **CTRL+ENTER** to separate lines.

Footer

Text to print below the image. Again, you can have up to 10 lines, separated by **CTRL+ENTER**.

Font

Shows the currently selected font. This dialog box will display if you select **Set Font**:

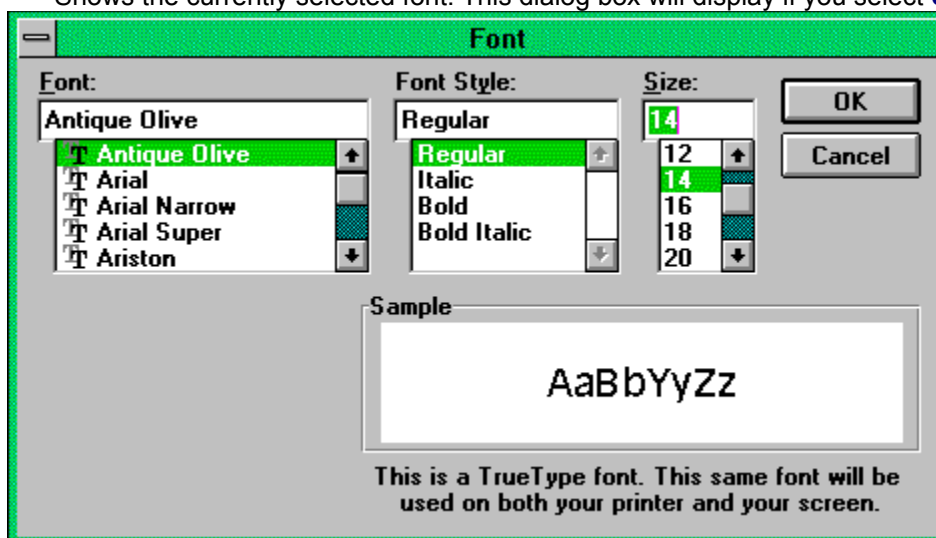


Image Size

Determines whether or not Mandel scales the image to the size available (**Automatic**), or prints at the printers specified resolution (**Use printer resolution**).

Margins

Specify, in inches (sorry, non-US users, I havent allowed for metric yet), the **Top**, **Left**, **Right**, and **Bottom** margins.

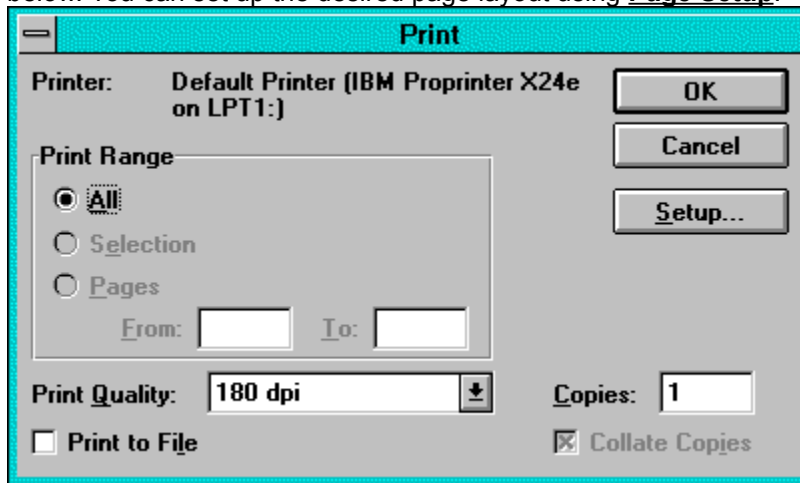
Include

Selects which items are printed:

Image Only	Print only the image; no headers, footers or image information will be included.
Statistics	Include the computational statistics.
Coordinates	Include the coordinate range of the image.
Parameters	Include information about how computations were done.
Draw Borders	Draw borders around each section printed.

Print

Use this selection to print the current image to a printer. It uses the standard **Print...** dialog box, show below. You can set up the desired page layout using **Page Setup**.



The image shows a standard Windows-style 'Print' dialog box. It has a title bar with a minus button and the word 'Print'. The main area contains several controls: a 'Printer:' label followed by 'Default Printer (IBM Proprinter X24e on LPT1:)', a 'Print Range' section with three radio buttons ('All' is selected), and two empty text boxes for 'From:' and 'To:'. Below these are 'Print Quality:' (set to '180 dpi' with a dropdown arrow) and 'Copies:' (set to '1'). At the bottom, there are two checkboxes: 'Print to File' (unchecked) and 'Collate Copies' (checked). On the right side, there are three buttons: 'OK', 'Cancel', and 'Setup...'.

Print

Printer: Default Printer (IBM Proprinter X24e on LPT1:)

Print Range

☒ All

☐ Selection

☐ Pages

From: To:

Print Quality: 180 dpi

Copies: 1

☐ Print to File ☒ Collate Copies

Save Setup

Saves the current environment, including color scheme, window size, calculation method, iteration limit and execution priority. This setup saves all settings from all dialog boxes. Individual sections may be saved from the appropriate dialog box.

Revert

Loads and applies the last saved setup values to the current window. This selection restores *all* settings; to restore individual settings, select the **Use Defaults** button in the appropriate dialog box.

Edit Menu

Select All

Paste Palette



Select All Shift+F2

Selects the entire image for spawning or copying to the clipboard. See Selecting and Zooming below.



Paste Palette 256

Will retrieve a color palette from the clipboard and apply it to the current image. This palette may be sorted, rotated or animated as any other.

Colors Menu

Palette

Rotate

Reverse

Invert

Animate

Shuffle

Sort

Edit



Reverse Shift+F3

Reverses the order of the entries in the current palette; thus, the first become last and the last become first.

Invert **Ctrl+F3**

Inverts the colors in the current palette. Each color is replaced by its logical complement.

Rotate F3

Rotates the current color scheme and re-displays the image. The colors are rotated in the order specified by the **Animate Direction** in the **Display** dialog box.

Animate **F4** **256**

Continuously rotates the current palette, producing interesting visual effects. Palette animation is available only on palette-based displays (generally 256 or more colors). You can change the animation speed and direction using the **Display Options** dialog box.



Shuffles the current color scheme and re-displays.



Sorts the current color scheme from light to dark (**Shift+F6**), dark to light (**Ctrl+F6**), or by spectrum (**F6**).



Palette Editor

Name:

Current Range

Full Palette 201

X: 40
R: 56
G: 218
B: 49

Buttons: Cut, Copy, Paste, Tween, Sort, Undo, Add, Change, Delete, Restore, Save As..., Save, OK, Cancel

The name of the palette from the **MANDEL.PAL** file. If the palette has been modified by rotating, sorting, etc., this field will appear as **"(new)."** You can also change the name of an existing palette by changing it here and selecting **Save**.

This field displays a magnified view of the *selected color* and those around it. This makes selection of a particular color easier when the palette has a large number of colors. Clicking on a color here makes it the *selected color* and the *current color*.

This control displays the complete palette being edited. Clicking on a color here will make it the *selected color* and the *current color*. You can select the *tween color* by holding down the **SHIFT** key while clicking the left mouse button.

Cuts the *selected range* (those colors between the *selected color* and the *tween color*, inclusive) of palette entries to the clipboard.

Copies the *selected range* of palette entries to the clipboard.

Pastes a palette from the clipboard into the *selected range*. Note that only the number of colors currently selected will be pasted.

Sort

Sorts the *selected range* by spectrum (RGB distance).

Tween

Interpolates intervening colors between the *selected color* and the *tween color*, using a simple formula that divides the distance for each RGB value by the number of colors between the two.

Undo

Undoes the last operation that changed the palette.

Adjustor Pad

The adjustor pad displays the *current color* in the center. The eight buttons surrounding the current color are changes to this color based on the following chart. The numbers indicate the keypad key which can be used to change the color.



The **X** field sets the amount each of these adjustor buttons changes from the *current color*.

Clicking on any of these fields causes it to replace the *current color*. Each adjustor button is then re-computed based on the new selection.

R, G, B

These fields show the RGB value of the *current color*. They may be edited or scrolled to affect the current color.

Add

When the palette is not full, this button adds the *current color* to the palette **after** the *selected color*.

Change

Changes the *selected color* in the palette displays to the *current color* described by the **RGB** fields (and displayed in the center of the **Adjustor Pad**).

Delete

Removes the *selected color* from the palette. The last color cannot be deleted.

Restore

Restores the palette to its state before you began diddling with it.

Save As...

Saves the palette under a new name. Displays a list of all current palette names and prompts for a new name.

Save

Saves the changes to the palette. Will prompt for a new name if the current palette name is empty or "(new)."

OK

Exits the palette editor, using the edited palette to display the set.

Cancel

Exits the palette editor, canceling changes to the current palette (any palettes you saved are still saved, though).

Options Menu

Palette

Display

Compute

Coördinates

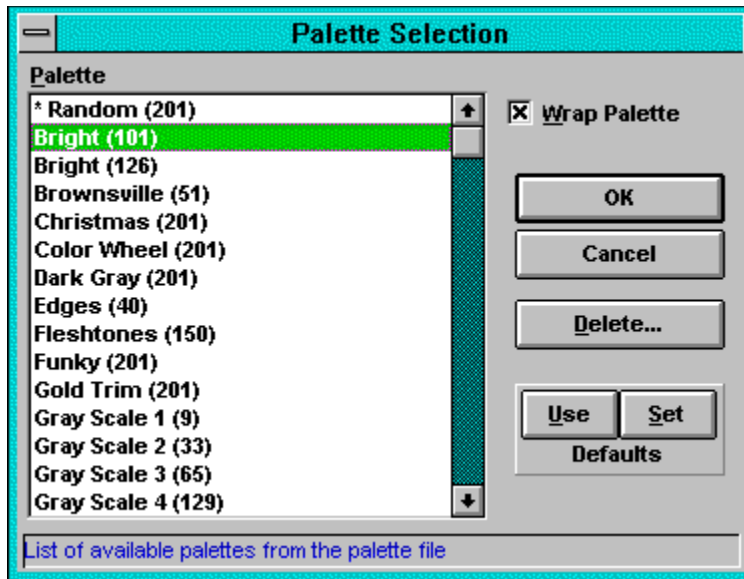
TCP/IP Server

Full Screen

Statistics

Toolbar

Palette Ctrl+P



Displays this dialog box, which allows the selection of a color palette. The image does not have to be recalculated when changing palettes; each iteration count is simply assigned a new color. The available palettes are in the file **MANDEL.PAL**. If this file does not exist, Mandel creates it with several default palettes. You may modify or add to this file with the E**dit Palette** option.

The **Wrap Palette** check box indicates whether Mandel should repeat the palette colors over the range of possible colors (up to 200).

The **Delete...** button allows you to delete unwanted palettes from the palette file.

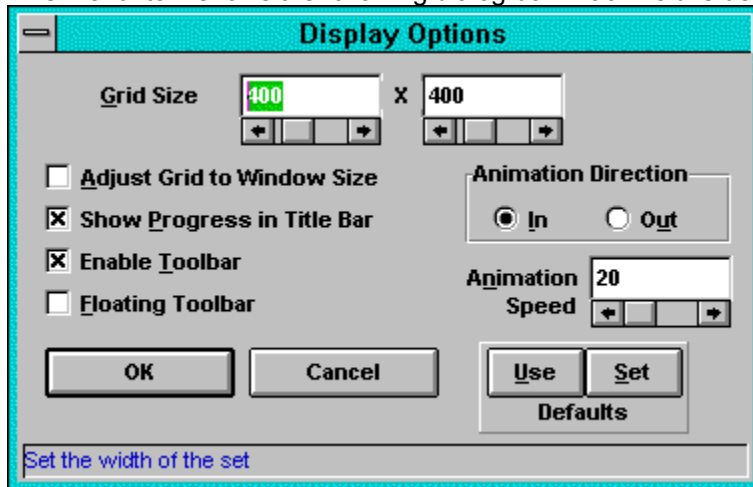
The ***Random** palette causes Mandel to randomly select 200 colors.

Most of the color palettes are designed for 256-color displays; each color will be mapped to the nearest solid color on 16-color displays.



Display **Ctrl+D**

This menu item shows the following dialog box. Each field is described below.



Grid Size

Defines the size grid to be computed. This will be the same as the window area if the **Adjust Grid to Window Size** box is checked. Full Screen mode disables this field.

Adjust Grid to Window Size

Causes the computational area to be redefined if the window size is changed (and vice versa). Clearing this box allows you to generate images larger than the display area. In this case, scroll bars will appear in the window if it is smaller than the grid size and re-sizing the window will not cause computations to restart.

Show Progress in Title Bar

When checked, the approximate percent complete and time remaining will display in the title bar and icon title.

Enable Toolbar

Enables the Toolbar.

Floating Toolbar

Displays the Toolbar as a small, vertical moveable window which you may position anywhere on the screen. When this checkbox is not selected, the toolbar is a horizontal strip displayed at the top left of the window.

Animation Direction

256

Specifies the direction for palette animation. See Colors-Animate for more information on palette animation.

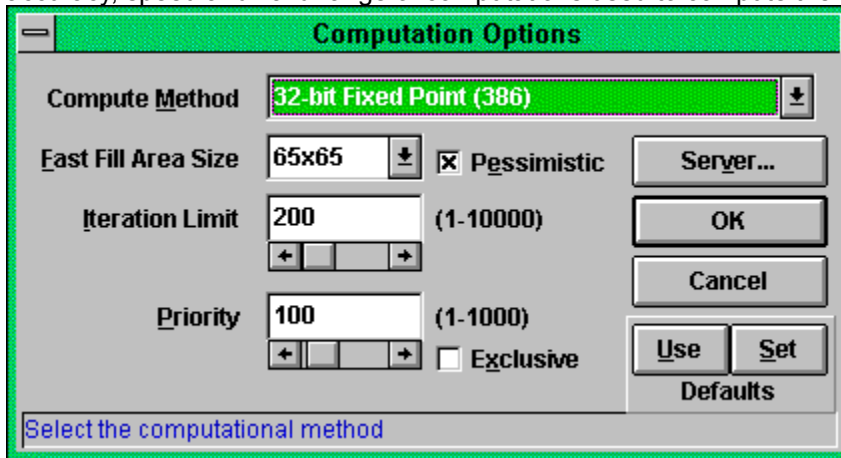
Animation Speed

256

Specifies the delay, in milliseconds, between subsequent palette animation rotations. Use large delays for rotating palettes to select a desired configuration; use small delays for a mind-bending affect.

Compute **Ctrl+C**

Displays a dialog box which allows you to specify computation options. These options determine the accuracy, speed and valid range of computations used to compute the Mandelbrot set.



Compute Method

Determines the computational method Mandel uses to compute the set. Your system may not be capable of all methods; for example, systems without a math co-processor cannot run the in-line double or floating methods. Only those methods which are available on your system will display in the combo box.

32-bit Fixed Point	Computes points of the set using 32-bit fixed-point math. The actual format uses 24 bits for the fractional part, 7 bits for the integral part and 1 bit for the sign.
32-bit Fixed Point(386)	Uses the same number format as 32-bit Fixed Point, but uses 80386 instructions for efficiency.
64-bit Fixed Point	Allows 56 bits for the fraction, 7 bits for the integer and 1 sign bit. Because of the additional add and multiply instructions, this method is about 4 times slower than 32-bit Fixed Point. However, it will allow much deeper zooming into the set.
64-bit Fixed Point(386)	Same as 64-bit Fixed Point, except that it uses 80386 instructions for efficiency.
Double Floating(Library)	Uses library routines for double-precision floating point math. Like Single Floating-Library, this is extremely slow but allows you to delve deep into the set.
Double Floating(Inline)	Uses the 80x87 math co-processor to perform the math, like Single Floating-Inline. Math co-processor required.
TCP/IP Compute Server	Communicates with a remote system over TCP/IP (Local ethernet, or the Internet) which actually performs the calculations. Depending on the speed of the compute server, this may be significantly faster than the local PC. Requires the retail version of Mandel, which includes source for the program to run on the server. See also the <u>Server Setup</u> dialog box.

Fast Fill Area Size

Here you may choose the size area Mandel uses to optimize computations. When **(none)** is selected,

Mandel computes each point in the selected grid individually. Any other Fast Fill Area Size causes Mandel to divide the grid into areas of this size. Each of these areas is partially computed (depending on the **Pessimistic** setting below); if all of these partial points are identical, then the area is filled. Otherwise, the area is sub-divided into four smaller areas, and Fast Fill is recursively attempted on each of these areas.

Pessimistic

If selected, this check box causes the Fast Fill routines to completely compute the perimeter of the area, virtually guaranteeing that the fast fill is accurate. Otherwise, only the corner and center points are computed; in this case, some loss of accuracy may occur especially at large fill area sizes.

Iteration Limit

The limit to which Mandel carries computations for each point. To start with 50 to 100 is a good range of values. The deeper you delve, the larger this limit must be to see an accurate representation. In general, areas near the set (black in most Palettes) are intricate; if edges are blunt and uninteresting, you should raise the limit for an accurate view.

For the most interesting colored views, selection an iteration limit that is a multiple of the palette size less one; for example, if the current palette has 57 colors, choose an iteration limit that is a multiple of 56.

Priority

This field selects the number of points that Mandel computes before relinquishing control to Windows. The higher the priority, the faster Mandel computes the set but the slower other applications will run.

The **Fast Fill Area Size** also affects the priority. Mandel will not release control during computation of the area. See Restrictions for details.

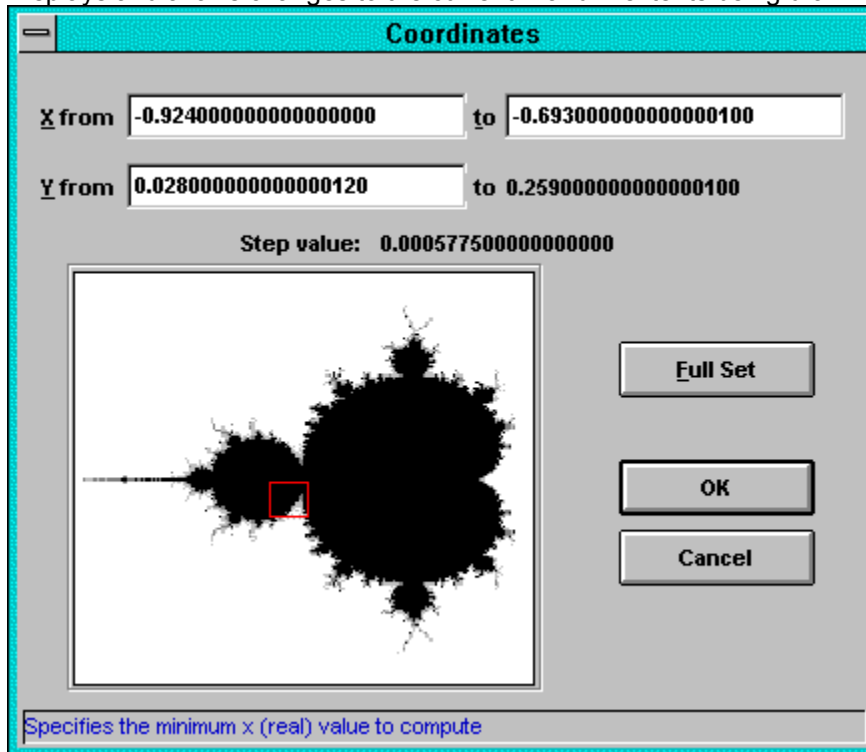
Exclusive

Checking this box will cause Mandel to take control of the system during the entire computation. No other application will run until the set is complete. Use this option with care, as there is no escape other than a reboot or the "three-fingered-salute".



Coördinates Ctrl+O

Displays and allows changes to the current X and Y extents being drawn using this dialog box:



X from

Selects the minimum value which Mandel uses for the x (real) coördinate.

X to

Selects the maximum value which Mandel uses for the x (real) coördinate.

Y from

Selects the minimum value which Mandel uses for the y (imaginary) coordinate.

Full Set

This button causes Mandel to set the coördinate values for the entire set. Mandel computes Y to and Step value based on the values given for the above and the set size, which is specified in the Display Options dialog box.

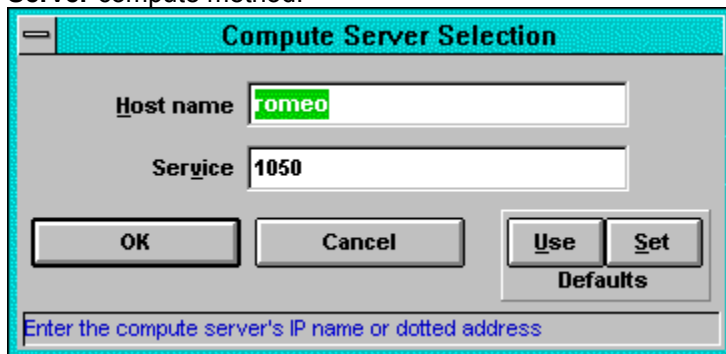
A miniature version of the Mandelbrot Set also appears in this dialog box. A red box outlines the coördinate limits if they are sufficiently far apart to see as a box; otherwise, a cross-hair indicator intersects there.

If the current window lies wholly or partially outside this representation of the set, the indicator is not accurate.



TCP/IP Server Ctrl+T

Shows this dialog box for selecting the name and address of a compute server for use with the **TCP/IP Server** compute method:



The dialog box is titled "Compute Server Selection". It contains two text input fields: "Host name" with the value "romeo" and "Service" with the value "1050". Below these fields are three buttons: "OK", "Cancel", and a button labeled "Use" and "Set" with "Defaults" underneath. At the bottom of the dialog is a text box with the placeholder text "Enter the compute server's IP name or dotted address".

Host Name

This field specifies the Internet host name or address of a UNIX system running the **mandeld** daemon. **Mandeld** is included (in portable UNIX source code format, for use with TCP/IP and *inetd*) with the retail version of **Mandel**. Mandeld must be entered in the */etc/inetd.conf* configuration file on the server.

Service

Specifies the service name or IP port number for connecting to **mandeld**. This should be the same number as entered in the */etc/services* file for the *Mandel* service.

Further information on using a UNIX compute server is included with the source for **mandeld** in the retail distribution.

Full Screen F7

This option causes Mandel to use the entire display for the set. It expands the window to fill the screen and removes all window ornamentation, including the menu bar, scroll bars and borders. The grid size is set to the size of the screen. See the Display Options dialog box for more information on grid size.

The menu bar is unavailable in full screen mode, but you can get **floating menus** by pressing **F10** or the right mouse button anywhere in the window. You will have the same options as available on the menu bar, with the addition of:

- Move to Back** Puts the window at the bottom of the display order (underneath all other windows).
- Move to Front** Returns the window to the top of the display.
- Minimize** Minimizes the window.



Statistics F8

Mandelbrot Statistics	
32-bit Fixed Point (386)	
Total Points to Compute	160000
Points Completed	86062 (100.0%)
Points Saved by Fast Fill	73938 (46.2%)
Points per Second	1955
Iterations Completed	7932217
Iterations Saved by Fill	13147862 (62.4%)
Iterations per Point	92
Iterations per Second	180277
Elapsed Time	0:44
Time Saved by Fast Fill	1:12
Close	

Displays statistics from the current or last computation, updated approximately every two seconds.

Toolbar

Ctrl+B

This menu selection toggles the Toolbar on or off.

Help Menu **F1**

Displays Windows Help for Mandel.

Keyboard

There are two keyboard modes: *Selection* and *Scrolling*. The general function of keys remains the same between the two modes, but in *Selection* mode, the keystrokes generally apply to the selection area, while in *Scrolling* mode, keystrokes apply to the currently displayed window into the set. Scrolling mode is only available when the size of the set is larger than the size of the window. (See *Automatic Window Adjustment* in the **Display Options** dialog box).

Scrolling Mode

F2	Create a selection area and enter <i>Selection mode</i> .
←	Move the viewing window to the left.
→	Move the viewing window to the right.
	Move the viewing window up.
↓	Move the viewing window down.

Selection Mode

ESC	Cancel selection mode
←	Move the selection area to the left.
→	Move the selection area to the right.
	Move the selection area up.
↓	Move the selection area down.
PAGE UP	Expand the selection area
PAGE DOWN	Contract the selection area
ENTER	Selection complete - shows the <u>Selection Buttons</u> .

Modifiers

In both *Selection* and *Scrolling* mode, the **CTRL** and **SHIFT** keys modify the action of any arrow or page key.

SHIFT	Moves or sizes by a larger increment (one-third the width or height).
CTRL	Moves or sizes by a smaller increment (a single pixel).

Accelerators

The following keys are menu accelerators. Descriptions of each item are in the **Menus** section:

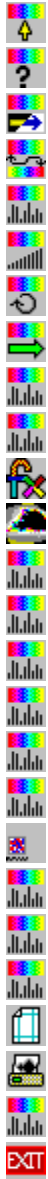
Ctrl C	Display the <u>Compute Options</u> dialog box.
Ctrl D	Show the <u>Display Options</u> dialog box.
Ctrl O	Show the <u>Coördinates</u> dialog box.
Ctrl P	Show the <u>Palette</u> dialog box.
Ctrl S	<u>Save</u> current image.
Ctrl T	Show the <u>Server Setup</u> dialog box.
F1	Show Help Contents.
F3	<u>Rotate</u> the current palette.
F4	Toggle palette <u>animation</u> .
F5	<u>Shuffle</u> the colors in the current palette.

F6	<u>Sort</u> current palette by spectrum value.
Shift F6	<u>Sort</u> current palette entries by intensity, lightest to darkest.
Ctrl F6	<u>Sort</u> current palette entries by intensity, darkest to lightest
F7	Toggle <u>Full-Screen</u> mode.
F8	Toggle display of the <u>Statistics</u> window.
F9	Execute the <u>Palette Editor</u> for the current palette.

Toolbar

Ctrl+B

The toolbar allows you to easily select many Mandel operation with the mouse. It is available in both windowed and **Full Screen** modes. Selections available from the Toolbar are marked with the appropriate button in this Help file. You can use the **Display Options** dialog box to select a floating vertical toolbar rather than the default horizontal toolbar.



Select a **Palette** from the palette file.

Create a random color palette

Invert the colors in the palette.

Reverse the order of colors in the palette.

Shuffle colors.

Sort colors by spectrum.

Rotate colors.

Animate palette. **256**

Paste a palette from the clipboard.

Edit the current color palette. **256**

Select a **Special Effect**.

Switches between the **Effects** and normal images.

Selects the entire image for copy, spawn or zoom.

Display and select **Coordinates**.

Select **Compute** options.

Select **Display** options.

Select a **Server** for network computation.

Show **Statistics** of the current image.

Minimizes **Mandel**.

Toggles **Full Screen** mode.

Save the current image.

Open a saved image.

Page Setup for printing.

Print the current image.

Get **Help**.

Exit the Mandelbrot program.

Selecting and Zooming

A portion of the image may be selecting by dragging the mouse or via the **Keyboard**. The shape of the selected area is constrained by the dimensions of the current window.

To select an arbitrary area to copy to the clipboard, hold the **CONTROL** key while selecting. To select from the center outward, hold the **SHIFT** key while selecting. Once an area is selected, a set of buttons will appear:



Zoom

Zooms in, in the current window, to the selected area and re-computes for that area.



Spawn

Zooms in, in a new window, to the selected area and computes for that area. Current options, such as selected palette, are passed to the new window.



Copy

Copies the selected area to the clipboard in DIB (Device-Independent Bitmap) and Bitmap formats. The current palette is also copied.



Cancel

Cancels the select operation and removes the selection rectangle.

Effects

Select

Show

Select

Allows you to select a method of special effects, which uses a generated image to produce a more interesting representation of the Mandelbrot set. Currently, two effects are implemented:

Perspective

Allows you to generate the appearance of a tilted flat plan extending into the distance, with 3-D (up or down) effects also.

Edge Tracing

Traces the boundaries between colors. Great for kids to color!

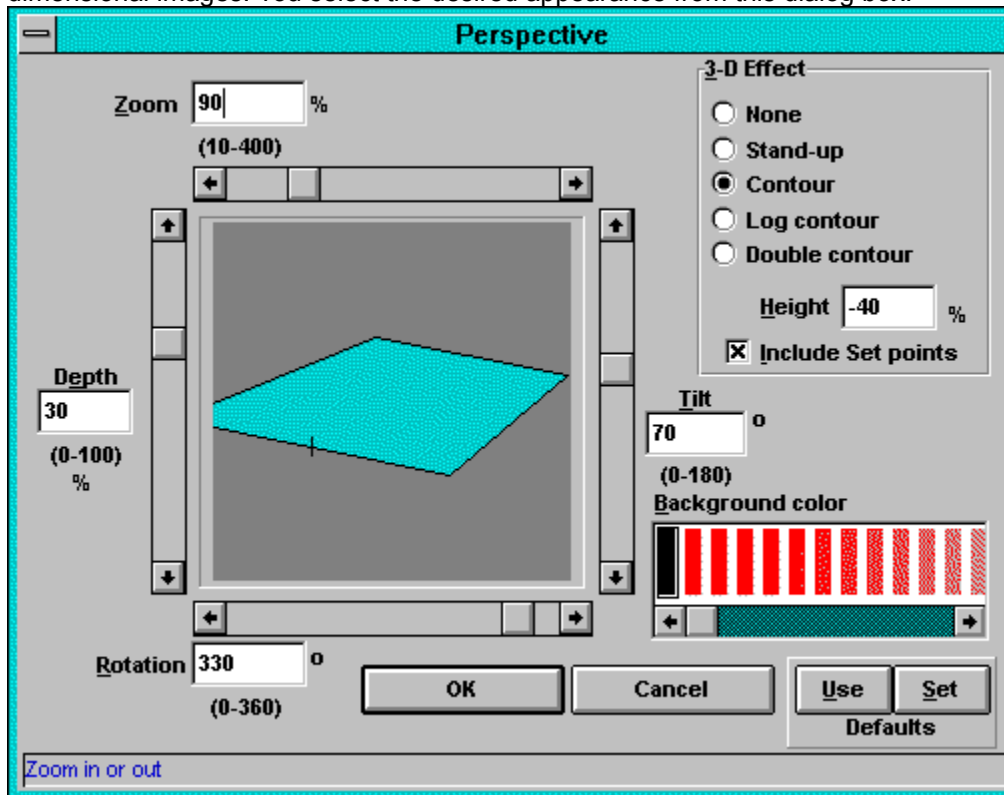
Selecting **Overlay on previous effect(s)** determines whether the effect is applied either to the computed image or layered on a previously "effected" image.



When **Mandel** creates a special **effects** image, the original computed image is not lost; this selection (or double-clicking with the left mouse button) switches back and forth between the original and the "effected" image.

Perspective

This special effect can create images which appear to recede into the distance, and can also make three-dimensional images. You select the desired appearance from this dialog box:



Zoom

Selects how much to zoom in. Note that zooming in too far (more than 150% or so) may cause the image to look boxy.

Depth

Sets the amount of depth cue. The back side (top) of the image is reduced by this percentage so that it appears to recede into the distance.

Tilt

Specifies the angle (in degrees) of tilt from vertical. Should be used in combination with Depth and/or Rotation.

Rotation

Selects the angle of rotation. The apparent plane will be rotated clockwise this many degrees. Should be used in combination with Tilt.

3-D Effect

While rotating, tilting, zooming and depth-cueing the image, Mandel will set the apparent height of points using the selected 3-D effect. Each of the available 3-D effects is described below.

None No height adjustment made.

Stand-Up Mandel draws a line from the perspective point upward or downward to

	the height-adjusted point.
Contour	Mandel plots the height-adjusted point only, giving a contour map appearance.
Log Contour	Mandel computes the height adjustment using the logarithm of the color value rather than the color value itself. This produces more even contours.
Double Contour	Mandel plots two points for each image point: one above the plane and one below.
Height	Specifies the maximum adjustment height (as a percentage of the height of the original image) for the effects described above.
Include Set Points	Unless this box is selected, Mandel does not apply the 3-D effect to the points which are contained in the set. If you select this option, it usually looks better if you also select the Background Color .

Background color

Selects the background color for the perspective image, which is used for any points not plotted. The default background color is the same as the set points (the first entry in the palette).

Edge Tracing

This effect traces the boundaries between different color values of the current image. I use it to generate images to print for the kids to color. It also produces better-looking printed images on printers that cannot dither or those that do not provide many levels of gray.

Restrictions

Sorting colors after **animating** or **rotating** with **Wrap Palette** off (in the **Palette** dialog box) may result in the loss of some colors.

Priority (in **Compute Options**) translates to the number of points to compute on each pass; consequently, slower computational methods may effectively take over the machine at relatively low priorities.

When you select **Fast Fill** optimization in the **Compute Options** dialog box, Mandel will only release control between areas; thus, selecting a 33x33 fast fill area will result in an effective priority of at least 128 to 999 (4x-4 to x2), depending on the complexity of each area.

Palette **Animation** is extremely slow on ATI Wonder Super VGA cards using the WindowSTM 3.1 drivers. The WindowSTM 3.0 drivers animate properly, even under 3.1.

In the **Coördinates** dialog box, if the current window lies wholly or partially outside the representation of the set, the box or hairline indicator is not accurate.

The **Palette Editor** will not allow you to paste beyond the current select range; there is no way to add colors to a palette except one at a time.

The **Current range** and **Full palette** controls in the **Palette Editor** have no keyboard interface you have to use the mouse.

Error Messages

Here is a list of error messages that Mandel reports with a more complete description of the problem.

Are you sure you wish to delete 'PALETTE'?

Asked to verify that you really want to delete a palette from the file.

Can't create file 'FILENAME'.

For some reason, Mandel could not create the file as requested. Check that the drive and directory exist, that the file name is valid, and that there is free space on the drive.

Can't link to Wollongong socket library (SOCKDOS.DLL).

This version of Mandel only supports Wollongong TCP/IP, and Wollongongs library (SOCKDOS.DLL) must be in one of these places:

1. In the directory with MANDEL.EXE.
2. In the Windows System directory (usually C:\WINDOWS\SYSTEM).
3. In any directory specified in the PATH environment variable.

Can't load Toolbar resource

Either memory conditions are very low or MANDEL.EXE has been damaged.

Can't load TouchHelp resource

Either memory conditions are very low or MANDEL.EXE has been damaged.

Can't subclass control in dialog box for TouchHelp

Mandel could not initialize support for TouchHelp.

Can't open clipboard.

The clipboard may be locked by another application.

Can't open file 'FILENAME'.

The file may be locked for exclusive access by another application, or may be opened from a DOS box.

Can't read palette number NUMBER from palette file

Either an IO error or modification of the palette file by another Mandel instance could cause this error.

Can't write to file 'FILENAME'. Check disk space.

Probably the disk is full, or there could be a disk error.

Cannot connect to 'HOST'

The specified TCP/IP host did not respond to the request to attach to the service. Ensure that all network settings are correct and that **mandeld** is correctly entered in the hosts **inetd.conf** file.

Cannot set socket options

Could be caused by a very old version of Wollongong TCP/IP.

Computations are not complete. Are you sure you want to PRINT,SAVE?

Mandel has not completed computations. Just to make sure you really want to do what you picked.

Error loading accelerator key definitions.

MANDEL.EXE has probably been damaged, or the system is very low on memory.

Error writing to palette file

The disk is full or reported an I/O error.

File 'FILENAME' is not in Mandel format.

Mandel could not locate the proper signature in the file you tried to open. It was either not written by Mandel or has been damaged.

Illegal value specified.

You must specify a value in the proper range. The edit box in error will have the caret after you press OK.

Insufficient memory to perform requested operation.

Mandel could not allocate enough memory to do what you asked. Try closing other applications.

Invalid host name 'HOST'

The host name specified is empty, too long or contains invalid characters.

Invalid limit; must be in the range LOW - HIGH

The iteration limit must be in the quoted range.

Invalid palette name

The palette name is empty or too long.

Invalid priority; must be in the range LOW - HIGH

The priority must be in the quoted range.

Invalid service 'SERVICE'

The service name speified in the Server dialog box has no entry in the **services** file in the Wollongong directory.

MANDEL.EXE is damaged -- cannot extract resource 'RESOURCE'.

MANDEL.EXE is corrupted, either by disk or communication errors, or by tampering with a resource modifying program. Restore from backup or download again.

Network read error

The read operation over the network failed. May happen if the **mandeld** daemon fails or is killed on the host system, or may indicate a configuration or network problem.

Network write error

The write operation over the network failed. May happen if the **mandeld** daemon fails or is killed on the host system, or may indicate a configuration or network problem.

No available TCP/IP sockets

All configured Wollongong TCP stream sockets are in use. Exit other network applications and try again.

No palette entries found.

The palette file is empty. You may delete it from the disk, in which case Mandel will create a new one with the distributed palettes.

No Windows timers available.

Mandel uses a windows timer for palette animation. Exit other applications which use timers and try animating again.

Palette 'PALETTE' already exists; do you wish to overwrite?

If you attempt to save a palette whose name already exists in the palette file, you must confirm that

you want to overwrite it.

Print dialog failure (code=CODE)

The attempt to initialize the Windows PRINT dialog box failed.

Step value below minimum; set to VALUE. Do you wish to change the compute method?

The step value needed to compute the selected area is too small to be represented in the number format used by the compute method you have selected. If you select YES, you will see the **Compute Options** dialog box, where you may select a different compute method. If you select NO, Mandel will recompute the maximum X and Y values based on the minimum step value.

The selected printer cannot render bitmaps

You have asked Mandel to print on a printer which is not capable of printing bitmap (raster) images, such as a plotter or a band printer. Select a different printer.

This option requires a palette-based (256-color) display

Some options, such as palette animation and palette editing, require a 256 or more color display adapter and driver. If your display is capable of 256 colors, make sure the Windows display driver you are using is 256 or more colors. Use **Windows Setup** to change the display driver.

Unable to access DIB or Set memory.

Probably received after an Out of Memory error, since Mandel could not allocate memory for the image.

Unable to access printer

Mandel could not send data to the driver for the selected printer. Make sure it is set up correctly from **Printer Setup** in the **Control Panel**.

Unable to create Toolbar window

Mandel was unable to create the window for the toolbar, either because of low memory conditions or scarce system resources.

Unknown host name 'HOST'

The host name specified in the **Server** dialog box is unknown. Check the Wollongong documentation for information on setting up hosts.

Unknown service 'SERVICE'

The service name specified in the **Server** dialog box is unknown. Check the Wollongong documentation for information on defining services.

Ordering Information

Mandel is distributed as uncrippled shareware. I have avoided unnoxious reminders, but please remember to support Shareware authors by registering the products you use. To register and receive the latest version of **Mandel**, please send **\$25.00** to:



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**Producing outstanding systems and technical software
to satisfy unique and unusual demands.**

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