Envision Toolbox Manual

Chapter 2

Animate

Chapter 2 - Animate

Figure 1: The animate program is used to sequence through images that have multiple frames. Here, the "baby" sequence is used ($SAMPLEDATA/data/sequences/marine_movie.xv, shorthand "sequence:baby").

A. Introduction

The animate program is an interactive image sequence display tool. This application allows you to input an image that contains multiple frames and sequence through those frames. Alternatively, you may provide a basename that describes a set of single band images located in the same directory, and use these as input to animate.

The features provided by animate include:

- Forward and reverse sequencing.
- Different sequencing mechanisms (looping, single stepping, auto reverse).
- Variable sequencing speed.
- Optional display of frame number
- Input of single files containing multiple frames, or sets of files containing one frame each.
- Clip masks

- Alternate colormap file
- Autocolor operations
- Normalization of colormaps, application of functions to colormaps
- Generation of new data sets for animation

Animate can be executed from within cantata, or directly from the command line. When using the command line interface, a single multiband image or a set of single band images must be specified at the time of execution. This is done by providing one of the [-i filename] or [-base basename] option flags.

A.1. Overview of the Animate Graphical User Interface

The master form of animate displays the sequence animation in a workspace. Above the workspace are "License", "Help", and "Quit" buttons, from which one may access the license agreement, display online help pages, and quit the program, respectively. To the left of the workspace are two subform buttons labeled "Files" and "Options". Above the workspace are five buttons that allow you to sequence through the animation.

Use the "Files" subform button to display the "Input Files" subform. From this subform, you may input a new multiframe image, or a new basename describing a set of single frame images to be used as animation data. The "Input Files" subform also allows you to enter a clip mask to be used with the animation sequence, or a file containing a colormap to be applied to the sequence.

A number of other features are available from the "Options" subform, which contains five panes: "Attributes", "Display", "Animate List", "Colormaps", and "Function".

The "Attributes" pane of the "Options" subform lets you set animation sequencing to looping, single-step, or autoreverse. This pane also lets you control whether or not the frame number is displayed, and allows you to set the frame speed.

The "Display" pane of the "Options" subform gives you control over the colormap that is used with the animation; the colormap may be normalized, and you can set which of the map columns is associated with the red, green, and blue "guns" of the display. You can even define the red, green, and blue values displayed to be a function of the map values if desired.

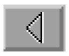
The "Animate List" pane of the "Options" subform provides a list of the input files that have been used in any particular animate session, for quick reference. The "Animate List" pane can also be used to go directly to a particular frame in the sequence.

The "Colormaps" pane of the "Options" subform offers a number of predefined colormaps that may be automatically installed on the displayed image sequence.

The "Function" pane of the "Options" subform allows you to create new data sets for use in sequence animation.

A.2. Running the Animation

Above the workspace in which the animation is displayed are five buttons that are used to control the animation sequencing. These buttons display pixmaps that represent reverse, single-step reverse, stop, single-step forward, and forward, respectively.

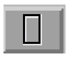


Reverse

When this button is pressed, the image frames will sequence automatically in the reverse direction. When "Animation Control" is set to 'Loop', the sequence will be repeated continuously. When "Animation Control" is set to 'Single', the sequence will be displayed only once.

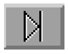
Single-Step Reverse

Each time this button is pressed, the last image frame will be displayed. This represents single step in the reverse direction.



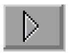
Stop

This button when pressed will stop the image frames from being sequenced. When any other sequencing direction button is pressed the sequencing picks up from where it left off.



Single Step Forward

Each time this button is pressed, the next image frame will be displayed. This represents single step in the forward direction.



Forward

When this button is pressed, the image frames will sequence automatically in the forward direction. When the "Animation Control" toggle on the "Options" subform is set to 'Loop', the sequence will be repeated continuously. When "Animation Control" is set to 'Single', the sequence will be displayed only once.

When sequencing through the frames in an image, the last frame is considered to be adjacent to the first frame. Thus, if the last frame is displayed when the user is single stepping with a looping sequencing mechanism, the first frame will be displayed on the next step.

A.3. Command Line Arguments

Animate can be executed from within cantata, or directly from the command line. When using the command line interface, an image must be specified at the time of execution. This is done by providing the [-i filename] option flag, specifying the multiframe image containing the frames to be animated.

Alternatively, you may provide a basename that describes a set of single frame images located in the same directory, and use these as input to animate. For example, you might have a directory called "frames" that contains 30 single frame images named "frame.01" to "frame.30". In this case, the *basename* would be, `frames/frame.` -- in other words, the part of the directory path and filename that all the images to be input have in common. In this case, the single frame images are combined into an internal multiframe image before being sequenced through as they would in the first case.

The minimum syntax specification to run animate from the command line is:

```
% animate -i filename
```

or

```
% animate -base basename
```

You will be immediately prompted to place the animate master form. The animate master form will have a workspace attached beneath it, in which the image specified will immediately be displayed.

The program-specific arguments for animate are as follows. Note that animate also supports the 10 standardized Khoros arguments for xvroutines, which are covered in the Introduction.

```
% animate
  [Optional Mutually Exclusive Group - Specify one or none of the 2 options:]
    [-base] (string) Basename for a Set of Image Files
    [-i]    (infile) Filename of Input Object Containing Multiple Images
  [-c]          (infile)  Filename of Input Object with Clip Mask
  [-cmap]       (infile)  Filename of Input Object with Alternate Colormap
  [-use_cmap]   (boolean) Use colormap?
                (default = true)
  [-update]     (float)   initial update time
                (update > 0.0, default = 0.25)
```

[-i {image sequence filename}]

This is the input data object that contains the frames to be sequenced. Frames may be organized down depth, time, or elements.

[-base {basename}]

This argument allows you to provide a basename that describes a set of single band images located in the same directory, and use these as input to animate. For example, you might have a directory called "frames" that contains 30 single band images named "frame.01" to "frame.30". In this case, the *basename* would be, `frames/frame.` -- in other words, the part of the directory path and filename that all the images to be input have in common. In this case, the single band images are combined into an internal multiband image before being sequenced through as they would in the first case.

[-c {clip mask filename}]
If desired, a bit image may be input and used as a clip mask. When an image is used as a clip mask for the currently displayed image, the only part of the current image that will appear normally is that part defined by the pixels in the clip mask image that have a value of (1). All other parts of the current image will appear in the background color of the image window. It must be specified as "-c filename" where the file provided is a Khoros viff file of data type bit.

[-cmap {data object w/ alternate colormap}]:
If desired, another image may be input, and its colormap will be used with the currently displayed image, instead of the currently displayed image's colormap.

[-use_cmap {t/f}]
While the default action of animate is to use the colormap associated with the currently displayed image, no colormap is required to be used. If the colormap associated with the currently displayed image is not wanted, AND the "-cmap_image filename" is not used, specify "-use_cmap 0", or "-use_cmap false". In this case, the default colormap associated with the screen on which animate is being run will be used.

[-update {update time}]
Suppose that while you are displaying an image with animate, the data object containing frames that are currently displayed is over-written. Animate will automatically register the fact that the data object has changed, and update the displayed sequence accordingly. Using this argument, you can determine how often the input file is checked for any potential modifications. It must be specified "-update floatvalue", where floatvalue is a floating point value which must be greater than zero.

B. The Files Subform

The "Files" subform allows you to input new files to be used with animate.

B.1. Multiframe Input File

This input file selection allows you to input a new multiframe image for sequencing. The new input image may be entered manually in the text parameter box to the right of the "Filename" label; alternatively, you may use the file browser to select an input file. To activate the file browser, click the left mouse button on the "Filename" button. If you use the browser to enter the filename, simply wait for the input image to be read in after selecting an input image. If manually entering the filename into the parameter box next to the "Filename" label, hit <cr> after entering the filename correctly. Remember that an input image to animate must be a multiframe image.

B.2. Basename for Input Files

An alternative to using a multiframe image with animate is to instead provide a *basename* that specifies a set of single-frame images, where each of the single-frame images is named similarly, with a numerical extension, as in "my_sequence.01", "my_sequence.02", my_sequence.03", and so on. The single images will be combined into a sequence in alphabetical order. If you have a group of more than 9 but less than 100 images, all named, for example, "my_sequence.x" where x is the sequence order, you will have to make sure that x starts with "01" through "09". This is because *alphabetically*, "my_sequence.1" will be followed by "my_sequence.10", producing an incorrect sequence order unless you follow the convention where files 1-9 have extensions "01" through "09".

B.3. Clip Mask Input File

If desired, a bit image may be input and used as a clip mask. When an image is used as a clip mask for an animation sequence, the only part of the sequenced data that will appear normally is that part defined by the pixels in the clip mask image that have a value of (1). All other parts of the current frame will appear in the background color of the image window. Note that clip mask always work best when they are of the same size as the input data. `$SAMPLEDATA/data/masks/` contains two images that make good clip masks. To get a clip mask to go away, NULL out the "Clip Mask" parameter, and hit <cr>.

B.4. Colormap Input File

This feature allows you to use a different colormap with the images being displayed, other than the one that is included in the data object which describes the frames. This feature is often useful if you have developed a data object containing only a colormap, and wish to install it on various images. Colormaps from other images can also be used with the input image.

Each time you provide a new filename for "Colormap Input File" and hit the <cr> key, the new colormap is installed on the input sequence. To restore the original colormap, enter the same filename as that which is being used for the input frames.

B.5. Multiframe Output File

This output file selection allows you to output the currently displayed data set as a multiframe image for sequencing. It is most often used after a new data set has been created with a function, using the "Function" pane of the "Options" subform. If any autocolor procedures or colormap operations have been performed on the data set, the colormap output will reflect them.

C. The Options Subform

The "Options" subform provides access to five panes:

1. The Attributes pane, which allows you to control various features of the sequencing procedure, including animation speed and sequencing type.

2. The Display pane, which allows you to perform various operations on the colormap, such as normalization, display of different map columns as red, green, and blue, and displaying functions of map columns as red, green, and blue.

3. The Animate List pane, which provides a history of the input files that have been used in a particular session with animate, and lets you display a particular frame directly (bypassing the sequencing mechanism).

4. The Colormaps pane, which provides access to a number of predefined colormaps which may be installed automatically.

5. The Functions pane, which allows you to create new data sets for animation.

C.1. The Attributes Pane

The "Attributes" pane allows you to control various features of the animate program, including animation speed and sequencing type.

Animation Control

This sequencing mechanism is a toggle between 'Loop', 'Single' and 'Autoreverse'. When 'Loop' is selected, the image frames will be sequenced in a continuously repeating loop. When 'Single' is selected, image frames will be displayed in order only once. When 'Autoreverse' is selected, the entire set of image frames will be displayed in one direction, and then in the opposite direction; the sequence will continue to play back and forth.

Animate Down

Animate supports a variety of ways in which image frames may be traversed. Image frames may be organized down elements, depth, and time, or any combination of the three. Animate will traverse first down depth, then down time, then down elements. The number of frames considered to be included in the image is computed with (depth * time * elements), when each of these flags is selected. If the frames are not organized down elements, for example, turn this flag off. See Chapter 1, "Introduction" of the Programming Services Manual, Volume II, for more details on the use of depth, time, and elements.

Show Frame Number

Regardless of which of the above sequencing methods you choose, it is often helpful to have the frame number of each data frame displayed. When this logical selection is set to "True", the frame number of the currently-displayed data frame will appear in the upper left hand corner of the display window.

Frame Speed

The speed field controls how fast the frames in the image are to be sequenced. The speed may be set by typing a value between 0 and 5 in the box, or may be selected by moving the scroll bar to the right of the speed field back and forth. The speed is in seconds, where 0.0 is as fast as possible on your machine, and 5.0 is very slow. Note that 1/60 sec = 0.016 (normal frame rate for TV). We DO NOT recommend that you set the frame speed to 0.0 in most situations, as this intensive operation will often make it extremely difficult to re-gain control of the graphical user interface.

C.2. The Display Pane

The "Display" pane of the "Options" subform allows you to control the appearance of the image by changing the way the red, green, and blue values of the map columns are displayed.

First, it is assumed that the image being displayed has a minimum of three columns in its map data. Thus, the capabilities offered here are not very useful with bit images. Grey scale images are considered to have three identical map columns, with incremental values ranging from 0 to 255; thus, while it does "make sense" to use the capabilities on this pane with grey scale images, operations will not make a great difference in the appearance of the image.

At a minimum, to take advantage of the capabilities on this pane, it is necessary to have an input images with a standard colormap, where each pixel value in the value data indexes into the three map columns, where the first map column specifies the red values of the pixels, the second map column specifies the green values of the pixels, and the third map column specifies the blue values of the pixels.

A much greater amount of functionality can be obtained with images that have specialized map data, for example, those images produced by clustering algorithms used as input to spectrum, where there are many map columns in the map data, and there is not a specific rule for which map columns will dictate the red, green, and blue values of the colormap displayed.

C.2.1. Colormap Normalization

Then, set the "Type Of Normalization" to "Global" or "Local". With local normalization, the normalization procedure is performed locally using the maximum and minimum values of each of the red, green, and blue map columns. For example, if the minimum and maximum values in the red column are 0 to 1, and the minimum and maximum values in the green column are 100 to 200, the red column will be normalized such that the value 0 stays 0, but the 1 value becomes 255, while the green column will be normalized such that the 100 value becomes 0, and the 200 value becomes 255. For global normalization, the normalization procedure is performed globally over all of the three columns displayed as red, green, and blue. Thus, with global normalization, if the minimum and maximum values over all the red, green, and blue columns are 1 to 200, all three map columns will be normalized such that 1 becomes 0 and 200 becomes 255.

Finally, use the "Normalization Method" toggle to specify the method of normalization you prefer. When normalization is to be performed, this attribute defines the algorithm which is used in normalization. Normalization may be a simple stretch over the values that may be displayed on your workstation, or any of three variations on a standard deviation normalization may be used. For a simple normalization of values to within displayable intensity bounds, use "0 <= values <= Max Colors". Alternatively, images can have contrast increased or reduced using on of the standard deviation normalizations. "-1*(std.dev) <= values <= 1*(std.dev" will normalize values to within 1 standard deviation, "-2*(std.dev) <= values <= 2*(std.dev)" will normalize values to within 2 standard deviations, and "-3*(std.dev) <= values <= 3*(std.dev)" will normalize values to within 3 standard deviations.

C.2.2. Changing the Map Columns Displayed as Red, Green, Blue

By default, an image with a colormap has the first map column defining the red values of the colormap, the second map column defining the green values of the colormap, and the third map column defining the blue values of the colormap. However, when the input image has more than three map columns present, it is useful to be able to change which of the map columns are providing the values for red, green, or blue.

Clicking on "Change Red Map Col", "Change Green Map Col", or "Change Blue Map Col" will pop up a list of the map columns stored in the input file. You may then choose the map column that is to provide the colormap values for red, green, or blue.

By default, the red, green, and blue map columns are set to the first, second, and third map columns, producing the results that you would normally expect for an image with a colormap.

C.2.3. Defining Functions of Map Columns To Define Red, Green, Blue

With images having colormaps made up of more than three columns, such as those produced by clustering algorithms, it is often informative to be able to apply a function to the values in those map columns in order to define the values that will be displayed as each of the red, green, and blue columns. For example, in an image having 6 map columns, you might define the red intensity of pixel 10 as (map column 2)[10]+ (map column 3)[10]/ (map column 4) [10]. In this case, the "RED", "GREEN", and "BLUE" string selections may be used to define the function to be applied in order to produce the values that will be used as red, green, and blue. Functions must have *only* variable *M*, where *M* stands for "map column"; following each *M* must be a number *starting at zero* and ranging to *N-1*, where *N* is the number of map columns available in the image. For example, a valid function for red might be:
(M2 - M3)/(M2 + M3)
or
(M0 + M1 + M2)/(M3 - M4)
Equation evaluation follows the standard rules of precedence; evaluation proceeds from left to right, and use of parentheses is fully supported.

In a more simple use, equivalent to using the "Change Red Map Col", "Change Green Map Col", and "Change Blue Map Col" buttons, the red, green or blue functions may also be set to represent the map column which is to be used to specify the red, green, or blue values of the pixels in the image. For example, if you wanted the fourth map column to define the red values of the pixels in the image, (remember that map column numbering begins at 0), you could set the "Red" function to:
M3
You can also set the "RED", "GREEN", and "BLUE" functions to a constant, if desired. For example, if you wanted the red values of all the pixels in the image to be 200, you could enter "200" in the "RED" function.

C.3. The Animate List Pane

The "Animate List" pane of the "Options" subform keeps a history of all the images that have been input to animate during the session; thus, it provides as a convenient way to redisplay a sequence that was displayed earlier in the session. This subform also lets you specify which band of an image is currently displayed.

Animate List

The "Animate List" list selection on the left of the pane will contain the name of each sequence that has been input to animate during the session. Click on the name of the desired image, and it will be re-input automatically.

Band List

The "Band List" list selection on the right of the pane will contain one entry labeled "Image Band X" for each frame of the currently displayed sequence. You may go directly to a particular frame by simply selecting the number of the desired band from the "Band List" selection.

C.4. The Colormaps Pane

The "Colormaps" pane of the "Options" subform offers a number of autocolor procedures that may be used to define a new colormap for the image, and a number of colormap operations that may be used to modify the current colormap of the image.

The different colormap operations and autocolor procedures available are detailed in Chapter 1, "Introduction", of the Envision manual.

C.5. The Function Pane

The "Functions" pane of the "Options" subform allows you to generate 1D, 2D, 3D, 4D, or 5D datasets of any data type. For dataset generation, you must specify double precision *begin* and *end* values, as well as an integer *size* value, for each of width, height, depth, time, and elements, as relevant to the desired dimensionality of the dataset to be created.

C.5.1. Generation of Data Sets

The function that will define the dataset is specified as:

f(w,h,d,t,e) = <expression>

Where *w, h, d, t,* and *e* are double precision values ranging from *begin* to *end* with the number of values to be generated determined by *size*.

When you have entered the function as desired, specified the data type, and provided the desired begin, end, and size values, click on "Create Data" to create the data set. Depending on the complexity of the function and the size of the data set specified, the data set may take a shorter or longer amount of time to generate.

C.5.2. Example: Generation of an Image

Image display implies the need for a 2D data set organized as (width x height). Therefore, the expression provided for f(w,h,d,t,e) will use the variables "w" and "h"; begin, end, and size values will be provided for width and height only.

1. First, provide the value "(w % h) + (h * t)" as the expression.

2. The default values of 0 for the "Begin" value will be left alone for Width, Height, Depth, Time, and Elements.

3. Provide "End" values of 100 for both Width and Height; the "End" value for "Time" may be set to 50; the "End" values for Depth and Elements will be left as 0.

4. Provide "Size" values of 50 for both Width and Height; the "Size" values for Time may be 10; "Size" for Depth and Elements will be left at 1.

5. Select "float" as the data type, using the "Select Data Type" submenu.

6. Click on "Create Data" to create the data set.

After the data set has been generated, the first frame will automatically be displayed; then, you may begin animation of the data set as usual.

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