

NCSA Audible Image for Microsoft Windows



Introduction

NCSA Audible Image for Microsoft Windows is a visualization tool for use in the Microsoft Windows 3.0 environment. Image can load and display Windows BMP and HDF raster images in a MDI display window. HDF animations are also able to be loaded and displayed. This current release is considered an alpha release, and may be quite buggy (but probably should run fine). A 80386 or greater CPU is required, as is a graphics board capable of displaying 8 bits per pixel. The following sections of this document detail how to use the features currently available in Image.

Loading a File or Animation

To load an individual file (as opposed to an animation, which is composed of many files) choose the **Open** option from the **File** menu. This option pops up a standard Windows file browser, from which you may choose a BMP or HDF formatted file to load into Image. Image defaults to loading HDF formatted files

currently. To change the file format to load, click on the **Format** button and choose the new format from the options presented. When the correct file and file format is selected in the browser, press the **Open** button and the image file will be loaded into an Image MDI window. To load an animation, choose the **Animation** option from the **File** menu. This option also pops up a standard file browser, but the method for selecting the file to animate is slightly different. All the files to animation must be the same resolution, stored in individual HDF files and also be stored in the same directory. To load an animation into a window, select one file from the files to animate and make certain that the HDF format is chosen, then press the **Open** button. This action will load all the files in the directory the file was selected in. The files in the directory are alphabetically ordered in the animation to be displayed. Displaying the animation forward or backward is controlled from the Animate menu (documented in a further section).

Edit and Vis Menus

Currently, these menus are not connected, and may produce strange results if the copy and paste options are selected from the Edit menu.

Animate Menu

The ***Animate*** menu controls all the animations displayed on the screen. To make animations progress forward through the frames

loaded, choose the ***Forward*** option, and likewise choose the

Backward option to progress backward through the animation frames.

These options can also be used while an animation is in progress to

reverse the frame direction. Choosing the ***Stop*** option stops all the animation displays.

The animation frame rate will initially be quite slow, because

the files are being loaded and flipped (HDF files store images from the

top down, and Windows displays images from the bottom up). After

all the animation frames have been loaded, the animation frame rate

speeds up quite a bit, usually a factor of two or so.

Sonification

The sonification extensions made to Image for the PC release

function primarily as mouse exploration tools. Selections may be captured,

sonified in a number of ways, and replayed at will. Selections may also be

sonified during an animation, resulting in a data-created "soundtrack."

This section will outline how to utilize the sonification extensions.

Hardware

There is only minimal support for the PC's built-in speaker in Image. The

built-in speaker is incapable of producing all but the simplest of

sounds with acceptable sound quality, and the monophonic nature of the PC speaker makes it incapable of producing the sort of multi-dimensional sound the sonification extensions are intended to create. For this reason, MIDI (Musical Instrument Digital Interface) was chosen as a relatively low-cost (but flexible) sound-production mechanism- in particular, Roland's MT-32 and its successors, the LAPC-1 and the CM-32L synthesizers are supported. Actual development was done using a CM-32L. These synthesizers are capable of producing up to nine tracks of sound at a time, with 32 voices playing simultaneously. Any multi-timbral MIDI synthesizer may be used with the sonification extensions; however, configuring a system using a different synthesizer may require considerable knowledge on the part of the user. A Roland MPU-401 (or compatible) interface is required to connect the MIDI synthesizer to the computer.

Sonification Tools

The sonification tools are accessible from both toolboxes and menus. There are three toolboxes: the ***Sonify*** toolbox, which selects the sonification tools, the ***Statistics*** toolbox, which selects which statistics will be sonified, and the ***Patch*** selection toolbox, which allows selection of alternate patches on the MIDI synthesizer.

These toolboxes can be made visible from the ***Sonify*** menu, present at the top of the main window. If no MIDI interface is present, the ***Patch*** menu is unavailable.

The **Sonify** toolbox contains the basic interface to the sound tools: the first panel, labelled **Capture**, contains the radio buttons for the type of selection to be captured. Only **Captured** selections (paths and areas) may be **Replayed**.

Point - the captured selection is a point, represented by a large dot. Only the pixel in the center of this dot is sonified. The point is captured when the left mouse button is pressed in an image window.

Freehand - a line may be traced out with the mouse freehand. The line contains all points the mouse cursor passes over while the left mouse button is pressed. The mouse cursor is constrained to only move one pixel at a time, so that a continuous line will be drawn.

Polyline - a polyline may be drawn with the mouse. The path contains all points in the polyline. Click the left mouse button once in the image window to begin a polyline, and then click the left button again at each additional vertex. Click the right button to terminate the polyline.

Area - an area can be captured for statistical analysis. Click the left mouse button and drag the rubberbanding box around the area to be analyzed.

None - No selection will be captured. The cursor will move freely through the image and produce sound, sonifying sampled data beneath the cursor. Even though the path is not being captured, all of the sound tools except Anim and Stats are available. If **None** is selected, it is impossible to **Replay** the

selected **Sound**, since the data is not being captured for playback.

The next panel is the **Sound** panel, which uses checkboxes to identify the selections available for sonifying data. These tools may be used in any combination: only one may be turned on, two may be turned on, or all of them may be turned on if desired. If none are selected, no sound will be heard. Note that some selections are not available for some Capture types; unavailable selections are greyed out in the selection panel. The selections are as follows:

Discrete - The sound produced is a standard "note" - i.e., G sharp, C, etc., which is played for a short time interval. The data is mapped across a range of 64 note values.

Continuous - The data is mapped across a four-octave range, and the pitch of the synthesized voice is varied across this range, creating a smooth frequency change, with much greater resolution than the Discrete sound tool.

Gradient - This tool produces a high-pitched "click" if the data has increased from the last data value, or a low-pitched "click" if the data value has decreased. If the data value is unchanged, no sound is produced.

Contour - The data range (that is, the range of the palette - 0-255) is divided into eight equal "regions" - whenever the data value (the point underneath the cursor) crosses one of the seven boundaries, a sound which is pitch-mapped to the data range being entered is played.

Animation - When this box is checked, animations will be sonified. This has various effects, depending on which **Capture** type is currently selected. For **Point**, the sound is a pitch-mapped note which represents the value, equivalent to the **Discrete** tool. If **Freehand**, **Polyline**, or **Area** is selected, any of the statistics which are checked will be heard (See the section on the **Statistics** dialog box for more information on this.)

Statistics - This function sonifies (and displays) one or more of the following statistics: Minimum, maximum, mean, median, and mode. A sonic "histogram" may also be selected. These selections are made in the Statistics toolbox, or from the menu.

Underneath these two panels are buttons marked **Replay**, **Replay Evenly**, and **Stop**. These buttons allow the user to repeat the sonification of a path, point or area selection with the same settings, or even to alter the sound tools selected and replay the captured selection. For example, a **Freehand** line captured with the **Gradient** tool selected will sonify the increases and decreases in the data. Then, the **Gradient** tool could be deselected, the **Continuous** tool selected, and the **Replay** button pressed. The captured path will be sonified as if the user

had re-traced it with the **Continuous** tool selected instead of the **Gradient** tool.

The **Replay Evenly** option differs in that the path is traversed with a set time interval between data values. This time interval may be set from the **Mapping**

Controls dialog box (see the last section, which explains the **Mapping Controls** dialog box). **Stop** will halt any selection currently being replayed. The **Hide** button will hide the **Sonify** dialog box.

The **Statistics** dialog box contains the selections for statistics to be sonified, both statically and during animations. The first selection, **Histogram**, allows a "sonic histogram" to be heard- this histogram will play through all the data values present in the area or path, playing a sound that is pitch-mapped to each data value and volume-mapped to the number of occurrences of that data value in the area or path. This means that a value with a low frequency count will be played much more softly than a data value which occurs many times. Any values that do not occur in the captured section will not be played at all. The other five selections in this dialog box (**Min**, **Max**, **Mean**, **Median**, and **Mode**) will play a note that is pitch-representative of that particular statistic in the captured selection. Any number of these options may be selected. If a static image is being analyzed, selected statistics will be heard, with gaps of .5 seconds between each note being turned on. As each statistic is sonified, the mouse cursor will change to represent the statistic currently being added to the chord. If statistics

are being played during an animation, there will be no gaps between the beginning of notes, and the notes will sound like a single chord per frame of animation.

The **Patch** selection dialog box will only be available if a MIDI interface is present. This dialog box allows selection of any of the preset patches to be selected for the following tools: **Discrete**, **Continuous**, **Contour**, **Histogram**, and **Statistics**. The default values are the voices which we have chosen for the MT-32 series. NOTE: the **Contour** and **Histogram** tools do **NOT** send MIDI "note off" messages, so the patches for these tools should have a fast attack and a quick decay if the patches are changed from the default values. The **Mute** button is provided to send the MIDI "All Notes Off" message on all channels, which will silence any errors in patch selection.

The **Mapping Controls** dialog box is used for options that usually do not need to be accessed on-the-fly- currently, the only functional options are **Speed** and **Output**. **Speed** allows you to select the number of milliseconds between path locations when **Replay Evenly** is pressed: for example, if a larger number is selected, a path that is **Replay Evenly**'d will play back more slowly. The **Output** box allows the user to select whether the output is sent to the PC's internal speaker or a MIDI interface (if present). If no MIDI interface is present, the user will not be able to select **MIDI**.

Notes for Use

Currently, the only tool that functions properly on the PC speaker is the **Continuous** tool, using the **None** Capture type. Most of the

other functions are
not yet implemented on the standard PC hardware - this may be
implemented if
demand warrants.

All functions available from the sonification dialog boxes are also
available from
the **Sonify** pull-down menu.

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