Amapi™ 3.0

USER MANUAL

by

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Basic Concepts—The Interface

Amapi's friendly interface is so intuitive that you almost don't need instructions.

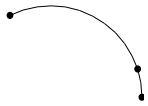
- Most tools are completely accessible from the screen you don't need to use the menus.
- Each tool is represented by an icon that tells you its function just by looking at it.
- Simple key commands are standard and predictable throughout the program.

Polyhedral Modeling

Amapi creates models based on the concept of Polyhedral Modeling. According to this concept, you are able to create three different types of objects. This is important to know because some tools are available for use with only certain types of objects.

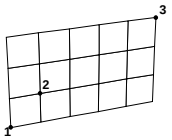
Curves

Curves are formed of points. They can be two- or three-dimensional. Some examples of curves are arcs, rectangles, polylines, NURBS, and circles.



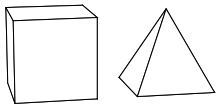
Surfaces

Surfaces are formed of facets. They can be two- or three-dimensional. Some examples of surfaces are tubes and rectangular surfaces formed of cells (facets).



Volumes

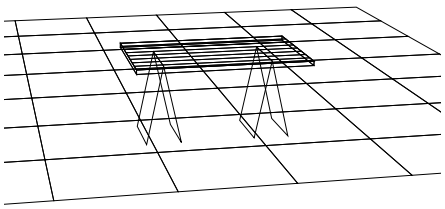
Volumes are closed surfaces. Some examples of volumes are spheres, cubes, and pyramids.



The Drawing area

The Workbench and Grid

In the center of an empty Amapi scene is the workbench and grid. Your model is built on top of this workbench. Use this workbench and grid as a reference so you can tell if you have changed the screen orientation. The position of the workbench and grid tells you if you have zoomed or panned the screen, where you are in X, Y, Z space, and the current orientation.



Hiding the Workbench or Grid

If you do not want the workbench or grid on the screen, open the Amapi Control Panel by dragging the cursor off the bottom of the screen. Choose the Hide tool and click the workbench or grid to hide either of them. If you want either back, show them using the Show tool.

Views and Planes

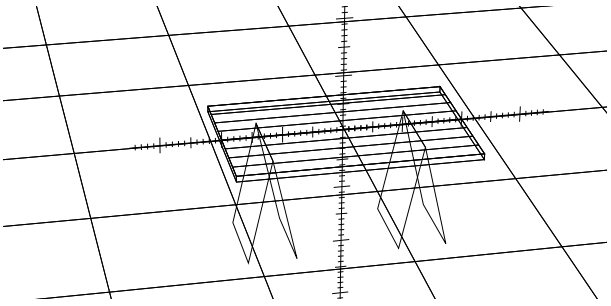
Amapi's X, Y, and Z axes help you keep track of your orientation and help you perform specific modifications to your models. By knowing which axis is which, you will understand the view you are looking at and also the current working plane. Amapi causes the current working plane to be that orthogonal plane which is most parallel to the screen in the current view.

The Hide tool is the gray phantom. The Show tool is the white phantom.

This does not mean that you cannot work in another plane. See Working Plane, page 7-10.

Displaying the Axes

The X, Y, and Z axes appear automatically (although only two at a time, depending on the current view) when you choose tools. Depending on certain factors, such as an absence of geometry on the screen, the axes might snap to the center of the workbench. At other times, you may be able to pick an origin.



- You can now leave the "Reference point" selection mode (Scale fixed point, center of rotation, ...) by putting aside the mouse at the right of the screen. This is available in following tools : Rotate, Scale, Symetry, Copy

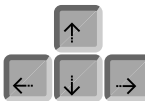
Color Representation

The color of the X, Y, and Z axes is another way that Amapi helps you keep track of your orientation. Each axes has a unique color, no matter which view you are in. X axis Red Y axis Green Z axis Blue Knowing this, you can be sure you are in the top view (and plane) if the red and blue axes are showing, in the front view if the green and red axes are showing, and in the side view if the green and blue axes are showing.

Arrow Keys / Number pad rotation

Rotate and Pan to different views and planes using the arrow keys, Control key and number pad. For more information, see the next section, Keyboard Shortcuts.

Keyboard Shortcuts



Arrow Keys

Use the left, right, up, and down arrows to adjust the view incrementally. By default, the rotation is based on a pivot point located at the center of the screen. As expected, the Left Arrow shifts the view toward the left, the Up Arrow shifts the view up, and so on. To achieve a panning effect, use the Control Key in combination with the arrows.

Control Key

The Control Key is used for panning the view or executing a Tool with a duplicate of the current object.

Pan the view

Hold the Control Key and then hit the Arrow Keys to achieve a panning effect. If you are working on a large model or just need some room in one direction or another, hold the Control Key and hit one or more of the Arrow Keys to pan the view in that direction.

Working on an automatic duplicate of the current object

Hold the Control Key and click on a modification tool icon (In Modeling or Assemble ToolBox) with a current object selected. The tool will operate on a copy of the selected object which will remain unchanged (For example, Control-click on Move Tool allows you to make a single copy of an object and to locate it where you want)

To change the rotation pivot point, use the Zoom Window in Amapi's Control Panel.

Number pad Use the number pad to change your view and current plane. Also use the number pad to zoom in and out.

2 Front view
3 Zoom In
4 Left view
5 Top view
6 Right view
8 Back view
. Zoom Out

- The keyboard keys '0' and '1' have respectively been binded by default to the 'Zoom extents" and "Zoom Window" tools, to access faster to this very used functions

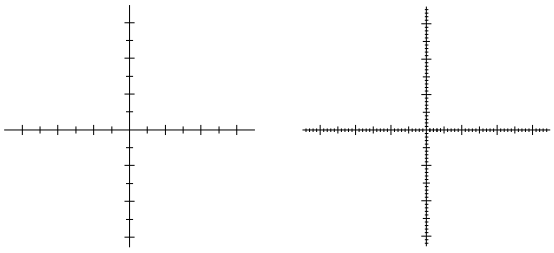
+ and - Keys

Use the + and - keys, either on the keyboard or number pad, to

increase and decrease the accuracy of an action. The + and - Keys can be used when you are aligning or sizing something with the axes, defining a curve, or specifying an area susceptible to modification. They may also be used to scroll the Catalog images and to walk trough the displayed database for current object selection.

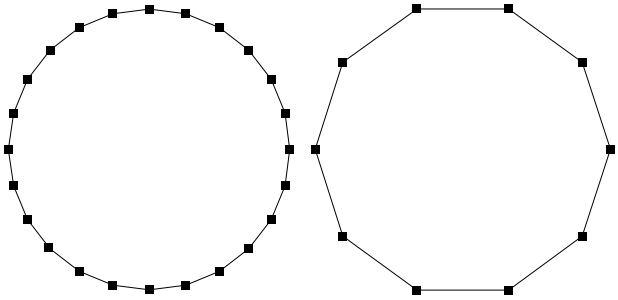
Aligning or Sizing

When one or more axis line is on the screen, use the + and keys to increase or decrease the number of hash marks on the axis. This increases or decreases the precision that you are allowed in performing the alignment or sizing. When the Rotate tool is selected, use the + and - Keys to increase or decrease the number of hash marks available for rotation.



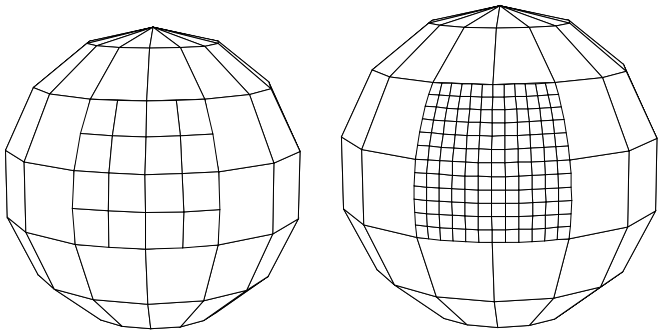
 Defining a Curve

When you have just created a curve, you will see a slider icon. When this icon is present, you can tell Amapi how many points to use to define the curve. Use the + and - Keys to increase and decrease the number of points.



Tuning tool parameters

Some of the Modeling Tools (such as the Smooth tool, in this example) allow to define parameters of the object. Use the + and Keys to increase or decrease the tools's current parameter.



Current object selection

When several shapes overlap, use + and - keys to successively select the current object from all the shapes displayed on the screen.

Return Key

Use the Return Key to enter numerical data when creating models or to signify the end of an action.

Enter Numerical data

Whenever you type information about an object into the data

box, hit the return key to enter that information.

This is called Validating.

Generally, the data boxes reveal the numerical information that you could specify through mouse clicks.

Signify the end of an action

Some tools require multiple mouse clicks (like Polylines, NURBS curves, and extrusions). Hit the Return Key to tell Amapi you are done placing points for that object.

Tab Key

Use the Tab Key to access data boxes that appear at the lower left corner of the screen. A data box may appear when you are selecting, constructing, modifying, or assembling objects.

Naming Objects

When you have no tool selected, hit the Tab Key to type a name for the current object. Hit return to validate.

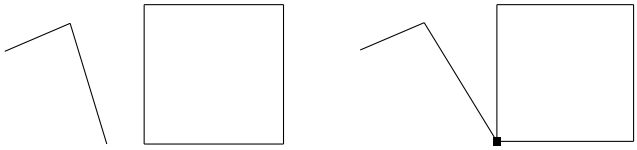
Constructing, Modifying, or Assembling Objects

When you choose almost any of the Construction, Modeling, or Assembly Tools, you will see a data box in the lower left corner of the screen. Hit the Tab Key to type a location, size, or other numerical information about the object.

Shift Key

If you want to create a point on a new object that is in the same location as a point on an existing object, use the Shift Key. If you hold the Shift Key and move the cursor around, the cursor will snap to the nearest point. The Shift Key also allows you to select additional objects with the wand cursor.

If you select multiple objects in this way, they will be grouped together. Ungroup them, if necessary, with the Control Panel's Ungroup tool.

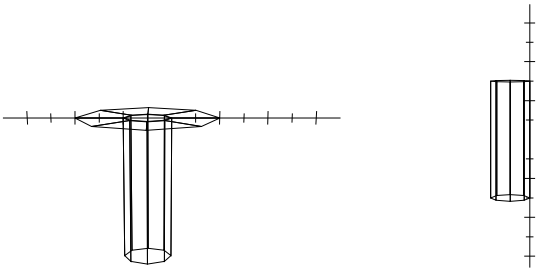


Space Bar

The Space Bar has many toggling effects. Sometimes it will lock onto one axis to limit your modifications, or it might contain a tool-specific command.

Locking onto one axis

There are several instances where you have the opportunity to hit the space bar in order to lock onto one axis or another. This is helpful when moving objects, extruding in one direction only, and when creating aligned duplicates.



1. If you want to lock onto an axis, hit the space bar.
Only the horizontal axis shows and you must keep the cursor on this axis.

2. Hit the space bar again.
Now you are locked onto the vertical axis.

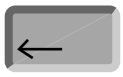
3. Hit the space bar again.
Now you may align on both axes again.

Specialty Commands

Sometimes you will use the space bar for a tool-specific variation. The Duplicate or the Sweep tools, for instance, will offer different model orientations if you hit the space bar.

Option Key

The Option Key allows you to access sub-tools that are available with the currently selected tool. When the Wand cursor is showing, and frequently with other tools, the selection tools (Lasso and Bull's-eye) can be accessed using the Option Key. Sometimes, as in the Measurement tool, additional tools are accessible through the Option Key. The option-click will always reveal each possible tool and then start over from the beginning.



Delete Key

Hit the Delete Key at any time to undo your last action when you are inside a tool. For many tools, you can undo several steps by hitting the Delete Key as long as you are inside the tool. After the tool is put-aside, hitting the Delete Key will also delete the currently selected object(s).

Selecting Objects

When you have no tool selected, the cursor is a Wand icon. This cursor has a number of uses for selecting different screen objects. One object on the screen is always selected. Selecting

objects will become important to you because most tools work only on the currently selected object or selected points.

However, it is possible to change the current object inside the following tools :

. Move
. Stretch
. Rotate
. Scale
. Snap

To do that, when you are using one of these tools, press the ESC key. The magic wand appears. Click the object you want to be the current one (Put-aside on the right of the screen to Cancel). You can continue to use the current tool on the new selected shape.

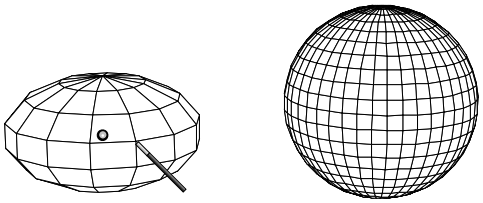
Accessing the Cursors

By default, the Wand cursor is always what you see when you do not have another tool chosen. If you hold the Option Key and click the mouse button, you see an arrow icon. This is the Lasso cursor. It is used to surround a group of points for selection. Option-click again and you see a Bull's-eye cursor. This is used to choose individual points for selection. Option-click again and you are back to the Wand cursor.

The Cursors

• Wand : 

Use this cursor to select an entire object. Click anywhere on the object you want selected. The selected object is distinguished by its cyan color and its center of geometry. The center of geometry is marked on the selected object with a small white sphere.



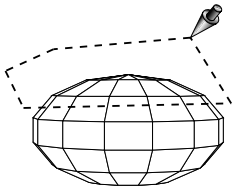
• Lasso : 

Use this cursor to surround a number of points, facets, or lines on the currently selected object. A selection like this will allow you to work on only part of the object. The selected points and lines are highlighted on the screen.

The Lasso cursor will only select points and lines on the current (clicked with the Wand) object.

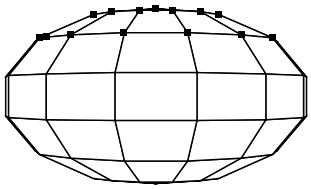
To surround part of an object with the Lasso:

1. Click points to form a ring around the part you want to select.



2. When everything you want is surrounded by the Lasso, hit Return.

The points are now selected.

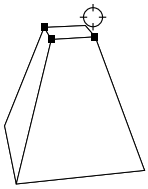


• Bull's-eye : 

Use this cursor to select one point or several individual points. This works well if you need to isolate certain points that are spread out and therefore won't work with the Lasso cursor.

1. With the Bull's-eye cursor, click points you want selected.

Each point you click is highlighted. To deselect a point, just click it again.



2. When you have clicked every point that you want, hit Return.

The points you clicked are now selected and you can use one of the other tools to edit them.

The Toolboxes

There are five different toolboxes you use when creating a model in Amapi. They each have a set of tools that make designing simple.

Accessing the Toolboxes

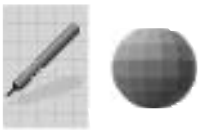
The three creation toolboxes are located at the right side of the Amapi screen. To switch from one Toolbox to another, simply sweep the cursor off the right side of the screen. We call sweeping the cursor off the right side of the screen "put-aside" or "putting-aside." This is because when you put a tool away (put it

aside), you drag off the right side of the screen, just as you do when toggling toolboxes. When you open Amapi, the Construction Toolbox appears on the screen automatically. Put aside the cursor, and the Modeling Toolbox appears. Put-aside the cursor again and the Assembly Toolbox appears.

As you put-aside the cursor to reveal the toolboxes, this is the order they always appear: Construction, Modeling, Assembly, Construction again...

The Toolboxes

- Construction Toolbox



This Toolbox contains tools for the creation of primitives. Tools here will create 2D shapes like arcs and rectangles and 3D shapes like spheres, cubes, and extruded forms. See Chapter 4 for more information.

- Modeling Toolbox

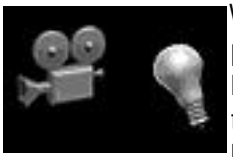
This Toolbox contains tools for editing primitives. First create a primitive with the Construction Tools and then modify it with the Modeling Tools. Some modifications you can make are stretching, scaling, smoothing and adding fillets. See Chapter 5 for more information.

- Assembly Toolbox

This Toolbox contains tools for changing the orientation of screen elements. By the time you use the Assembly Tools, you have created a model with the Construction Tools and probably modified it with the Modeling Tools. Some modifications you can make using the Assembly Tools are rotating, welding, and duplicating. See Chapter 6 for more information.

Along with the three creation toolboxes, Amapi offers two more toolboxes that allow you to view and access your work more easily. They are the Control Panel and the Catalog.

- Render and Animation Toolbox



When any of the three previous toolbox is displayed, pressing the Space Bar reveals the Render and Animation Toolbox. Space Bar is a toggle since pressing again on it will come back to the previous modeling toolbox displayed. This toolbox contains Rendering and Animation tools, accesible through the Render and Animation menus. See Chapters 9 and 10 for more information.

- The Control Panel 

  Amapi offers another toolbox that you access almost like the three creation toolboxes. If you drag the cursor on the bottom-right of the screen icon, you reveal the Control Panel. The Control Panel allows you to change the way you view your model. Some of the tools available here let you group and ungroup, hide and show, zoom, and paint. To release the Control Panel, put it aside by dragging the cursor off the right side of the screen. See Chapter 7 for more information.

- The Catalog

  At the bottom of each of the creation toolboxes is the icon for the Catalog. The Catalog is a toolbox in itself Use the Catalog to store, retrieve, or delete models, and to import and export files. See Chapter 2 for more information.

Releasing Tools

There are a couple of ways to release tools when you are done using them. The method of releasing the tool depends on how the tool is used.

Validate

A tool which requires a number of mouse clicks to define the shape is released when you hit the Return Key. Tools such as Polyline and NURBS curves can be created with two mouse clicks

or twenty. The Return Key tells Amapi that you are done choosing points. When you hit the Return Key to release a tool or end an action, it is called Validating. You may also have to put-aside a tool after validating.

Put-Aside

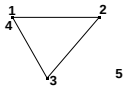
A tool which requires a specific number of mouse clicks to define the shape is released when you sweep the cursor off the right side of the screen. This is called putting-aside. A circle, for example, is created with only two mouse clicks. Each of these tools is released by putting it aside.

Creating Forms

Many of the tools create or modify an object by:
1. choosing points through mouse clicks or
2. typing values for the location of points or
3. using a combination of typing and clicking points.

To create a form by clicking points with the mouse:

After you choose a tool, simply click points where you want them to be located. Notice the dialog box at the lower left corner of the screen. This gives you information regarding the point you will be creating when you click the mouse



To create a form by typing values in the data box:

In most cases, when you choose a tool, a data box appears at the bottom left corner of the screen. This allows you to type in specific values for the location of points on your drawing.

Select Absolute Mode from Edit menu to have any coordinate indicating the absolute location in space (origin is the center of the Workbench). Unselect Absolute Mode from Edit menu if you want to have any coordinate indicating the relative location of the cursor from the previous clicked point (this is the default).

1. Hit the Tab Key to activate the data box.

2. Type in a value
If there is more than one value field available, you can toggle between them by pressing the Tab Key.

3. When the data box holds the value you want, hit Return to see the effect on the drawing.

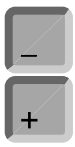
To use a combination of typing and clicking:

You may want to use a combination of typing and clicking. Perhaps you will hit the Tab Key and type in a specific value for the object's starting point and then click the mouse to indicate the object's second point.

Defining Curves

When drawing a curved shape, you may specify how many points you want used in defining the curve. Upon completion of the curve, a +/- slider icon appears.

This icon allows you to choose the number of points you want defining the curve. This information can be input in one of two ways:



1. Use the + and - Keys on the number pad to increase or decrease the number of points.
Move the cursor off the right side of the screen to put-aside the tool.

OR

2. Hit the Tab Key and type in the number of points you want defining the curve.
Hitting Return changes the number of points and releases the current tool.

The more points used, the smoother the curve. Initially, you may want to keep the shapes in a rough form and use the Smooth Tool later as a finishing touch. Shapes formed of fewer points will redraw more quickly.

Canceling Actions, Undoing, and Erasing

If you catch the mistake in time, nearly every action is reversible. For many tools, like Polyline and NURBS curves, you can undo several steps with the Undo command in the Edit menu. You can also Undo an operation by using the customary Macintosh keyboard shortcut, Command-Z.

In Amapi, hitting the Delete Key will also undo the last step(s) if you haven't put-aside the tool. After you have released a tool, you have the opportunity to Undo-Redo several steps of modifications. The number of these steps is defined by the corresponding setting value in Amapi preferences dialog.

Even if Amapi was specially optimized to be smallest memory consuming to keep informations for cancelling the previous operations, some tools (like cutting operations for example) takes memory to be cancellable. So adjust the number of Undo steps available in the Amapi preferences dialog (Edit menu) in accordance to the system memory available for Amapi.

Erasing the screen or part of it

To erase the screen and save nothing

1. Click the bottom icon on any creation tool palette.

This will display the Catalog. The Catalog is Amapi's built-in file management system. At the left side of the Catalog is the Black Hole.

 2. Click the Black Hole.

Everything on the screen disappears. If you click the Black Hole by accident, hit Command-Z or choose Undo from the Edit menu to bring it all back. If you are working on an existing file, only the objects are deleted but the filename still exists as can be seen in the title bar. To delete the entire file, you need to drag the contents from the Catalog into the Black Hole.

3. Sweep the cursor off the right side of the screen.

This is the way you release any tool you are using in Amapi.

To erase one or more objects on the screen

1. Display the Control Panel

 2. Click the Disintegrator Gun icon.

This is, officially, the Delete Entity tool. It acts just as you might expect a Disintegrator Gun to act.

3. Point the Delete Entity tool at the object you want to erase and click the mouse button.

Be aware that this tool deletes the object closest to it. If you accidentally deleted something you need, hit Command-Z or choose Undo from the Edit menu.

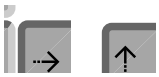
4. Put-aside the cursor.

To move to a new location on the screen

If you do not want to erase the objects on the screen but want

a new area to work in, try panning the screen.

1. Hold the Control Key.


2. Hit any of the keyboard arrows.

You will, of course, want to use the arrow that will take you in the direction you want to pan. If you use these arrows without the Control Key, the view will rotate in 3D space around the center point of the screen.

3. Start creating in your new open work space.

To locate the objects you have panned away from, sweep off the bottom of the screen to display the Control Panel. Click Zoom Extents to display all objects.

To save the image and clear the screen

1. Click the bottomost tool on any creation tool palette.

This displays the Catalog.

2. If necessary, click the scroll arrows to display an empty box in the Catalog.

Amapi is packaged with an assortment of sample files. These files appear in the Catalog. If you click on an occupied box, a thumbnail sketch of the drawing appears and you may place it in your drawing.

3. Click on an empty box.

A tiny representation of the current screen image appears in

the box.

4. Type a name for the saved image and hit Return.
This is now saved as an actual file in the Amapi folder. To do the same action, use Save or Save as... from the File menu.

5. To erase the screen, click the Black Hole at the far left of the Catalog.
The scene disappears from the screen, but it is saved in the Catalog.

Extended drawing constraints

When you are working on the graduated rulers, it is possible to define constraints for attracting the cursor interactively.

The cursor may be attracted :

- to existing points or segments
- to the horizontal and vertical lines passing through a point
- to a line parallel or perpendicular to 2 points.
- to the intersection of these constraint lines.

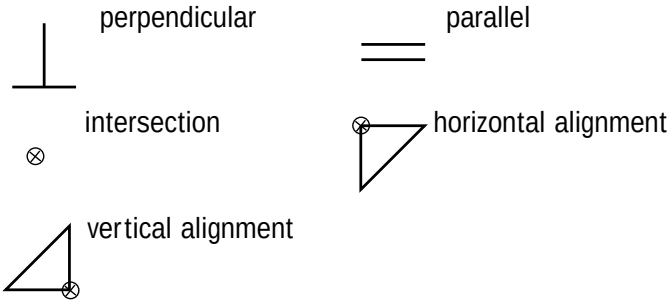
The following commands are used :

- The Shift key to start constrained drawing mode
- The combination of Control and Shift key to define points of constraint.

By default and if the corresponding preference has been activated, attraction to both points and segment is available. This means that during your drawing, the cursor will be attracted by the nearest point or segment by holding the Shift key, as well as by the horizontal and vertical lines passing through the current origin of the ruler (This origin becomes automatically a point of constraint).

To define a second and third point of constraint, hold both Control and Shift keys and click on the required point.

Then move with the mouse whithout releasing the Shift key. Your position in relation to the points of constraint is displayed on the bottom right-hand-side of the screen.

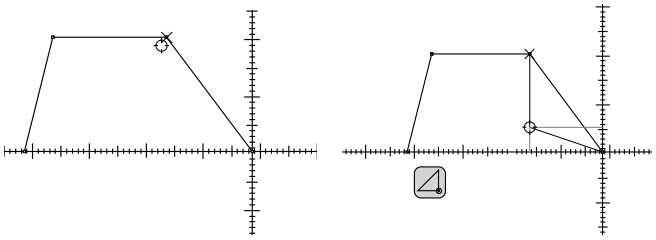


For example, if you have selected a point of constraint and the position of the cursor forms a right-angle with the straight line from the origin of the ruler to the point of constraint, a right-angle icon is displayed and the movement of the cursor is constrained to this perpendicular (but not blocked).

When you release the Shift key, the attraction is deactivated and the points of constraint disappear.

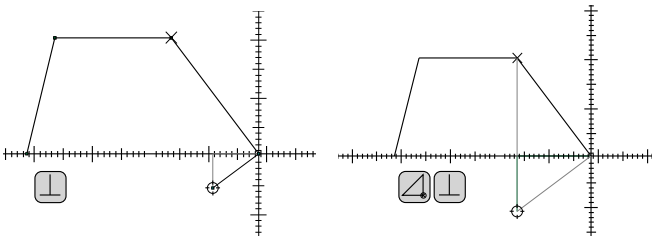
Selection of a point of constraint using Shift+Click

The cursor is attracted to the vertical from this point



Attraction and constraint perpendicular to the last segment

Combination of perpendicular and vertical attraction



The Catalog

The Black Hole

Copying Catalog Images

Saving Images to the Catalog

Importing

Exporting

Changing Directory

Setting Bookmark

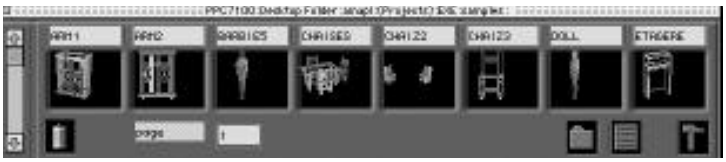
Utilities

The Catalog

The Catalog is Amapi's built-in file management system. It allows you to store libraries of images for easy access. The Catalog gives you a visual link to all the Amapi files you have saved on your hard drive. With the Catalog, you don't need to use the open or save commands, although you certainly can if you want. It is very easy and fast to pick a file from the Catalog and bring it into your work space. The Catalog also supplies buttons for importing and exporting documents and erasing screen elements.

The Catalog is accessible at any time by clicking the bottom icon of any of the three creation tool palettes.

The Catalog appears across the top of the screen. You have 5 possible actions : use the Black Hole to erase something from the screen, place an image from the catalog into the current scene, place an image from the scene into the catalog, import, or export.



The Black Hole

The icon on the left side of the Catalog is the Black Hole. Use this icon to erase catalog items or items from the current scene.

Erasing a Catalog image

Erasing a Catalog image is essentially the same as throwing that particular file in the trash from the desktop. This action cannot be undone, so be sure you want the image destroyed.

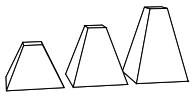
1. Click the image in the Catalog you want to erase permanently.
   A small version of it appears as you move the cursor around.

2. Click the Black Hole.
   The image is gone.

Erasing part of the scene

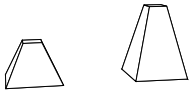
Erase one or more elements from the current scene by dragging them into the Black Hole. This action cannot be undone, so be sure you want the image destroyed. If, however, you saved the drawing before placing the item in the Black Hole, you can retrieve the deleted item it by closing the file without saving.

1. Click the object with the Wand cursor in the scene you want to erase permanently.



   A small version of it appears as you move the cursor around.

2. Click the Black Hole.
   The image is gone.



Erasing the entire scene

If you want to erase everything from the current scene and start over, this is the way to do it. However, as you can see the file is not erased, only the contents are. To start over in a new file, choose New from the File menu.

1. Do not click any of the screen elements.
   The cursor should be the Wand.

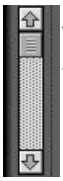
2. Click the Black Hole.
   Everything is gone! If you make a mistake and need to bring your geometry back, choose Undo (or Command-Z) from the Edit menu.

Copy an image from the Catalog

A common use for the Catalog is to place a copy of an image from the Catalog into your current scene.

Browsing the Catalog

Amapi allows a number of ways for you to browse the Catalog. Use the scroll slider, + and - keys, or type a page number.



Scroll Slider

The Catalog has a page browser that you can use to browse the catalog images. Drag the slider to replace the entire line of ten with the previous or next ten images.

+ and - Keys

Use the + and - Keys to scroll the Catalog images. These keys work just like the scroll arrows.

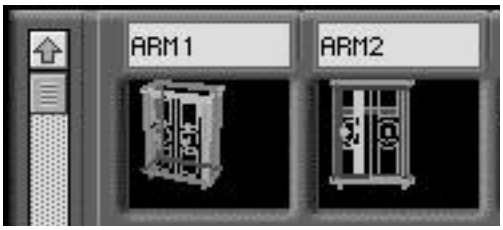
Erasing the screen in this manner also returns the default view. For example, if you had zoomed in before clicking the black hole, the view is zoomed out again after you click the Black Hole.

Typing a page number

Each page in the Catalog is numbered. When the Catalog is chosen, a data box appears. You can hit the Tab Key and type a page number you want to see. Hit Return to go to that page.

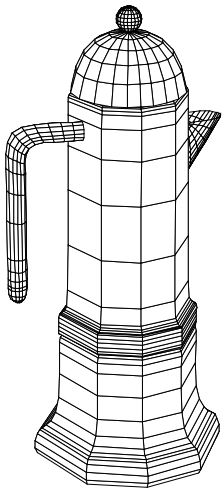
Copy an image from the Catalog

1. Use the scroll arrows (or any browsing method), if necessary, to locate a scene in the catalog that you want to place in your drawing.



2. Click the image you want.

A small version of it appears as you move the cursor around.



3. Click the scene to place the image.

This places a copy of the image into your current file. You can also use the Merge... command in the File menu to insert the geometry into the current drawing.

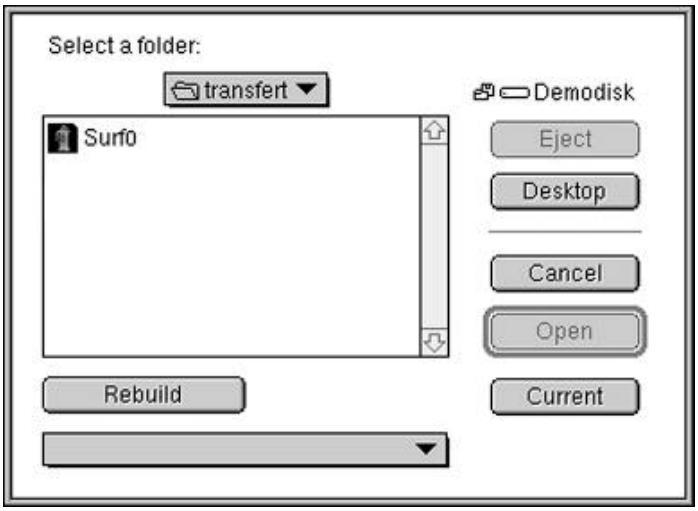
To work directly with the image and not with a copy, you will need to Open the file from the File menu.

4. Use any of the tools to modify the form.

Define the Catalog

The Catalog always displays the files that are saved in the current work directory. To choose the current folder, follow these steps:

1. Choose Define Catalog ... from the File menu.



2. Open the folder whose contents you want to appear in the Catalog.
Once the folder is open, the list of Amapi files contained in this folder appears

3. Double-click on a file name to specify the shown folder for the Catalog folder
The dialog box is dismissed and the files contained in this folder are now displayed in the Catalog.

Amapi uses a file named CAT.LIST to determine which file is present in the Catalog and the place where it is located. If no file CAT.LIST exists in the open folder (you may have moved some files from a folder to another using the system file management), no icons will appear in the catalog. To fill it with all files contained in the selected folder, click rebuild (you may access to the rebuild command through the utility icon -right corner of the catalog-).

To exit the dialog box without changing the Catalog folder, click Cancel.

To rename a Catalog entry later, click in the area where the name is displayed. Type the new name and hit Return.

Save a model to the Catalog

The following steps will save the entire scene as one Catalog entry.

1. Use the scroll arrows, if necessary, to locate an empty box in the Catalog.

2. Click one of the empty boxes.

The current scene appears in the box.

3. Type a name for the scene and hit Return to enter it.
If you don't give it a name, it is automatically called "Surf" plus a number to identify it.

If you want to save 3 of 5 objects in one Catalog entry, first group those objects and then drag them into the Catalog

The following steps will save a selected object as one Catalog entry.

1. Click the object you want to save in the Catalog.
A small version of it appears as you move around the cursor.

2. Click an empty box in the Catalog.
The selected object appears in the box.

3. Type a name for the scene and hit Return to enter it.
If you don't give it a name, it is automatically called "Surf" plus a number to identify it.

Replace a Catalog entry

If you have stored your scene in the Catalog and then make changes, you may want to replace the Catalog image with the current screen image.

1. Scroll to the Catalog image you want to replace.

2. Before clicking on any image, hit the Return Key.
The cursor shows a small preview of the current screen.

3. Click the Catalog image you want to replace.

The new image replaces the old.

Rearranging Catalog Items

You can change the order of drawings in the Catalog just by dragging them to new locations within the Catalog.

1. Click the Catalog image you want to move.
A small version of it appears as you move the cursor around.

2. Click an empty box to place the scene in the new location.

Import

This command imports a document. An import icon is available (in addition to the Import command in the File Menu) when you choose the Catalog from any Toolbox. The Import button displays a pull-down menu when you click it. This menu allows you to choose what type of file you want to import : Amapi, DXF, Illustrator 3, 3DMF (on Macintosh), VRML, 3D Studio, or IGES.

To import a file

1. Click the Catalog's Import icon (or choose Import from the File menu).
In either case, a submenu of File Types appears.

2. Click the File Type you want to import.
An import dialog box appears, allowing you to choose a document to import. Only documents of the File Type you specified are available.

Export

This command saves the current document in a different format. An export icon is available (in addition to the Export command in the File menu) when you choose the Catalog from any Toolbox. The Export button displays a pull-down menu when you click it. This menu allows you to choose a type of format for the exported file. You can export the file in these formats : Amapi 2.x (for versions of Amapi prior to the 3.0 version), DXF, IGES, STL, 3DGF, CadRender, RIB, RayDream Designer, KPT Bryce (available for the «pro» version), 3D Studio, 3DMF (For Mac version only), FACT, Illustrator 3.0, PovRay, Strata Studio Pro (Mac only), VRML, TrueSpace and Lightwave.

To export a file

1. Click the Catalog's Export icon (or choose Export from the File Menu).
   In either case, a submenu of File Types appears.

2. Click the File Type you want to export the current Amapi document as.
   An export dialog box appears, allowing you to name the document and choose a location to store the exported file.

3. Type a name and choose a location for the exported file.
   Amapi will add an appropriate extension, depending on the format you choose for the export.

In the right corner of the Catalog, you will find 3 utilities icons.

Change Directory

By Holding the mouse button on this icon, you will get a menu, allowing you to change the Catalog Directory. The displayed list shows you the sub-directory of the current Catalog directory, as well as the bookmarks list.

Set Bookmark

If you want to keep the current Catalog directory as a bookmark, hold down the mouse button on this icon, then release it on the «Bookmark N» item. The current folder will be recorded as a bookmark, and will be displayed in the Change Directory menu, allowing you to go directly to this directory in a future session of work.

Utilities

This icon let you access to several utilities :

Toggle Directory: Allows you to change the current Catalog directory, as well as the Define Catalog menu command.
Rebuild Catalog: Creates a new catalog from scratch, which becomes updated according to the contents of the selected directory, as well as to Re-create the corresponding previews. This could allow you for example to import a

whole project from an other system (Mac, PC or Unix workstation), as well as to update a folder in which you have added files.
Verify Catalog: Removes from the catalog the scenes they are not on the disk, and adds into the catalog the scenes directly added on the current directory (like Rebuild, but without recreating the previews).

Catalog Preferences: Access to the network settings for remote communications (See Chapter 2 - Network Preferences).

The File and Edit Menus

The File Menu

The Edit Menu

The NURBS Mode

The File and Edit Menus

The File and Edit Menus offer many of the same file management and editing options as other applications, but Amapi has added functionality to these too!

The File Menu

New (□ N)

This command in the File Menu creates a new Amapi document. The new document has no name (the title bar shows “Untitled”). You may have several documents open at a time.

Open... (□ O)

This command in the File Menu opens an existing document. The Open dialog box offers options to narrow your search area. You may choose to open a document in Amapi format (default choice), DXF, IGES, EPSF or PICT format. The All option lets you choose from any of these formats. The dialog box also displays a thumbnail preview window so you can see what you are opening.

Opening a document

1. Choose Open... from the File Menu.
   The dialog box appears.
2. Open the appropriate folder.
3. Click the file name you want to open.
4. Click the Open button.

Merge... (□ M)

This command in the File Menu opens an existing document and places the form(s) it contains into the current drawing. When you choose Merge..., the Open dialog box appears. It offers options to narrow your search area. You may choose to merge a

document in Amapi format (default choice), DXF, IGES, EPSF or PICT format. The All choice lets you choose from any of these formats. The dialog box also displays a thumbnail preview window so you can see what you are merging.

Merging Documents

1. Choose Merge... from the File Menu.

2. When the dialog box appears, choose the format you want.

3. Open the appropriate folder.

4. Click the file name.
Verify through its thumbnail preview that it is the correct document.

5. Click the Open button.

6. The drawing is merged (added to the existing geometry) with the current drawing.

Close (⌘ W)

This command in the File Menu closes the current Amapi document. You are asked if you want to save changes to the current drawing. If you have unsaved changes that you want to keep, click the Yes button. If you want to close without saving changes, click the No button. If no documents are still open, Amapi remains open, ready for you to open or start a new document.

Save (⌘ S)

This command in the File Menu saves the current Amapi document. If you have saved the document previously, it is updated and saved in the same location as it was saved before. If you want to save it to a different location or with a different name, choose Save As.... If you choose Save and the document has not been saved previously, the Save As... dialog box appears automatically, allowing you to name the document and specify the location in which to save it.

Note: You should save frequently or use Amapi's Autosave function.

Even though your drawing appears on the screen, it is not stored on the disk until you save it. Hours of work can be lost because of a power failure. It is also important to save before performing any intricate, multi-step maneuvers. In that way, if the result is not exactly what you had hoped, you can return to where you were before the operation by closing the document without saving.

You can also close the document by clicking the close box at the upper left corner of the title bar.

Use the Preferences command in the Edit menu to turn on Autosave. At time intervals you specify, Amapi will save the current document to disk.

Save As... (□ E)

This command in the File menu saves the current document. A dialog box appears so you can name the current document, give it a different name, or save it to a different folder.

1. Choose Save As... from the File Menu.
   The dialog box appears.
2. If necessary, display a different folder.
3. Type the name you want to use in the File name box.
4. Either press Return or click Save.

Making a backup

You should make a backup of your work in case you make many changes and want to go back to the original version. You can use the Save As... command in the File Menu and save the file with another name. If you wish to save the hidden objects in the file, use Save or Save As... from the File Menu.

System Crash Backup File

Under situations when you run out of memory which results in a System Crash, Amapi creates a crash backup file called AMBackup in the current Catalog folder. In case, the current Catalog folder is not set, the file is created in the same folder as the Amapi Program (Amapi 2.0 Folder). It is recommended that you launch this Amapi document just like any other modeler file and use Save As... to save the file under a different filename. This is to ensure that in case of future crashes, the AMBackup file is not overwritten.

Define Catalog... (□ K)

Amapi's catalog system allows you to save forms that you can open quickly for use in your designs (the catalog is accessed through the bottom tool on all of the tool palettes—for more information, see The Catalog, chapter 2). The Define Catalog command in the File Menu allows you to choose which forms appear in the Catalog. You may want to save forms into different folders. This way, the Catalog will contain only the forms that you need at that time, eliminating the need to scroll through a long list. In order to change the catalog by using Define Catalog..., you need more than one folder containing Amapi documents.

Define the Catalog

The Catalog always displays the files that are saved in the current work directory. To choose the current folder, follow these steps:

1. Choose Define Catalog... from the File Menu.

2. Open the folder whose contents you want to appear in the Catalog.
   Once the folder is open, the list of Amapi files contained in this folder appears.

3. Double-click on a file name to specify the shown folder for the Catalog folder
   The dialog box is dismissed and the files contained in this folder are now displayed in the Catalog.

When you have the Catalog open, you can access the Define Catalog... dialog box by hitting the space bar.

To exit the dialog box without changing the Catalog folder, click Cancel.

Import

See Import in the Catalog—Chapter 2.

Export

See Export in the Catalog—Chapter 2.

Page Setup

If you do not have a printer driver installed in your System's Extensions folder, nothing happens when you choose the page Setup or Print commands.

Use Page Setup to give specifications to the document in preparation for printing. Depending on the type of printer you have, you will see a dialog box asking such typical questions as the page orientation and paper size.

Print (⌘ P)

Print will print the current scene to your printer.

Not only can you choose Print or use the cmd-P keyboard shortcut; you can also click the Printer icon in the Control Panel.

1 Choose Print from the File Menu.
A print settings dialog appears.

2. Set the parameters you want to use for printing and hit OK when ready to continue.
A rectangular page icon representing the page appears.

3. Hit the space bar to toggle between landscape and portrait orientation.
Place the center of the page over the center of the geometry you want to print.

4. Click the mouse button when the center is located.
Move the cursor to expand the size of the page.

5. Click when the geometry you want to include is within the page boundaries.
The geometry you include on the page is sized to fit within the page boundaries.

6. If you are using the Printer driver, the system printing dialog box brings up.
Depending on the type of printer you have, you are able to specify printer settings, or cancel printing.

Quit (□ Q)

This command in the File Menu closes Amapi. You will be asked if you want to save changes before quitting.

1. Click yes to save and quit.

2. Click no to not save and quit.

3. Click cancel to not save and not quit.

The Edit Menu

Undo (□ Z)

This command in the Edit menu reverses the last action. While using some tools, you can undo many times in a row. The number of times possible after putting aside the current tool depends on the number of Undo levels you have specified in preferences. In Amapi, hitting the Delete key has the same effect as choosing Undo from the Edit menu when you are inside the tool.

Redo (□ R)

This command in the Edit menu reverses the last Undo. E.g. if you cancel the last operation, you may return to the original situation, re-doing the action you have cancelled.

Cut (□ X)

This command in the Edit menu removes the selected objects and places them on the Clipboard. Each selection you cut or copy to the Clipboard replaces the previous Clipboard contents.

Cutting objects

1. Select the object to be cut.
   Click it with the Wand; the selected object is colored cyan and displays its center of geometry as a white sphere.

2. Choose Cut from the Edit menu.
   Once you cut a selection, you can paste it. In Amapi, a cut object is pasted exactly in the position it was cut. You can use Cut and Paste to create duplicate geometry in the current document or from one document to another. You can even paste the cut selection into a document in a different application.

Copy (□ C)

This command in the Edit Menu places a copy of the selected object onto the Clipboard without deleting the original. You can paste the copy elsewhere in the current document or into a different document. You can even paste the copied selection into a document created with a different application. Many of the illustrations in this manual were copied from Amapi and pasted into a word processing document.

Paste (□ V)

This command in the Edit Menu pastes a copy of the Clipboard contents onto the center of the drawing area, on top of other geometry. The Clipboard contents are not changed when you use the Paste command. You can also paste the selection into another

document or into a document created with another application.

Delete

This command in the Edit Menu deletes the currently selected object. The object is not saved to the Clipboard.

Select All (□ A)

This command in the Edit Menu selects all objects that are visible on the Amapi screen.

When you choose Select All the objects will be grouped together.

Windows

This command in the Edit menu gives the list of open windows. To select one of them as the current drawing, pull the cursor down to its name and release the mouse button

Absolute Mode

This command in the Edit menu allows you to activate or deactivate Absolute mode for display and input of (X,Y,Z) locations. By default, this option is deactivated, so all the given coordinates are relative to the last point entered. If you activate this mode, all the coordinates values will be displayed and input as absolute positions from Amapi World Center, which is located in the middle of the WorkBench.

Redraw (□ T)

This command in the Edit menu redraws the entire screen, flushing away eventual remanent drawings and cleaning objects appearance.

Preferences... (□ ;)

Amapi allows you to set preferences so that you can customize your copy of Amapi to suit your needs. Mac (only for Macintosh and PowerMacintosh versions), Unit, Amapi, EPSF import, and DXF import / export settings can be customize.

Setting Preferences

1. Choose Preferences from the Edit Menu.

A pull-down menu appears, listing the categories that you can set preferences for.

2. Choose the desired category and release the mouse button.

A specific dialog appears, allowing you to set preferences for this category.

3. When you are done setting these preferences, click OK.

Clicking OK saves the preferences. The next time you open Amapi, the preferences will be set to your specifications.

Mac Preferences

Choose Preferences from the Edit Menu and release mouse button on «Mac settings» item.

• Iconize when background : If you activate this preference, when you quit AMAPI temporarily to use another application (or the Finder), only the AMAPI logo is displayed, on the top left-hand side of the screen. You go back into AMAPI by clicking on this icon. Otherwise, the AMAPI window continues to be displayed in the background.

• Quickdraw drawing (Slower) : In order accelerate the display of lines as they are drawn, we have substituted our own line display method for the standard Macintosh QUICKDRAW. If your system is equipped with a graphic accelerator, you may improve display speed by activating this option.

• Fast allocator : This option improves the speed of AMAPI, but uses quite a lot of extra memory. Adjust the value of the standard Macintosh memory allocator. If the "Not enough MAC memory" message is displayed, increase this value slightly.

• Stack size : In the case of operations requiring a special sys-

tem process (in particular, using Cut or Punch on objects with over 10 000 facets), it may be necessary to increase stack size so that the system can process the operation.

• Print : You may choose the font, size, and style of characters used for printing. This option is available for Clipboard, Printer, PICT, and Illustrator output formats.

Units

This dialog allows you to choose between : millimeters (mm), centimeters (cm), meters (m), inches (fractional), decimal inches, pixels (screen units) and none (virtual units).

You may also define the number of decimal digits displayed.

Finally, you have the opportunity to choose the unit in which angles are displayed (degrees or radians).

Amapi preferences

• Backup : This option saves all the shapes, including masked shapes, automatically, every "n" minutes in a backup file.

• Undo frames : This option is used to choose the number of previous modifications you wish to be able to cancel. Undo management is dynamic (uses very little memory space) in most cases. However, it is not advisable to use to high a value if you are short of available memory space.

• Crash file : By clicking on the «crash file» you can change the name of the file in which the current scene is to be saved in case of systems anomaly.

• Bounding box display : This option is used to display only the boxes surrounding the shapes in a series of movements. This makes it possible to move around or through the scene more quickly.

IO settings

• For each input / output driver available, you can define the way Amapi handles the communication with the source or destination application.

• Switch axes : Use this part of the dialog to modify the orientation in space of the imported or exported model, as not all software uses the same system (X,Y,Z). If you notice that the model is the wrong way round, use these parameters (which will be kept as preferences) to define a proper correlation between the position of the model in Amapi and in the other software.

• Coordinates transformation : This value represents the reducing or enlarging ratios applied in reading and writing files in choosen format. This ensures a perfect coherence in measurements between Amapi and other softwares.

• Extension: It allows you to define a default suffix for output files.

• Clean : You may want to suppress coplanar face when reading huge and / or complex files. Enabling this option will merge all coplanar faces of the input file, useful while some formats are needing triangulated faces.

• Smooth / Smooth angle: You can define if you want exported models to be automatically smoothed and for which value. Useful to communicate easily with rendering programs.

Network preferences

• You can define how you want to handle the remote connection to an URL address, defining local network parameters (use of proxy), as well as asking for cache files for a faster connection.

NURBS MODE

Use the NURBS Mode command to change the design mode of the program.

Amapi has two modes: Polyhedral modeling and NURBS modeling. At a glance, know which mode you are in by checking the indicator in the lower left corner of the screen. A “P” to the right of the close box indicates Polyhedral mode and an “B” indicates NURBS mode.

Polyhedral vs. NURBS

Polyhedral modeling creates basic surfaces made up of faces that are planar. All edges are straight. The surfaces of NURBS models are computed from the given points The faces of a NURBS model may be curved or planar. Edges are NURBS curves.

NURBS Benefits

NURBS models are more accurate than polyhedral models. Using the NURBS mode allows you to output exact models The drawback to this accuracy is slightly greater computer processing time. Each time a NURBS model is changed, the computer must recalculate all the equations that went into creating the model.

Amapi knows which objects on the screen are polygonal and which are editing, the Modeling Tools will work correctly on both polygonal and NURBS objects, no matter which mode is currently active.

Creating a NURBS model

Most of the Construction Tools can be used in creating NURBS models. Two of the 2D Drawing tools, the Bezier Curve and the Polyline, cannot be created in the NURBS mode. This is because these particular curves are not required in NURBS mode.

1. Choose NURBS Mode from the Edit menu (or hit Command-B).

A check mark appears to the left of the menu command and the lower left indicator shows an “B”.

2. Choose any of the Construction Tools and create a form.

Remember that Bezier Curves and Polylines cannot be described in NURBS mode. The NURBS form may look exactly the same as in the polyhedral mode. You will definitely see the difference when you try editing the NURBS model.

NURBS construction vs. Polyhedral construction

The construction tools have subtle, yet important differences in the two different design modes.

2D Drawing Tool

The 2D Drawing Tools create forms that, for the most part, appear to be the same in NURBS and Polyhedral modes. A visual difference comes when you modify them. Instead of being able to edit individual points, you edit a bounding polygon. This creates a smoother edited surface than if created in the Polyhedral mode.

Circle

A NURBS circle appears to be the same as a polygonal circle. It is actually formed of two semicircles. When you modify it, you pull points on a bounding polygon instead of individual points on the circle's circumference. Modification will change all points on one of the semicircles.

Polylines

Polylines are drawn ignoring NURBS mode and their description will always be polygonal.

Bezier

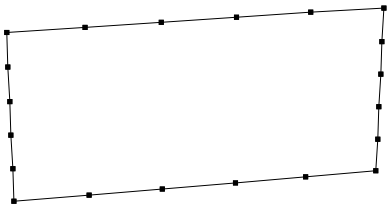
Bezier Curves are drawn ignoring NURBS mode and their description will always be polygonal.

Arc

A NURBS arc appears to be the same as a polygonal arc. It is actually formed of two arcs, joined by a point in the middle. When you modify it, you pull points on a bounding polygon instead of individual points on the arc itself.

Rectangle

The rectangle is one form that appears different in creation. Instead of being formed of four points (one at each corner), a NURBS rectangle has several points along each line. When you modify it, the bounding polygon allows you to turn the straight lines into curved lines. Although it appears so, the NURBS rectangle is not a closed curve. Amapi does not implement Periodical NURBS and real closed NURBS cannot be actually created. This means that when you fillet the NURBS rectangle, only three sides will be filleted instead of all four.



NURBS

If you create a NURBS curve (either in NURBS mode or in Polyhedral mode), you may modify only the points you clicked in creating the NURBS. Pull the NURBS reference points to deform the entire curve.

NURBS Interpolated

NURBS Interpolated curves work the same as NURBS curves (see above).

Mirror 2D Curve

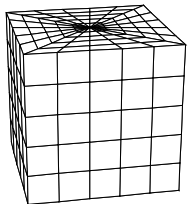
If you mirror a 2D NURBS curve and then modify it, you will have the same smooth results as with the other tools. The original curve, mirror, and connecting lines are each modified individually.

Sphere

The Sphere in NURBS mode has an initially smoother appearance than Polyhedral spheres. The NURBS sphere is formed of curved facets and is actually formed of two joined hemispheres. The Polyhedral sphere is formed of flat facets. Modifying a NURBS sphere, like other tools, results in a smoother form.

Cube

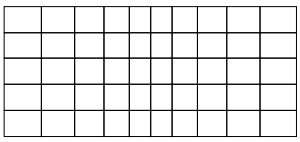
The NURBS cube has a different appearance than the Polygonal cube. Immediately, it takes on the appearance of the bounding polygon you might see surrounding a 3D NURBS form during modifications.



When you modify this cube, you have a few extra points to work with. You could reform a NURBS cube to become more of a spherical shape.

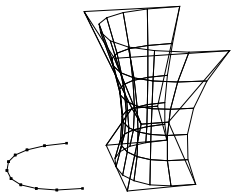
Rectangular Surface

The appearance of a NURBS Rectangular Surface is different from the Polyhedral Rectangular Surface.



Each cell of a NURBS Rectangular Surface is divided into several smaller cells. When you modify this surface, the modification is smoother due to the additional facets.

Extrusion



The Extrusion tool in NURBS mode creates quite a different model than it does in Polyhedral mode.

Create a NURBS Extrusion

1. Choose the Extrusion tool when you have a NURBS mode curve selected on the screen.

2. Click the curve and move the cursor.
A bounding box appears.

3. Move the cursor to a point to end the extruded segment and click
A smooth extrusion (with horizontal and vertical face lines) appears inside the bounding box.

4. Click an endpoint for another extrusion segment.
The joint between the two segments is smoothed. In the Polyhedral mode, that joint is sharp.

5. Hit Return when you are done creating segments.

6. When notified, click one end to cap it.
In NURBS mode, facets forming the cap are drawn.

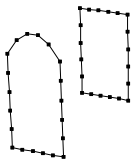
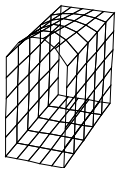
7. Put-aside the Extrusion tool.

If you try to validate the extrusion after creating only one segment, you are not able to do so. A NURBS curve cannot be created with only two points, so Amapi insists that you pick at least three points in the creation of a NURBS extrusion.

Sweep

The Sweep tool does not have any special NURBS abilities. This tool works the same way in NURBS and Polyhedral modes.

Ruled Surface

If you use the Ruled Surface tool on NURBS curves, it creates vertical face lines in addition to the horizontal face lines created between points you click.

Hull Surface

If you create a Hull Surface from three NURBS mode curves, the surface it creates behaves like other NURBS surfaces when it comes time to modify it. If you choose a modifying tool, the surface is surrounded by a bounding polygon. As with other NURBS forms, you may relocate points on the bounding polygon to create a smooth reformation of the surface.

Curve Extract

The Curve Extraction tool will extract a curve from a NURBS form just as it does from a Polyhedral form. It does not, however, create 3D Lines. You may toggle between the Lasso and Bull's-eye cursor, but the Bull's-eye selects boundary points on the selected object only. It extracts the curves between those boundary points, instead of drawing 3D lines between them, as in the Polyhedral mode.

Surface Extract 

The Surface Extract tool, even if used with NURBS forms, in NURBS mode, will create only Polyhedral facets.

Thickness 

Do not use the Thickness tool on NURBS forms. This will cause the NURBS forms to become Polyhedral.

Modifying a NURBS model

The Modeling Tools work differently on NURBS models. Instead of altering single points and faces, like in Polyhedral modeling, the entire NURBS surface is recalculated. This allows you to perform a smooth edit on the model.

Tools to avoid

Some of the Modeling tools do not work with the NURBS mode. You can choose and use these tools on a NURBS model, but this will cause the NURBS model to become Polyhedral. A Polyhedral model cannot be transformed into a NURBS model. If you want your NURBS model to remain that way, do not use these tools:

 Delete Facet  Punch  Cut

 Fillet  Thickness

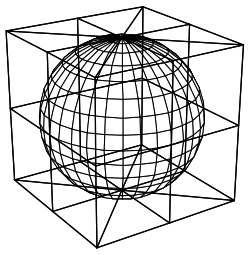
Remember that some of these tools will cause the NURBS model to become polygonal.

Control Polygon

A white bounding box surrounds the current NURBS object when you select one of the Modeling Tools. This is called the control polygon. The points that you alter are actually the control points on the control polygon, not the object's points.

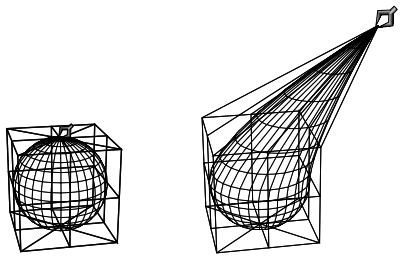
1. Choose a NURBS object as the current object.

2. Choose a tool from the Modeling Toolbox.
   The control polygon appears.



3. Use the tool to edit a point on the control polygon.
   If you try to grab a point directly on the object, Amapi grabs the nearest point on the control polygon.

NURBS modeling vs. Polyhedral modeling



Stretch

The Stretch tool works differently on NURBS mode objects. Instead of changing the location of one point on the object, you change the point on a bounding polygon. Modifying the bounding

polygon point actually reforms the surface by changing the location of several surrounding surface points and lines.

Mold

The Mold tool works very much like the Stretch tool. The precision of the Mold tool, by hitting the + and - Keys, can be altered. This allows somewhat more variation in your edit than does the Stretch tool.

Bend

The Bend tool does not have any special NURBS abilities. This tool works predictably the same on NURBS and Polyhedral models.

Delete Facet

Do not use the Delete Facet tool on a NURBS model. This will cause the model to become Polyhedral.

Cut

Do not use the Cut tool on a NURBS model. This will cause the model to become Polyhedral.

Punch

Do not use the Punch tool on a NURBS model. This will cause the model to become Polyhedral.

Proportional Scale

The Proportional Scale tool does not have any special NURBS abilities. This tool works the same way in NURBS and Polyhedral modes.

Single Axis Scale

The Single Axis Scale tool does not have any special NURBS abilities. This tool works the same way in NURBS and Polyhedral modes.

Smooth

When you choose the Smooth tool with a NURBS mode form as the current object, immediately you notice a difference between NURBS and Polyhedral smoothing.

1. Choose the Smooth tool when you have a NURBS mode surface as the current object.

A data box appears. In the data box, U Raw describes the spacing for smoothing in the direction of object creation (mostly horizontal spacing); V Raw describes the spacing for smoothing in a direction perpendicular to the direction of object creation (mostly vertical spacing). The larger the number, the greater is the smoothing.

2. Specify the amount of smoothing.

• You may change the amount of smoothing by using the + and - Keys (here you see immediate updates on the surface with each key press). By default, the + and - Keys will change the No. of U value in increments of 1. Hit the space bar and hit + or - to change the No. of V value in increments of 1. Here U and V have the same meaning as described in Step 1.

OR

• To change the amount of smoothing by typing values, hit the Tab Key and type in the data box. Hit Return to see the change on the surface.

Fillet

Do not use the Fillet tool on a NURBS model. This will cause the model to become Polyhedral.

The Construction Tools

2D Drawing Tool

Sphere

Cube

Rectangular Surface

Extrusion

Sweep

Ruled Surface

Hull Surface

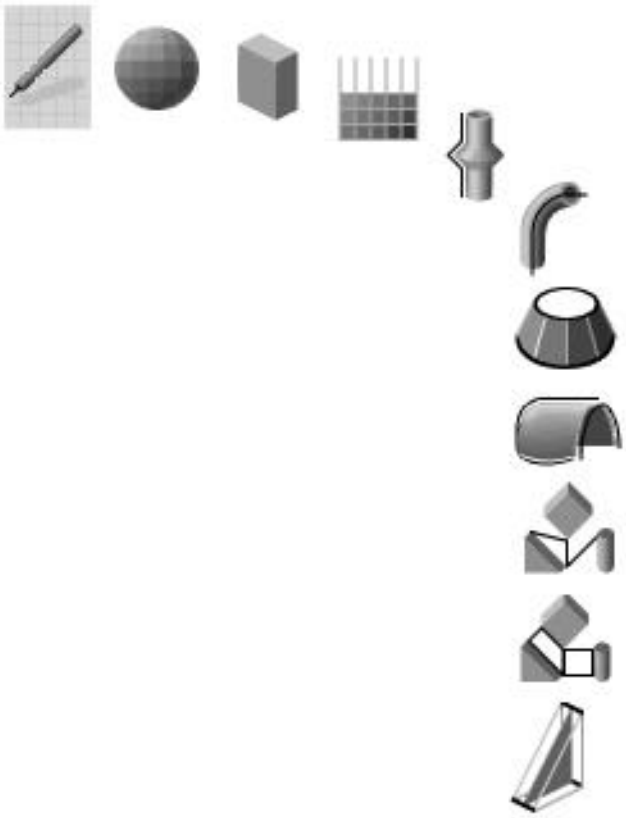
Curve Extract

Surface Extract

Thickness

The Construction Tools

When you open Amapi, the Toolbox that is visible on the screen contains the Construction Tools. The Construction Tools are used to create all of the basic shapes and geometry that form the basis of your model. This Toolbox supplies tools for creating both 2-dimensional shapes, like rectangles and arcs and 3-dimensional forms like spheres, cubes, and profiled surfaces. Use the other Toolboxes to modify, join, and otherwise edit the forms.



2D Drawing Tool

The 2D Drawing Tool allows you to draw 2-dimensional shapes. When the 2D Drawing tool is selected, its icon appears in the upper right corner of the screen. This tool has a sub-palette of drawing tools for drawing Lines, Arcs, Circles, Rectangles, Polylines, Bezier curves, NURBS, and Mirrored 2D Curves.

Using the 2D Drawing tool

1. Pick the 2D Drawing Tool.

Amapi may display a Bull's-eye cursor and two axes, waiting for you to click on a point to act as the beginning reference point for the 2D construction.

If you click an empty area of the screen, Amapi will automatically snap the axes to the closest object point it can find.

2. If necessary, click a beginning reference point.

• If there is nothing drawn on the screen, the cursor will automatically snap to the center of the work bench and a click is not necessary. That point automatically becomes your beginning reference point.

• If there are objects drawn on the screen, then you must click on a vertex of an existing object. That point becomes your beginning reference point. This beginning reference point acts both as a temporary origin for the 2D construction and positions the current work plane in space.

3. Pick one of the 2D tools from the upper right corner palette.

Once you have established the beginning reference point, then you can pick one of the eight 2D tools that appear in the upper right corner of the screen. The 2D shape you are about to draw will lie in a plane that goes through the origin you clicked in step 2.

4. Draw the 2D object according to the steps of that tool.

See the next section for the uses of each 2D tool.

5. Hit the Return Key to validate the object, if necessary.
The Wand cursor becomes visible.

6. Put-aside the Wand to end working with the 2D Drawing Tool
OR

Pick another 2D tool from the upper right corner of the screen and continue creating additional 2D geometry.

When you use any of the “open curve” 2D tools (Polyline, Arcs, Bezier, or NURBS tools), the last point of each curve created becomes the reference point for the beginning of a new 2D curve. This makes it easy to string together several 2D objects. Create a Polyline, followed by an Arc, followed by a NURBS, and so on. The objects are linked end-to-end as a single object. The connection point may be desactivated or re-activated by hitting the return key.

The “closed curve” 2D tools (the Circle and the Rectangle) allow you to continue adding additional separate objects without putting-aside the tool.

 Circle Tool

Use the Circle tool to draw a 2-dimensional circle.

Using the Circle tool

1. Click a center point for the circle.
If you prefer, hit the Tab Key to type a value for the location of the circle’s center. Hit the Return Key to enter the value.

2. Click a point on the circumference of the circle.

If you prefer, hit the Tab Key to type a value for the radius. Hit Return to enter the value.

3. Choose the number of points defining the curve.

 When the circle is complete, the +/- slider appears. Use the + and - Keys to change the number of points used in forming the circle. If you prefer, hit the Tab Key and type a value.

4. Put-aside or hit return key to validate the circle.

 Polyline

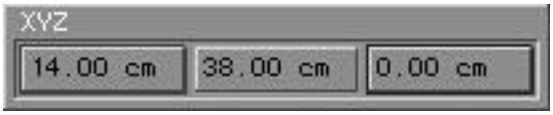
Use the Polyline tool to draw a series of straight connected lines.

Using the Polyline tool

1. Click the polyline's starting point.
If you prefer, hit the Tab Key and type a value for the starting point. Hit Return to enter the value.

2. Click as many other points as you want to create connected lines.
Each point you click is connected to the last point with a straight line. If you prefer, you may hit the Tab Key to type a value for as many other points as you want to create connected lines.

3. Hit the Return Key to validate the object.



Locking onto the X, Y, or Z axis

To create a perfectly horizontal or vertical line, hit the space bar to toggle through the axes available in the current view. With just one axis available, you are forced to keep the line on that axis.

Using polar coordinates

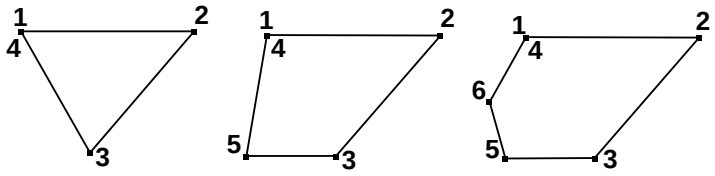
At any time, you may choose between cartesian coordinates (X,Y, Z values) and polar coordinates (distance from previous point and angle from previous segment). To toggle between the two coordinates modes, hold the option key and click the mouse button. Display and input of values for each point will comply with the current coordinate mode.

Creating an irregular polygon

When picking the last point of a connected line series, you may click on the location of the first point again to close the form. Once you close the form this way, it remains closed and any points you click create additional sides on a closed irregular polygon.

Creating 3D Polylines

Between endpoint clicks, use the arrow keys and keypad to rotate the view and working plane. You are then able to click a point in a perpendicular plane, creating connected lines in 3D space.



Bezier Curve

Use the Bezier Curve tool to create a curve that flows through points you click. The Bezier curve uses a different type of formula

than the NURBS curves. The Bezier curve is a simpler form that is not computationally intensive, but it won't represent aerodynamic and other very specific curves as well as NURBS.

Using the Bezier Curve tool

1. Click a starting point for the curve.
   If you prefer, hit the Tab Key to type a value for the starting point. Hit Return to enter the value.

2. Click as many additional points as you want to complete your Bezier Curve.
   If you prefer, hit the Tab Key to type values for as many additional points as you want.

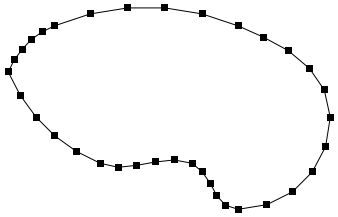
3. Hit the Return Key to validate the curve.

4. Choose the number of points defining the curve.

 Hit the Return Key to release the Bezier Curve tool and display the +/- slider. Use the + and - Keys to change the number of points used in forming the curve. If you prefer, hit the Tab Key and type a value. Hit return key or put-aside to end the drawing.

Creating a Closed curve

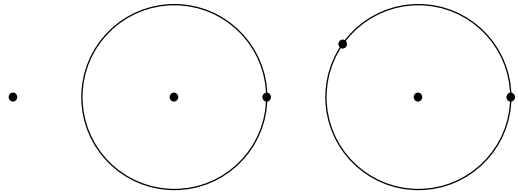
When picking the last point of a curve, you may click on the location of the first point again to close the form. Once you close the form this way, it remains closed and any points you click create additional points on a closed curve



Arc

Use the Arc tool to draw an arc of any size. There are two basic ways to use the Arc tool. You can choose the arc's center point, radius, and endpoints, or you can choose the beginning and endpoints and a point along the arc.

Center point-Radius-Endpoints method



1. Click a location to serve as the center point for the arc.

2. Click a point to indicate a point on the arc's radius.

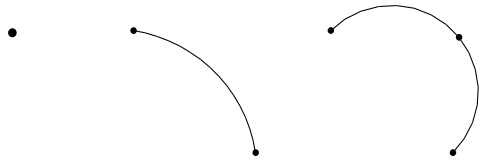
This is also the beginning point of the arc. If you prefer, you may hit the Tab Key and type a value for the radius, hitting Return to enter the value.

3. Move the cursor around to define the angle of the arc.

Click when the arc meets your specifications (or hit the Tab Key and type a value for the arc angle, hitting Return to enter the value).

If you option-click before clicking the endpoint of the arc, the first and second points you click become the endpoints of the arc and the final point you click will lie somewhere on the arc between the endpoints.

Beginning-Middle-Endpoint method



1. After choosing the Arc tool, option-click.
Notice that the reference lines run along the circumference of the circle instead of through the middle. This allows you to pick a beginning point on the circumference of the arc.

2. Click a location to serve as the beginning point for the arc.

3. Click a second point on the arc.
If you prefer, hit the Tab Key and type a value for the location, hitting Return to enter the value.

4. Click the endpoint for the arc.
If you prefer, hit the Tab Key and type a value for the location, hitting Return to enter the value.

The option-click is a toggle. Option-click a second time and you're back to deflnlng the center point.

Combining the two methods

You can combine these two methods by simply option-clicking after any step. For example, option-click to select a point on the arc itself. Option-click again to select the center point. Click the endpoint. Combine methods to create arcs exactly as they are needed in your design.

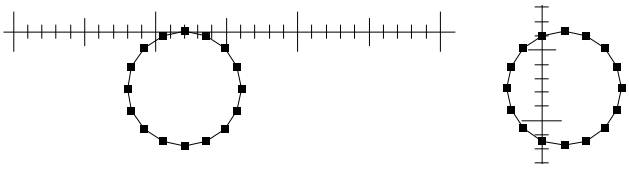
Changing the number of points defining the curve

 When the arc is completed, the +/- slider appears. Use the + and - Keys to change the number of points used in

forming the arc. If you prefer, hit the Tab Key and type a value. Hit Return or put-aside to validate the arc.

Locking onto the X,Y,or Z axis

Hit the space bar to toggle through the axes available in the current view. Wherever the cursor is located at the time you hit the space bar becomes a point on the axis. With one axis available, you can only change the arc in that direction.



Rectangle

Use the Rectangle tool to create a rectangle.

Using the Rectangle tool

1. Click a point that will be one corner of the rectangle.

If you prefer, hit the Tab Key to type a value for one corner of the rectangle. Hit Return to enter the value.

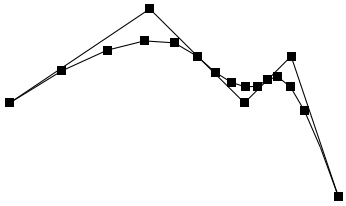
2. Click the opposite corner of the rectangle.

If you prefer, hit the Tab Key to type a value for the opposite corner of the rectangle. Hit Return to enter the value.

You may continue creating separate rectangles by picking the Rectangle tool and repeating these steps until you put-aside the 2D Drawing tool.

NURBS

Use the NURBS tool to create a curve controlled by the points that you click. Amapi uses these vertices as a bounding polygon for a NURBS curve. This NURBS tool will rarely create a curve that passes through the points you click.



Using the NURBS tool

1. Click a starting point for the curve.
   If you prefer, hit the Tab Key to type a value for the starting point. Hit Return to enter the value.

2. Click as many additional points as you want to complete your curve.
   If you prefer, hit the Tab Key to type values for these point. Hit Return to enter each value.

3. Hit the Return Key to validate the curve.

4. Choose the number of points defining the curve

 Hit the Return Key to accept the curve and the +/- slider is displayed. Use the + and - Keys to change the number of points used in forming the spline. If you prefer, hit the Tab Key and type a value. The number in the data box represents the number of points between each vertex you clicked. Hit Return or put-aside to validate the curve.

Hold the Shift Key to snap the cursor to existing vertices in the drawing.

Creating NURBS in 3 dimensions

After you have clicked at least one point on the curve, you can use the Arrow Keys or number pad numbers to rotate to another view. The drawing plane becomes the plane most parallel to the screen. Click points on the NURBS in all three planes by using the arrows to rotate the view and the plane.

 NURBS Interpolated

Use the NURBS Interpolated tool to create a curve controlled by the points that you click. The curve passes through these points, which serve as vectors.

Hold the Shift Key to snap the cursor to existing vertices in the drawing.

If you click the starting point again, you close the curve and automatically release the tool.

Using the NURBS Interpolated tool

1. Click a starting point for the curve.
If you prefer, hit the Tab Key to type a value for the starting point. Hit Return to enter the value.

2. Click as many additional points as you want to complete your curve.
If you prefer, hit the Tab Key to type values for these point. Hit Return to enter each value.

3. Hit the Return Key to validate the curve.

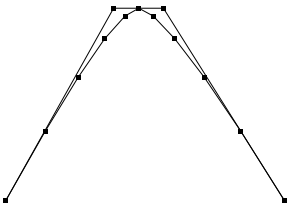
4. Choose the number of points defining the curve

 Hit the Return Key to accept the curve and the +/- slider is displayed. Use the + and - Keys to change the number of points used in forming the spline. If you prefer, hit the Tab

Key and type a value. The number in the data box represents the number of points between each vertex you clicked. Hit Return or put-aside to validate the curve.

Creating NURBS in 3 dimensions

After you have clicked at least one point on the curve, you can use the Arrow Keys or number pad numbers to rotate to another view. The drawing plane becomes the plane most parallel to the screen. Click points on the curve in all three planes by using the arrows to rotate the view and the plane.



Important:

NURBS curves are always drawn in NURBS mode (even if POLYHEDRAL MODE was selected from EDIT menu). Bezier curves and polylines are always drawn in POLYHEDRAL mode (even if NURBS MODE was selected from EDIT menu).

 Mirror 2D Curve

To create a mirror of a 2D curve, use the Mirror 2D Curve tool.

Using the Mirror 2D Curve tool

1. Create an open 2D curve.

Use the Arc, Bezier curve, Polyline, or NURBS tools. Make sure that the connection point is displayed (do not deactivate it).

2. Click the Mirror 2D Curve tool.

As you move the cursor, a straight line appears through it. This is the axis of symmetry.

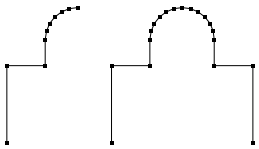
Do not exit the 2D Drawing mode before creating the mirror.

3. Hit the space bar to change the angle (horizontal or vertical) of the reflection.

You may not use the Arrow Keys to change your view. Verify that you are looking at the correct plane before you choose the Mirror 2D Curve tool.

4. Click the mouse button when the line is positioned where you want the mirror located.

A mirror image of the curve appears. It is linked to the original curve, creating a single form.



Important:

Since Amapi does not handle periodical NURBS, in the NURBS mode, it is technically not possible to generate a closed NURBS curve although it may appear closed. For example, if you create a rectangle in NURBS mode (not in polyhedral mode—see the NURBS mode discussion in Chapter 3 for more information), you will notice that due to the above restriction you cannot fillet the fourth edge where the curve appears to be closed.

The 3D tools work like the 2D tools—you need to pick a reference point and then pick a starting point for the creation of the object.

Sphere

The Sphere Tool allows you to draw 3D spheres anywhere in the work space. With the Sphere tool selected, its icon appears in the upper left corner of the screen.

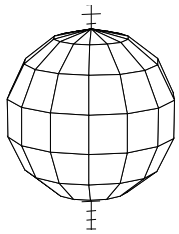
Using the Sphere tool

1. Pick the Sphere tool.

Amapi may display a bull's-eye cursor and two axes, waiting for you to click on a point to locate the axes. If there is nothing drawn on the screen, the axes automatically appear at the center of the workbench.

2. Click the sphere's beginning point.

That point becomes the base of your sphere.

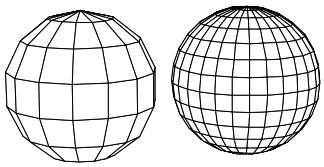


3. Complete the sphere by clicking a desired center point with the mouse.

OR

Hit the Tab Key and type a value for "Radius". Hit the Return Key to accept the value.

4. Choose the number of points defining the sphere.



Once you have drawn the sphere, the "+/-" cursor appears, allowing you to use the Plus and Minus Keys to make

the sphere more smooth or more coarse. If you prefer, you can hit the Tab Key and type a value for “Number of Points”. Hit the Return Key to accept the value.

5. Hit the Return Key to validate the sphere.
The Sphere tool is released and the Wand cursor appears.
OR

Put-aside the “+/-” cursor to validate the sphere.
The Sphere tool is released and the Wand cursor appears.

Cube

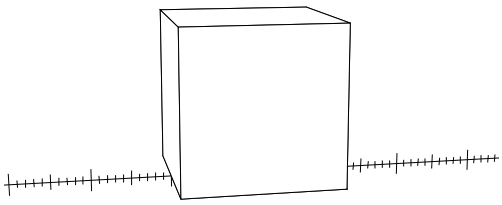
The Cube tool allows you to draw 3D Cubes anywhere in the work space. With the Cube tool selected, its icon appears in the upper left corner of the screen.

The Cube tool can creates any 3D rectangular shape by entering X, Y and Z dimensions with numeric input.

Using the Cube tool

1. Pick the Cube tool.
Amapi may display a Bull’s-eye cursor and two axes, waiting for you to click on a point to locate the axes. If there is nothing drawn on the screen, the axes automatically appear at the center of the workbench.

2. Click the cube’s beginning point.
That point becomes the base of your cube.



3. Click a point on the edge of the cube's base.
The Cube tool is released and the Wand cursor appears.
OR

Hit the Tab Key and type a value for "Dim X ", "Dim Y" or "Dim Z" to create a rectangular 3D shape. Hit the Return Key to accept the values.
The Cube tool is released and the Wand cursor appears.

Rectangular Surface

Use the Rectangular Surface tool if you want to create a flat surface mesh. Shape a Rectangular Surface later with the Modeling Tools.

Using the Rectangular Surface tool

1. Choose the Rectangular Surface tool.
Click a location to serve as the origin.

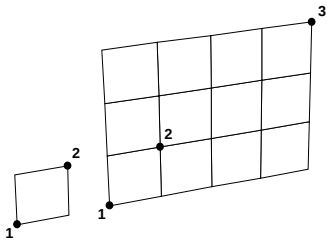
2. Click a point that will become one corner of the Rectangular Surface.
If you prefer, hit the Tab Key and type a value for the X, Y, and Z location, hitting Return to enter that value.

3. Click a point that defines the size of the facets, or mesh cells, that will form the Rectangular Surface.

If you prefer, hit the Tab Key and type a value for the length and height of the cell, hitting Return to enter that value.

4. Move the cursor to indicate the height and length of the Rectangular Surface.

Click when you have the size you need. If you prefer, hit the Tab Key and type values, hitting Return to enter the values for No. of U (horizontal cells) and No. of V (vertical cells) .



You always get complete Rectangular Surface cells. For example, if each facet or cell is 10 X 10, the entire Rectangular Surface can only measure a multiple of 10, such as 180 X 50, never 182 X 47.

Extrusion

The Extrusion tool is used to take a 2D curve and build a 3D shape based on a perpendicular projection of that 2D curve. This is done in two different ways:

The one-curve method

This allows you to take a single planar curve (open or closed) and extrude it in a direction perpendicular to the plane of the curve. You have the option of defining multiple extrusion segments and can vary the relative scale of the curve (make the curve larger or smaller) at the end of each segment.

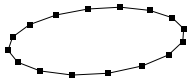
The two-curve method

This allows you to take a single planar curve (in this case referred to as a “section”) and extrude it in a direction perpendicular to the plane of the curve. The shape of the extrusion is created through a second curve (referred to as a “profile”).

Using the Extrusion tool (One-Curve Method)

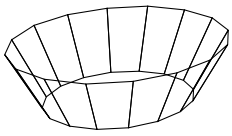
1. Select a 2D curve with the Wand to make it the current object.

2. Click on the Extrusion tool.
Using the keyboard arrows or the number pad, rotate to a view that is approximately perpendicular to your selected object.



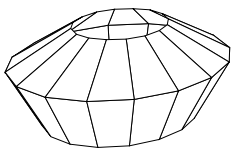
3. Click on the selected 2D curve to grab it.

4. Pull the curve to extrude it.



5. Click the mouse to end the first extrusion segment.
If you prefer, hit the Tab Key and type values for the radius and height, hitting Return to enter those values.

6. Repeat steps 4 and 5 as necessary.



7. Hit the Return Key when you want to end the extrusion.

8. If necessary, cap each end of the shape if the base curve is closed.

The two open ends of the extruded shape are outlined in red. This 2D curve must lie in one of the orthogonal planes. That is, either the Top, Front, or Right plane.

You will get the most predictable results with the Extrude tool by connecting one end of the profile to one vertex point of the section. This is not required, but the results otherwise might not be what you expected.

9. With the Wand, click on each end that you want capped.

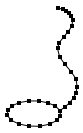
If you want them to remain open, just put-aside the tool.

Hit the space bar to lock onto a vertical axis, a horizontal axis, or both axes to aid in your extrusion.

Using the Extrusion tool (Two-Curve Method)

1. Create two curves in perpendicular planes.

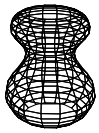
Each curve must lie in one of the orthogonal planes (Top, Front, or Right). One curve is the “section” that will be extruded over the shape of the “profile” curve.



2. Select the section with the Wand to make it the current object.

3. Click on the Extrusion tool.

4. Click on the profile.



An extrusion of the section that follows the shape of the profile appears. If the section is a closed curve, the two open ends of the extruded shape are outlined in red.

5. With the Wand, click on each end that you want capped.

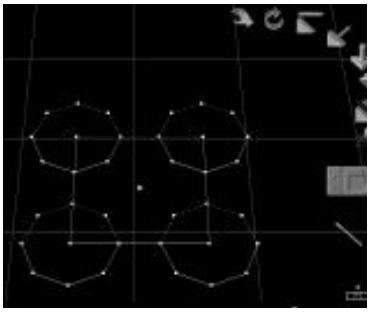
If you want them to remain open, just put-aside the tool.

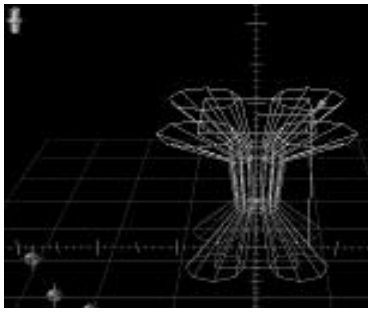
Both of the original 2D curves become hidden when the extruded shape is validated. This original curve can be brought back by using the Show tool.

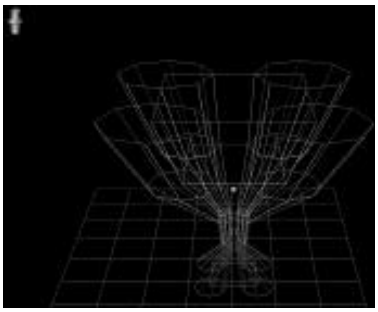
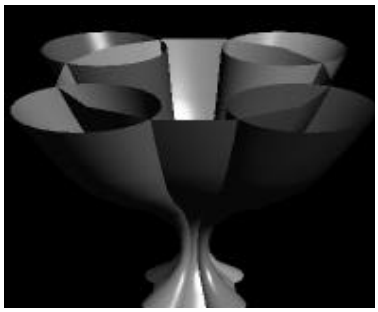
Extended Extrusion :

You can now extrude either a single curve, either a group of curves, either a whole surface or volume, or a face of a mesh.

If the current selected object is a group composed of curves (it must be composed only of curves), you can extrude it, both interactively and by a predefined profile

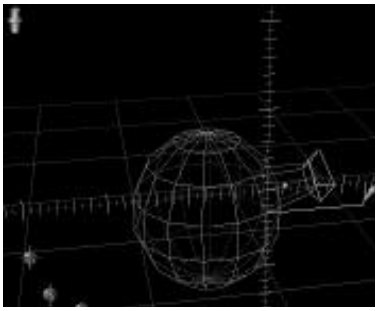
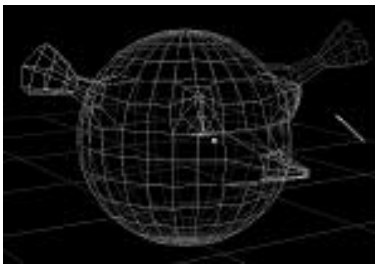




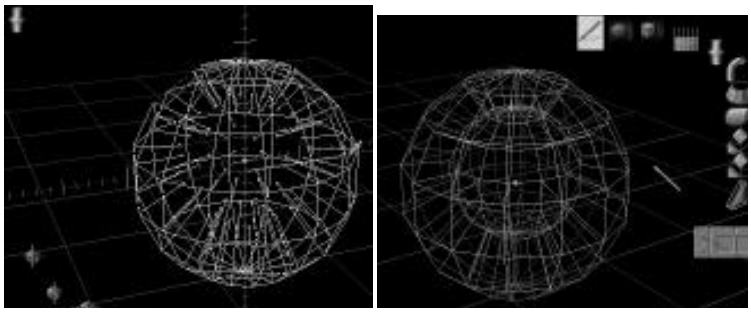



. If the current selected object is a surface (or a volume), you can also extrude it :

. If you click into an object face, you will extrude this face, creating this way additional geometry on your object. This may be useful to create organic shapes from simple objects (like spheres), by extruding some faces to construct excrescences.

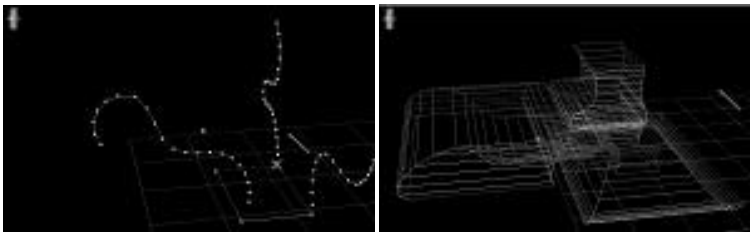




. If you click outside of the object (you dont select any face to extrude), the whole geometry of the object will be extruded, producing complex objects very simply.



- In the 2 curves mode, you can also snap a reference point by pressing "alt" key + mouse click (PC = right mouse button).

This point precises where the profile curve begins, otherwise a reference point is choosen automatically from section points. Useful when the curves have no common points or when the section curve (for ex. square) have no points in the main extrusion plane (You have to group the extrusion curves before extruding with them). If you have 3 extrusion curves, you will obtain 3 objects.



Sweep

The Sweep tool takes a 2D curve and builds a 3D shape based on a projection of that 2D curve. The Sweep, however, maintains the overall size of the “section” and can angle off in different directions. This is done in two different ways :

The one-curve method

This allows you to take a single planar curve (open or closed) and sweep it in any direction from the plane of the curve. You have the option of defining multiple swept segments, and can vary the angle of each segment.

The two-curve method

This allows you to take a single planar curve (in this case referred to as a “section”) and sweep it into a 3D shape. The shape of the sweep is created by following a second curve (referred to as a “profile”).

Using the Sweep tool (One-Curve Method)

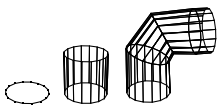
1. Select a 2D curve with the Wand to make it the current object.

2. Click on the Sweep tool.
Using the keyboard arrows or the number pad, rotate to a view that is approximately perpendicular to your selected object.

3. Click on the selected 2D curve to grab it.

4. Pull the curve to sweep it.

5. Click the mouse to end the first swept segment.
If you prefer, you may hit the Tab Key and type values for the distance and angle, hitting Return to enter those values.



6. Repeat steps 4 and 5 as necessary.

7. Hit the Return Key to end the sweep. If the section is a closed curve, the two open ends of the swept shape are outlined in red.

8. With the Wand, click on each end that you want capped.

If you want them to remain open, just put-aside the tool.

This 2D curve must lie in object one of the orthogonal planes. That is, either the Top, Front, or Right plane.

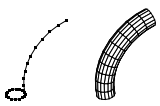
If one vertex point of the section is connected directly to an endpoint of the path, then that vertex point rides directly along the path. If the two curves are not connected, the geometric center of the section follows the path.

Both of the original 2D curves become hidden when the swept shape is validated. This original curve can be brought back by using the Show tool.

Using the Sweep tool (Two-Curve Method)

1. Create two curves in perpendicular planes.

Each curve must lie in one of the orthogonal planes. That is, either the Top, Front, or Right plane. One curve is the "section" that will be swept over the shape of the "profile" curve.



2. Select the section with the Wand to make it

the current object.

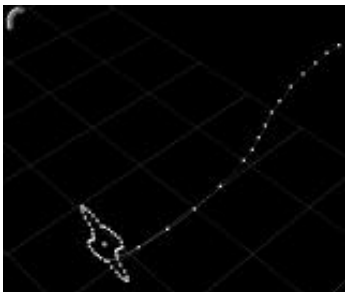
3. Click on the Sweep tool.

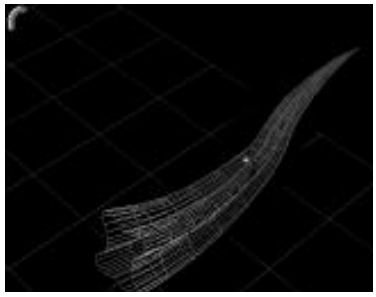
4. Click on the profile.
A sweeping of the section that follows the shape of the profile appears. The section is oriented so that it is perpendicular to the path at each point along the path. If the section is a close curve the two open ends of the swept shape are outlined in red.

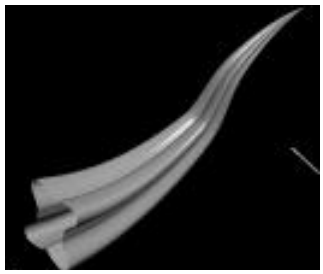
5. With the Wand, click on each end that you want capped.
If you want them to remain open, just put-aside the tool.

Sections scaling

Once you have created an object with the sweeping tool, while being able to change the orientation of the sections, you are now able to define a progressive scale on the sections. Use "+" and "-" keys to enlarge or reduce the size of the sections

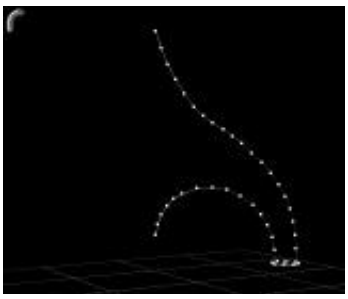
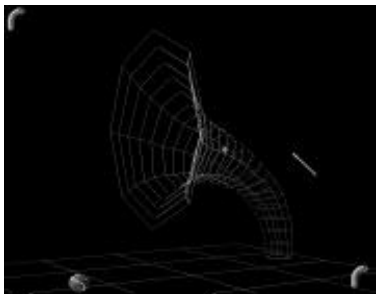






Double sweep

This method allows you to create shapes from one section and two profiles.
The section is repeated, oriented and adjusted according to the two profiles, used as guides.
This allows you for example, in a single operation, to create objects like horns, variable thickness tubes, helicoidal surfaces, ...


This tool works with 3D profiles (not lying in a plane), and which can be opened or closed, which allows you an infinity of resulting effects.
It also works in NURBS mode, and generates a NURBS surface if the section is a NURBS curve

Using the Double-Sweep method

Create a section and 2 profiles, each sharing a common point with the section, and preferably belonging to a perpendicular direction of the section, select the section as the current shape, take the Sweep tool,

 click on the double sweep mode icon (on the bottom-right corner of the screen) and select the 2 profiles as sweeping path. Your surface is built !

Limitations :
-The 2 profiles must be either both open, either both closed.
-Each profile must share a common point with the section
-The 2 profiles must not share the same point with the section

Orienting resulting sections

In the same time you are asked to cap ends of shape, you may press the Space bar to toggle orientation of swept sections. In a first time, original size of the section is unchanged but bounding edges may not be parallel. By pressing a first time on the Space bar, the size of each section if modified to keep bounding edges parallel. By pressing a second time on the space bar, each section will keep the original orientation of the swept curve, allowing you to create a different kind of surface.

Ruled Surface

The Ruled Surface tool allows you to create a “skin” or “patched surface” between two or more 2D curves. A simple example of this is to imagine an airplane wing. The structural ribs are the section curves, and the “skin” of the wing results from using this tool to connect those ribs.

The Ruled Surface tool can work with curves that are parallel to each other, but they don’t have to be. They can move and rotate through space.

The curves don’t need to be similar to each other or share the same number of points. Each one can be a completely different shape and can contain any number of points. Amapi will interpolate the points automatically.

The only requirement is that all the curves must be opened, or

they all must be closed. You cannot mix opened and closed curves.

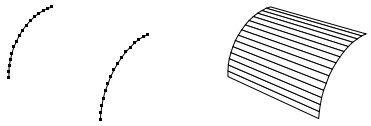
Using the Ruled Surface Tool

1. Create some 2D curves.

2. Pick the Ruled Surface tool.
It does not matter what the currently selected object is.

3. Click any point of the first curve of interest.

4. Click an appropriate point of the second curve.
As soon as you click, a “skin” or “patched surface” is created between the two curves. Amapi creates a straight “ruled” line between the two points you picked, and uses that as the basis for creating the surface. Pick your points carefully (that is, try to pick “related” points on each curve), because you can get varying results depending on what you pick.



5. Click on “related” points of additional curves, if desired.

6. Put-aside the cursor to validate the Ruled Surface.
The Ruled Surface tool is released and the Wand cursor appears.
OR

Hit the Return Key to validate the Ruled Surface.
If the original curves were closed, the two open ends of the shape are outlined in red.

7. With the Wand, click on each end that you want capped.
If you want to leave them open, put-aside the tool.

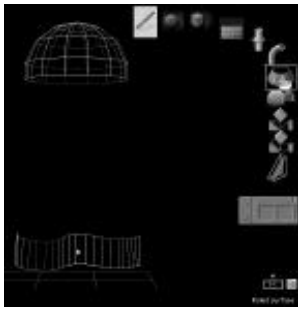
The orignal 2D curves become hidden when the Ruled Surface is validated. These original curves can be brought back by using the Show tool.

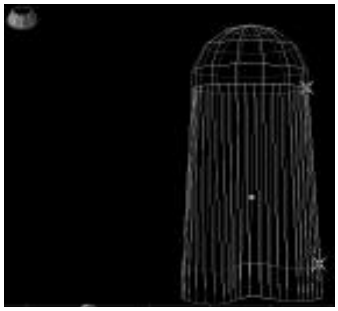
Ruled Surface construction between surfaces

You can also create ruled surfaces patched between two surfaces.

Have at least two surfaces in your scene. We mean by surfaces, polyhedral objects with open edges (e.g. not closed volumes).

Select a vertex on an open side (belonging to an edge sharing only one face), as well as a vertex on a curve, select another similar vertex: surface is build between the two boundaries!





Hull Surface

Use the Hull Surface tool to create complex surfaces. This tool allows you to create a surface that is defined by three curves (section, profile, and contour) in three different planes or four curves that may have any orientation in the 3D space. There are two methods of using the Hull Surface tool:

Three-curve method

Create three curves, one in each of the three orthogonal planes (Top, Front, Right) that the Hull Surface tool uses to define a surface. The section is repeated over the length of the contour in one direction and the profile in the other.

Four-curve method

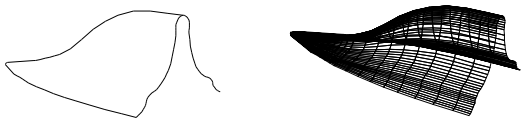
Create four curves that may have any orientation in the space but must share one point with another curve to form the boundaries that the Hull Surface tool uses to define a surface.

Using the Hull Surface tool (Three-Curve Method)

1. Create three flat (2D) curves.
   Create one in each of the three orthogonal planes (Top, Front, Side). The contour and the section must share a common point.

2. Choose the Hull Surface tool.
   You have to select the 3 curves in the following order: the section, the profile, and the contour.

3. Click on each curve, in that order.
   The curves become a surface. You may hit Command-Z or choose Undo from the Edit Menu if you make a mistake.



4. If necessary, optimize the Surface's Facets

Before putting-aside the tool, hit the minus (-) Key when your hull surface is complete to optimize the facets. This matches the number of points in each of the creation curves to the number of facets formed. When the surface is completely optimized, the minus key will no longer have any effect on its appearance.

5. Put-aside the Hull Surface tool.

Remember when creating curves that they will be joined as one object unless you put the Drawing Tool aside after each use. In order for the Hull Surface tool to work, you must have three or four separate curves.

Using the Hull Surface tool (Four-Curve Method)

1. Create four curves.

They may be created with any 3D orientation and dont have to lie in a single plane (you may use 3D curves). Each curve must share one point with another curve.

2. Choose the Hull Surface tool.

When you enter in the tool, hit the space bar to indicate that this will be a surface based on four curves. The 3-Curve Hull Surface icon displayed on the upper left corner of the screen is replaced by the 4-Curve Hull Surface icon.

The space bar command is a toggle. Before selecting any curve, hitting on the space bar allows you to switch between the two construction methods. Watch the upper left corner icon to control the method you are going to use.

3. Click on each curve, in any order.
The curves become a surface. You may hit Command-Z or choose Undo from the Edit Menu if you make a mistake.

4. Put-aside the Hull Surface tool.

Use the + Key to flip through the selection of each curve. The center point sphere shows for each separate curve to verify that you have 4 separate curves.

Using the Hull Surface tool (N-Curves Method)

This tool is an extension of the 4-Curve method. It allows you to create surfaces patched between a net of connected curves. The generated surface will be patched between the curves of longitude in one direction, and between the curves of latitude in the other.

1. Create a net of connected curves, representing the external and internal boundaries of the surface you want to create.

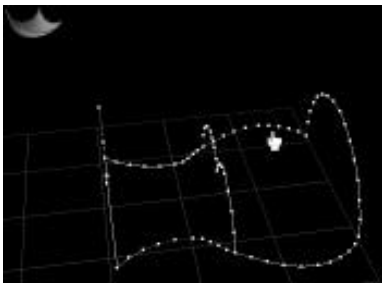
2. Take the Hull Surface tool

3. Toggle with the Space Bar to see the 4-Curve Hull Surface Icon

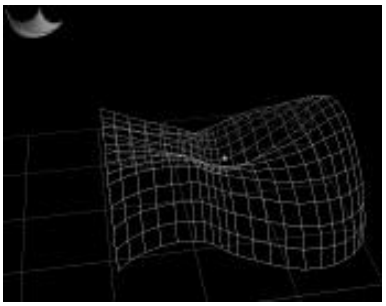
4. Click one by one the curves in longitude. They turn white when selected

5. When you have designated all the curves in longitude, Validate by pressing the Enter key. The wand cursor becomes the designation white hand.

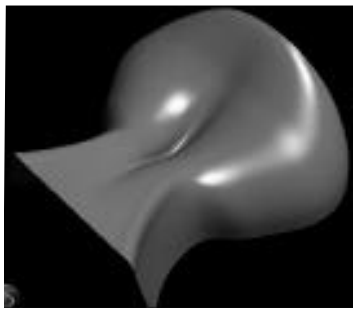
6. Then click one by one on the curves in latitude. They turn white when selected



7. When you have designated all the curves in latitude, Validate by pressing the Enter key.



The surface is generated, or a message is displayed if all the curves are not correctly connected



Limitations :

. All the curves must be connected between them like a net

. The curves in each direction (longitude or latitude) must be either all open, either all closed

. Even if the used curves are NURBS curves, the created surface is always polyhedral.

Curve Extract Tool

The Curve Extract tool creates a new curve object through points that you select on existing objects. This new curve is used often as the basis for a new Sweep, Extrude, or other surface creation operation. You may select these points with three different methods:

The Lasso Select method

With this method, use the Lasso cursor to select a set of existing points. A new curve object is generated through these points.

The Point-Select method

With this method, use the Bull's-eye (point selection) cursor to select existing points, one at a time. A new curve object is created through these points. You will be creating a 3D polyline through existing geometry.

The Automatic boundaries extract method

With this method, hit the return key before entering any point. This will automatically create the curves which define the free edges of the current object (Top and bottom circles of an open cylinder for example).

Using the Curve Extract tool (The Lasso-Select method)

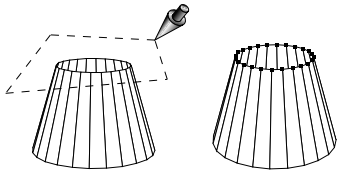
1. Have any 2D or 3D object already on the screen.

If there are many objects on the screen, make sure the object of interest is selected. The Lasso only "sees" points of the currently selected object. Any points of other objects contained within the Lasso are ignored.

2 Pick the Curve Extract tool.

The Lasso selection cursor automatically appears.

3. Draw a Lasso around the points of interest. Hit the Return Key to accept the selection.



A new curve object is drawn through those points. Remember, you must select a set of points through which it is possible to draw a single curve. You may end up selecting an invalid set. In this case, nothing will appear neither be created. For example, you cannot select an entire sphere object with this tool.

4. Repeat step 3 as desired to create additional separate curves.
OR

Put aside the tool to end the Curve Extract operation.
The Wand cursor appears.

Using the Curve Extract tool (The Point-Select method)

1. Have 2D or 3D objects already on the screen.
It doesn't matter which is the currently selected object.

2. Pick the Curve Extract tool.
The Lasso selection cursor automatically appears.

3. Hold the Option Key and click the mouse button.
This switches the cursor from the lasso to the Bull's-eye (point selection) cursor.

4. Click individual points on the existing objects.
As you click, a new curve object appears from one point to the next.

5. Hit the Return Key to accept the curve.
The Point-Selection cursor will stay active.

6. Repeat steps 4 and 5 as desired to create additional separate curves.
OR
Put aside the tool to end the Curve Extract operation.
The Wand cursor appears.

Using the Curve Extract tool (The automatic boundaries extraction method)

1. Have any 2D or 3D object already selected on the screen.
This method extracts the boundaries of an object. So it will be efficient only if the selected object is open (this method will give nothing if applied to a sphere or a cube).

2 Pick the Curve Extract tool.
The Lasso selection cursor automatically appears.

3. Hit the Return key.
One or several new curve objects are created and drawn, defining all the boundaries of the selected object. The Lasso selection cursor is still active.

4. Lasso-extract new curves from selected object if desired.
OR
Put aside the tool to end the Curve Extract operation.
The Wand cursor appears.

Surface Extract Tool

Use the Surface Extract tool to create facets either manually, by lasso, or automatically caping open shapes. You may need to create facets in order to mesh a special surface or create missing meshes on an object. The facets can then be welded together to form a uniform entity. You can create facets of any shape, with any number of edges.

You may use the Surface Extract tool with three different methods :

The Point-Select method

With this method, use the Bull's-eye (point selection) cursor to select existing points, one at a time. A new face object is created through these points.

The Lasso Select method

With this method, use the Lasso cursor to select a set of existing points. A new face object is generated through these points.

The Automatic boundaries extract method

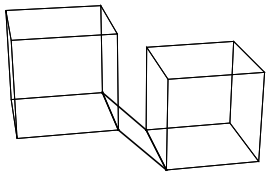
With this method, hit the return key before entering any point. This will automatically create the faces which cap an open object (creating top and bottom disks on an open cylinder for example).

Using the Surface Extract tool (The Manual Select method)

When you choose the Surface Extract tool, the Bull's-eye cursor appears.

1. Click points on the objects to identify the points of the facet.
   If you make a mistake, hit Command-Z or choose Undo from the Edit Menu.

2. When one facet is finished, hit Return.



The facet is its own object. If you create additional facets without putting the tool away first, they will be grouped together as one object. To create facets that are all separate entities, put-aside the tool after each facet is created. Re-choose the Surface Extract tool to create the next facet.

3. Click points to form additional facets or put-aside the Surface Extraction tool.

If the surface is not correct, you may erase it using Command-Z or Undo from the Edit Menu. Put-aside the tool to end the Surface Extract operation.

Using the Curve Extract tool (The Lasso-Select method)

1. Have any 2D or 3D object already selected on the screen.

If there are many objects on the screen, make sure the object of interest is selected. The Lasso only "sees" points of the currently selected object. Any points of other objects contained within the Lasso are ignored.

2. Pick the Surface Extract tool.

The Bull's-eye cursor appears.

3. Hold the Option Key and click the mouse button.

This switches the cursor from the Bull's-eye to the lasso cursor.

4. Draw a Lasso around the points of interest. Hit

the Return Key to accept the selection.
A new face object is drawn through those points. Remember, you must select a set of points through which it is possible to draw a single face. You may end up selecting an invalid set. In this case, nothing will appear neither be created. For example, you cannot select an entire sphere object with this method.

5. Repeat step 4 as desired to create additional separate faces.
OR

Put aside the tool to end the Surface Extract operation.
The Wand cursor appears.

Using the Surface Extract tool (The automatic boundaries extraction method)

1. Have any 2D or 3D object already selected on the screen.
This method extracts the boundaries of an object. So it will be efficient only if the selected object is open (this method will give nothing if applied to a sphere or a cube).

2 Pick the Surface Extract tool.
The Bull's-eye cursor appears.

3. Hit the return key.
One or several new face objects are created and drawn, caping all the boundaries of the selected object. The point selection cursor is still active.

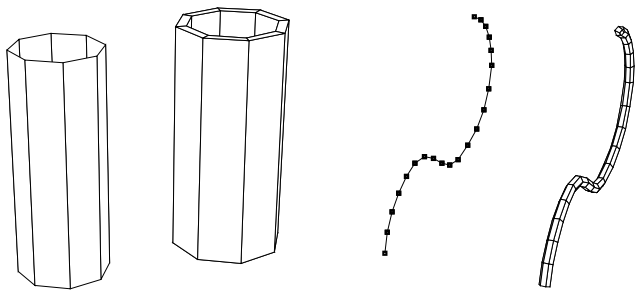
4. Manualy extract new faces from any object if desired.
OR
Put aside the tool to end the Surface Extract operation.
The Wand cursor appears.

You must have something drawn in the scene to use the Surface Extract tool.

Thickness

When created, objects have infinitely thin walls. Use the thickness tool to add uniform, parallel thickness to the outline of any object. Depending on the type of object you thicken, one of two things will happen.

1. If you are adding thickness to a surface (defined by facets) or volume (closed surface), such as a Rectangular Surface or sphere, you will get a wall parallel to each facet.
2. If you are adding thickness to a curve (defined by points), such as a circle, arc, or rectangle, you will get a tube or picture-frame effect.



Amapi automatically displays the sample thickness on a facet that is most perpendicular to the screen.

Giving Thickness to a surface or a volume

1. Click the surface or the volume you want to thicken with the Wand.
2. Click the Thickness tool.

The depth is automatically shown in red on one facet of the current object.

3. Increase or decrease the thickness.
Use the + and - Keys on your keyboard to increment the thickness. Hit the space bar to toggle thickness direction, inside or outside the surface. If you prefer, hit the Tab Key and type a value for the thickness, hitting Return to enter the value.

4. Click on the object with the Wand cursor.
The thickness appears. Hit Command-Z to cancel the operation or / and to give another thickness value.

5. Put-aside the Thickness tool.
The thickness is applied to the object and the Wand cursor appears.

Giving Thickness to a curve

1. Click the curve you want to thicken with the Wand.

2. Click the Thickness tool.
The depth is automatically shown in red between two points of the current object.

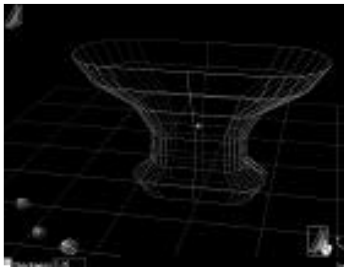
3. Increase or decrease the thickness and number of points
Use the + and - Keys on your keyboard to increment the thickness. Hit the space bar and use the + and - Keys to increment the number of points defining the thickness. If you prefer, hit the Tab Key and type a value for the thickness and number of points defining the thickness, hitting Return to enter the values.

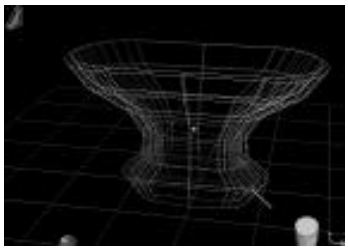
4. Click on the object with the Wand cursor.
The thickness appears.

5. Put-aside the Thickness tool.

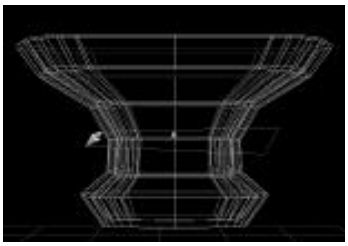
Creating an offset surface

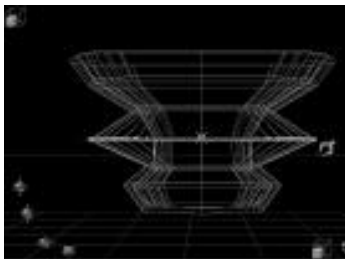
While you are tuning the thickness value, or once you have clicked to visualize the thickness result, you may click on the "Create Offset surface" icon to obtain a separate shape. It means that the result will be 2 separate objects, the initial one and the object generated by the offseted surface.The create Offset surface icon is a toggle. It means that you can switch between the offset surface creation mode and the closed volume creation mode.





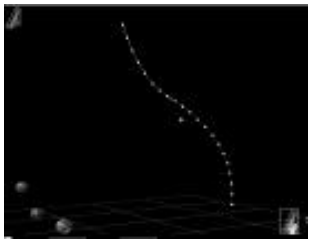
It allows you, for example, to build complex objects with variable thickness, since you can afterwards select the outside (or inside) offseted surface and edit one of its sections ...

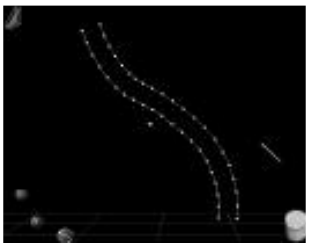




Creating an offset curve

By default, thickness on a polyline produces a tube as result.
While you are tuning the thickness value, or once you have clicked to visualize the thickness result, you can, as well as for surface thickness, toggle between the tube creation mode and the offseted polyline creation mode. This mode will produce an offseted polyline (you can choose the direction of the offset by using the Space Bar), instead of a tube surface.
To toggle mode, click on the "Create Offset curve" icon.





CHAPTER 5

The Modeling Tools

Stretch

Mold

Bend

Delete Facet

Cut

Punch & Boolean

Proportional Scale

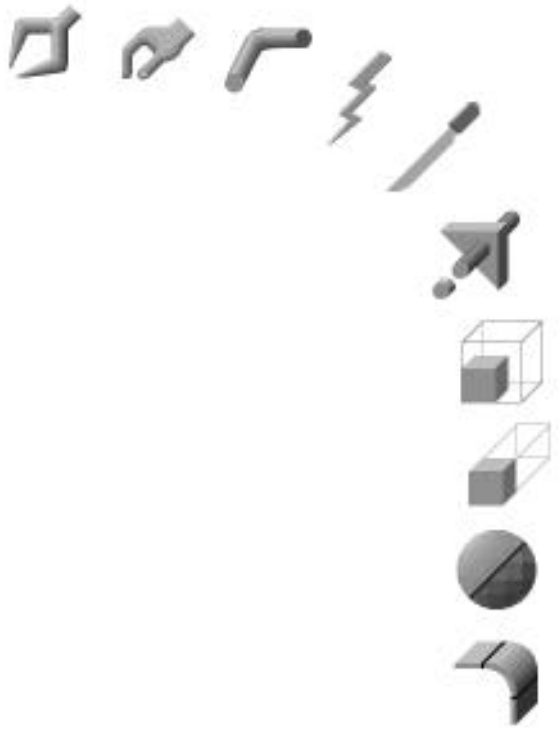
Single Axis Scale

Smooth

Fillet

The Modeling Tools

Use the Modeling Tools to modify forms you have created with the Construction Tools.



Stretch

The Stretch tool allows you to pick a single point of an object, or a group of points and pull it/them into a different position. The surface of the object stretches along with the point(s).

This tool works two ways:

Single Point method

This is the default condition of the tool. It allows you to grab one point at a time and stretch them individually.

Multiple Point method

By using both the Lasso cursor and the Bull's-eye cursor (Point-Selection), you can select any set of points you want and then stretch them as a group.

Using the Stretch tool (Single point method)

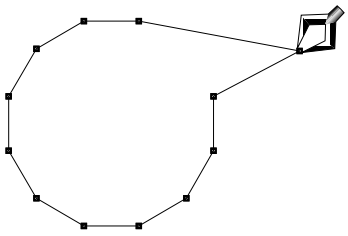
1. Click the object whose points you want to stretch with the Wand.

The object you want to modify must be the currently selected object.

2. Pick the Stretch tool.

The cursor changes to the Stretch tool icon.

3. Click a point with the Stretch tool and move it to a different location.



As soon as you grab the point, the two axes of the work plane appear through the point. As you stretch the point, its move-

ment is constrained to the current work plane. You can hit the + and - Keys to change the increment of the axes, which affects the snapping of the cursor on the work plane. You may hit the space bar to constraint the cursor displacement to a single axis (Toggle between Horizontal axis, Vertical axis and plane).
OR
Hit the Tab Key and type in values for “Loc X, Y, and Z”.
Press Return to validate. This displaces the point in 3D space.

When you click on a point, there are likely to be other points nearby. Amapi will always pick the “front-most” point closest to your cursor of the currently selected object. If you click a point in an empty area of the drawing, Amapi will still jump to the closest point of the currently selected object.

Undo a stretch by hitting Command-Z before you put the Stretch tool away.

Holding the shift key while moving the cursor, the moved point(s) are attracted by the points of existing shapes, allowing to snap any point of edited shape to another point of another shape.

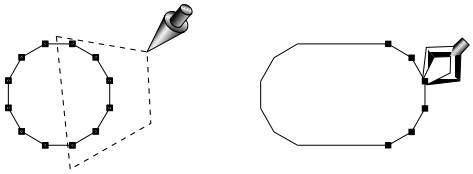
Multiple-point method using the Lasso cursor

1. Click the object whose points you want to stretch with the Wand.
The object you want to modify must be the currently selected object.

2. Pick the Stretch tool.
The cursor changes to the Stretch tool icon.

3. Hold the Option key and click the mouse.
The cursor changes to the Lasso cursor.

4. Draw a selection lasso around a group of points that you want to stretch. Hit the Return Key to validate selection.



The cursor changes back to the Stretch tool icon.

Option-click again and draw additional selection lassos if you want to select an additional set of points. Remember that the lasso will select all points of the current object that are inside the lasso, regardless of whether they are on the near side of the object or the far side. Points of noncurrent objects that lie within the lasso are ignored.

After you grab a point of the object, the movement of the cursor is constrained to the current work plane.

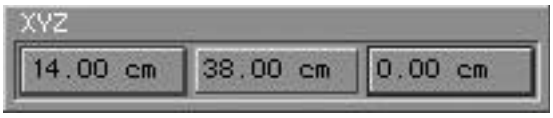
5. Click any one of the points with the Stretch tool and move them all as a group to a different location.

As soon as you grab the point, the two axes of the work plane appear through the point. You can hit the + and - Keys to change the increment of the axes, which affects the snapping of the cursor on the work plane. You may hit the space bar to constraint the cursor displacement to a single axis (Toggle between Horizontal axis, Vertical axis and plane).

OR

Hit the Tab Key and type in values for “Loc X Y, and Z“

Press Return to validate. This displaces the points in 3D space.



Multiple-point method with Bull's-eye (Point Selection)

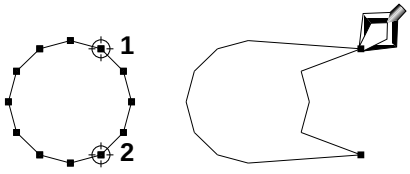
1. With the Wand, click the object whose points you want to stretch.
The object you want to modify must be the currently selected object.

2. Pick the Stretch tool.
The cursor changes to the Stretch tool icon.

3. Hold the Option key and click the mouse button twice.

The cursor changes to the Lasso, and then to the Bull's-eye (Point Selection) cursor.

4. Click individually on a series of points that you want to stretch.
As you click on each point, that point will turn red and all surface edges connected to it will highlight red.



5. Hit the Return Key to validate the selection.
The cursor changes back to the Stretch tool icon.

6. Grab any one of the points with the Stretch tool and move them as a group to a different location.
As soon as you grab the point, the two axes of the work plane

appear through the point. As you stretch the point, its movement is constrained to the current work plane. You can hit the + and - Keys to change the increment of the axes, which affects the snapping of the cursor on the work plane .You may hit the space bar to constraint the cursor displacement to a single axis (Toggle between Horizontal axis, Vertical axis and plane).
OR
Hit the Tab Key and type in values for “Loc X, Y, and Z”.
Press Return to validate. This displaces the points in 3D.

If you want to deselect a point that is currently selected, click on it with the Bull’seye cursor.

Option-click twice again and select additional points. Points of noncurrent objects that you click on are ignored.

NURBS curves Tangent Edition

With the stretch tool, you can now edit the tangents of the NURBS curves, instead of editing their control polygon:

1. Have a NURBS curve as the current selected object.

2. Take the Stretch tool.
The control polygon appears. You may edit the points of the control polygon by clicking on them and moving them onto the current plane.

 3. Click on the tangent edition icon

The control polygon disappears.

4. Click directly on a point of the curve and move the cursor

You are now manipulating the tangent at this point, allowing you to modify the shape of the curve by controling the tangency on each point.

Be careful that this method don't hold the topology (one circle could be open) and doesn't work on groups.

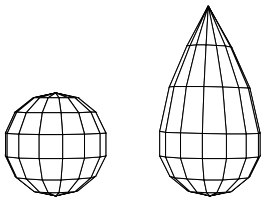
Mold

The Mold tool allows you to grab a point on an object and pull it into a different position. As the location of this point is changed, a number of points surrounding that point move with it, creating a smooth deformation of the object. This is a totally free-form tool. No data box is available, so modifications can only be accomplished visually.

Using the Mold tool

This tool will only edit surfaces on the currently selected object, so before you choose the tool, verify that the correct object is selected.

1. When you choose this tool, a hand cursor appears.



2. Click on a point of the surface you want to

edit.

The cursor grabs onto that point and you can see the influence area which is red highlighted on the edited surface. Only points that belong to this influence area will be affected by the deformation. You can hit the + and - Keys to increase or decrease the size of the area. The minimal size for the area means restricting the deformation to the single point you have choosen.

3. Move the cursor to deform the surface.

While you are editing a surface (that is, before you click the mouse a second time to finish the molding operation), you may hold the Control key on the keyboard and use the + and - Keys to increase or decrease the smoothness of the edit. The less smooth, the fewer points are affected by the move, and the tool acts more like the Stretch tool.

4. Click the mouse button when you have edited the surface to your liking.

To edit from another point, repeat steps 2 and 3.

While you are deforming the surface, hit the + or - Key to dynamically change the area being affected by the mold.

NURBS Free Form Deformation

NURBS technology based, to manipulate polygonal models.

1. Have a polyhedral object as the current selected object.

2. Take the Mold tool

3. Click on the Free Form Deformation icon

A control box appears around the object.

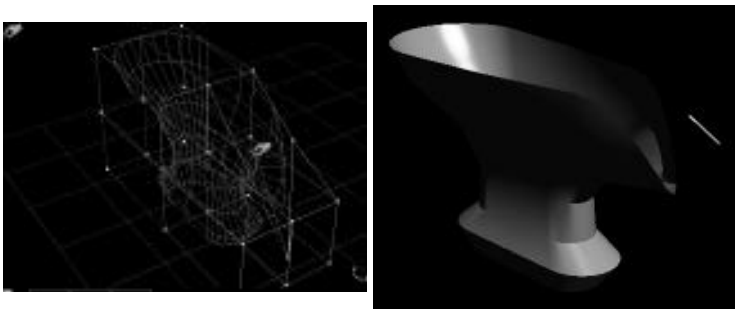
4. You may increase the number of control lines by pressing the "+" key (as well as you can decrease it by pressing the "-" key).

The Free Form Deformation box becomes now the current edited object and some manipulation tools appear on the bottom of the screen.

5. Use the mold tool cursor to modify directly the shape of the Deformation Box,

OR

Pick one of the manipulation tools and apply different transformations on the Deformation Box (rotation, scaling, ...).



You can obviously, either before taking one of the manipulation tools, or inside of each of these tools, select a part of the deformation box, using Option-Click (Right mouse button on PC), and surrounding the part of the box you want to edit with the lasso. This will allow you to make local smooth deformations, manipulating any polyhedral object as if it was a NURBS surface.

Bend

The Bend tool will deform the currently selected object to follow a curve you provide. There are two ways to use the Bend tool. Either draw a curve with one of the drawing tools or draw a curve with the Bend tool itself.

Bending to a Curve Drawn with the 2D Drawing Tools

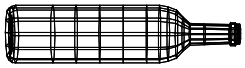
1. Create a curve that you want the object of interest to follow.

Use the Bezier Curve or an arc, or any composite curve.

The size of the curve you provide doesn't matter. It is the shape that is important. The object you are bending will keep its original cell size, regardless of the size of the curve.

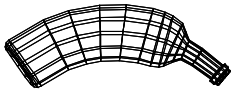
2. With the Wand cursor, click the object you want to bend.

The curve does not need to share a point with the object. It is now the currently selected object.



3. Choose the Bend tool.

4. Click on the curve you want the bend to follow.



5. Put-aside the Bend tool to end the operation.

Bending to a Curve Drawn with the Bend Tool

1. With the Wand cursor, click the object you want to bend.
   It is now the current object.

2. Choose the Bend tool.
   You see the Wand cursor

3. Click to locate the first point in a Bezier Curve for the bend to follow.

4. Click as many points for the curve as you want.
   When the curve is done, hit the Return Key. The object bends to take the curve's shape, and the curve that was created is hidden.

5. Put-aside to release the Bend tool.

Create complex surfaces

Use the Bend tool in one plane to create a bent object. Release the tool and move to another plane. Bend the object again to create a complex surface.

Delete Facet

Use the Delete Facet tool to remove a facet, point, or group of facets or points from a form. The only form the Delete Facet tool affects is the currently selected object. Use this tool to delete two types of objects:

Delete Faces

Use the lightning icon to delete a face off of a surface.

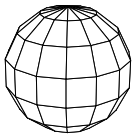
Delete Points

Use the lightning icon to delete points off of a curve. In either case, if you option-click, you toggle between the Lasso and the

Delete Facet lightning icon.

Deleting faces on a surface

1. Select the surface you want to work with by clicking it with the Wand cursor.

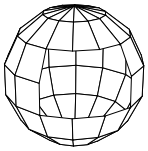


2. Choose the Delete Facet tool.

3. Click a facet with the lightning cursor.
The facet is highlighted red.

4. Click any additional facets you want to remove.
If you click through a deleted facet, the Delete Facet tool removes the facet on the back of the model.

5. Use the Arrow Keys to rotate the view.
Everything you clicked disappears as the screen is redrawn.



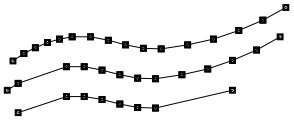
Deleted facets appear red, and since they are surrounded by other facets, you cannot necessarily tell that they have been deleted. Use the Control Panel's Fast Shade tool to render the surface quickly to see that the facets are gone.

Hold the Option Key and click to get the lasso tool. Use the Lasso to surround a group of facets or of points. Hit Return and the facets are deleted.

If you make a mistake, hit Command-Z or choose Undo from the Edit Menu.

Deleting points on a curve

1. Select the curve you want to work with by clicking it with the Wand cursor.
2. Choose the Delete Facet tool.
3. Click a point with the lightning cursor.
   The point disappears. If you click an endpoint of a curve, the end line segment disappears.



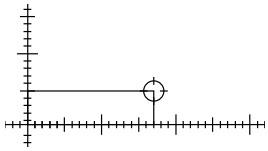
Cut

Use the Cut tool to divide an object into two separate entities. The Cut command produces a 3D cutting plane which appears horizontal to the current view.

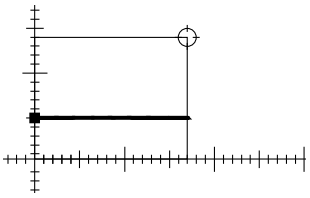
Using the Cut tool

The Cut tool will cut only the currently selected object, so verify that the current object is the one you want to cut. When you choose the Cut tool, the current object is bounded with a white cube, inside of which is the cutting plane.

1. Click a location for the origin.



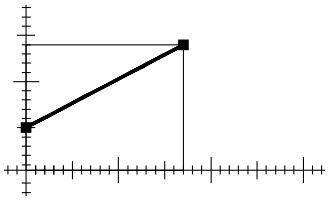
2. Click a location for the pivot point for the cut angle.



If you prefer, hit Tab and type values for this location, hitting Return to enter the values.

3. Move the cursor around the pivot point to change the angle of the plane.

Click again when the angle is correct (or hit Tab and type an angle, hitting Return to enter the value).



Cutting Part of a Model

If you want to affect only part of the object, option-click to reveal the Lasso tool before choosing the Cut tool. Surround the part of the object you want to cut, hit Return, and choose the Cut tool.

Changing the cutting plane

If the cutting plane appears in the wrong plane, hit Command-Z or choose Undo from the Edit Menu, put-aside the Cut tool and rotate your view.

Punch and boolean

Use the Punch tool to punch holes and create irregularly shaped cuts in 3D forms or to construct an object from intersection

of two surfaces (Boolean Operation).

This tool works to ways :

Punch a surface by a curve

By selecting an open or closed curve projected on and cutting the surface which is the currently selected object.

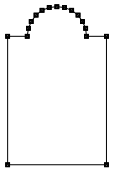
Create an surface or volume from intersection of two surfaces or volumes

By selecting a surface or volume which intersect the currently selected surface or volume, and then choosing parts of intersections which will form the resulting shape.

Punch a surface or a volume by an open or a closed curve

1. Create an open or closed 2D curve or line to serve as the cutting curve.

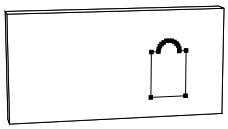
   This shape will be projected onto the model you want punched.



2. If necessary, use the Move tool (Assembly Toolbox) to move the cutting curve.

   Move it to the location on the 3D object where you want the cut. It doesn't matter where in space the cutting curve is, as long as it will intersect the model you want to cut in the current view. The Punch tool will cut the hole perpendicular to the plane where the cutting curve lies.

3. With the Wand, click the model that you want to have punched.

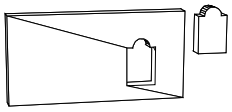


4. Choose the Punch tool.

A closed curve will create a hole filled with a plug in the curve's shape An open curve will create a cut in the object of interest. The 2d parts may then be moved as separate objects.

5. Click the cutting curve.

Depending on how complicated your models are, you may see some dialog boxes indicating that Amapi is calculating the cut.



If you punch a hole in a faceted object, additional lines are added after the punch to create facets around the hole.

6. The pattern is cut into the model and internal facets are generated.

Punching Holes in part of an object

Before choosing the Punch tool, use the Lasso or Bull's-eye cursor to select points forming the surface you want punched. When you choose the Punch tool, the cutting curve is only projected onto that one surface, instead of all the way through the model.

If you used a closed curve to create the hole Amapi creates the hole through the model and creates a plug to fill the hole. The plug is a separate entity and can be moved or deleted.

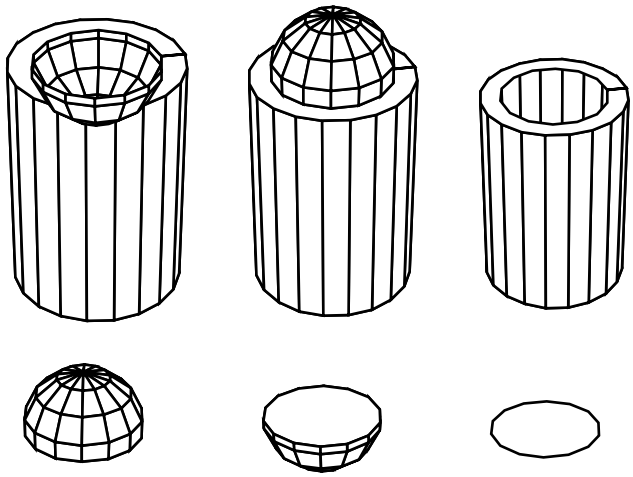
Create an surface or volume by intersecting two surfaces or volumes

1. With the Wand, click one of the two surfaces or volume you want to intersect.
It becomes the currently selected object.

2. Choose the Punch tool.

3. With the Wand, click the second surface or volume you want to intersect with the currently selected model.
The intersection between the two models is computed (it may take some time on complex models). And the first combination of the two objects intersection is shown.

4. Use + and - keys to display successiveley the different combinations between the two intersected objects and press return key when wanted shape is shown.



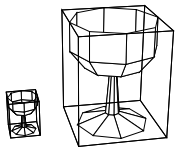
Proportional Scale

This tool modifies the size of the current object. It expands or shrinks the object in all directions at once.

Using the Proportional Scale tool

When you choose the Proportional Scale tool, the currently selected object is bounded with a white cube, which expands or shrinks along with the object.

• Click to start the proportional scale. Move the cursor around to change the size of the object and click the ending point.



OR

• Hit the Tab Key and type a value for the size that you want the object to become. Hit Return to enter the values.

Since this tool proportionally changes the size, you need to type only one dimension in the data box. To change this dimension to one axis or the other, toggle between the axes by hitting the space bar.

Changing the Fixed Point

When you use the Proportional Scale tool, one point on the model stays exactly where it was. By default, this fixed point of the scale is the base of the model, it means the center of the bottom face of the bounding cube.

1. With the Proportional Scale tool selected, hold the Option Key and click the mouse.

You will get an X cursor.

2. Click a different location for the fixed point.

Scaling part of an object

The Lasso and Bull's-eye cursors are also available if you option-click. Use the Lasso to surround a part of the object you want to scale or the Bull's-eye to choose specific points for scaling.

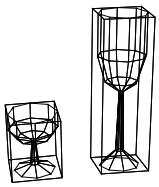
Single Axis Scale

This tool modifies the size of the current object. It expands or shrinks the object in only one direction, from the base of the object (the center of the bottom face of it bounding cube).

Using the Single Axis Scale tool

When you choose the Single Axis Scale tool, the currently selected object is outlined with a white cube, which expands or shrinks along with the object.

- Click to start the expansion. Move the cursor around to change the size of the object and click the ending point. Hit the space bar to toggle between the two axes available in the current view.



OR

- Hit the Tab Key and type values for the size that you want the object to become. Hit Return to enter the values.

Changing the Fixed Point

When you use the Single Axis Scale tool, one point on the model stays exactly where it was. By default, this fixed point of the scale is the base of the model, it means the center of the bot-

tom face of the bounding cube.

1. With the Single Axis Scale tool selected, hold the Option Key and click the mouse.
You will get an X cursor.

2. Click a different location for the fixed point.

Scaling part of an object

The Lasso and Bull's-eye cursors are also available if you option-click. Use the Lasso cursor to surround a part of the object you want to expand or the Bull's-eye to choose specific points for expanding.

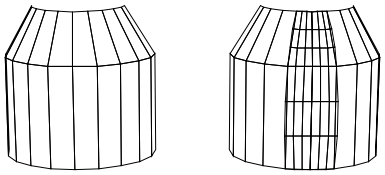
 Smooth

Use the Smooth tool to increase the number of facets forming a surface, and thus creating a smoother surface. When smoothed, existing facets are replaced with a finer mesh formed of Bezier surfaces. You may also use the smooth tool to add points to a curve. Straight lines can become curved lines using the Smooth tool.

Smoothing a surface or volume

1. Click a surface you want to smooth with the Wand cursor.

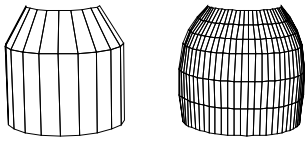
2. Choose the Smooth tool.
An area of tighter mesh automatically appears on the selected object.



3. Use the + and - Keys to increase or decrease the number of facets replacing each unsmoothed facet.

If you prefer, hit the Tab Key and type a value for the number of facets.

4. Click the object to see a preview of the smoothing.



If you put the Smooth tool away now or rotate the view, the smooth appearance will not remain on the screen. The object, however, is tagged by Amapi as being smoothed. When you export or paint, it will be a smoothed object. You can create permanent on-screen smoothing, if you want.

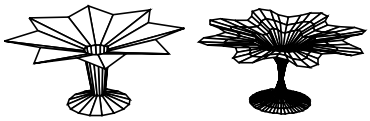
Try a fast shading on a tagged model to see that it is smoothed.

Permanent on-screen smoothing

If you want to keep the smooth appearance on the screen, hit the Return Key after smoothing the model. You may need to generate the smoothing in order to do some other manipulations on the model. Be aware that the smoother the model, the more it will slow down screen redraws.

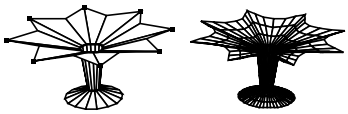
Defining sharp edges

Smoothing creates curved objects from straight ones. It means that the generated faces will define a continuous geometry between all the original unsmoothed faces. In some case, you may want to keep some angles sharp.



You have to ways to do that :

• Selecting sharp edges : by surrounding with the lasso or selecting the points of the edges you want to keep sharp.



• Tuning fracture angle : by defining using + and - keys or entering a numerical value, the angle at which the continuity of the surface will be interrupted.

Selecting sharp edges

1. After choosing the Smooth tool, option-click to reveal the Lasso or Bull's-eye cursor.

Use one of these tools to surround or select point by point the edges you want to keep sharp.

2. Hit Return.

The edges you have selected become white and will stay sharp. The Wand cursor appears and you may click to see the preview of the smoothed object or hit the Return key to keep permanent on-screen smoothing.

Tuning fracture angle

1. After choosing the Smooth tool, option-click to reveal the Lasso.

You can see that the lower left corner dialog box indicates now the current fracture angle.

2. Use + and - keys on the keyboard to increase or decrease the fracture angle.

OR

Hit the tab key and type a value for the fracture angle.

You see some edges displayed in white, indicating that they become sharp, because sharing faces that form an angle smaller than the fracture angle.

You may both combine selecting sharp edges by lasso or bull's-eye cursor and defining the fracture angle to control which part of the model will be curved or not.

Smoothing a curve

1 Click a curve you want to smooth with the Wand cursor.

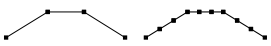
2 Choose the Smooth tool.

The smoothness is indicated by additional points along the surface of the curve.

3. Use the + and - Keys to increase or decrease the number of points replacing each unsmoothed point.

If you prefer, hit the Tab Key and type a value for the number of points.

4. Click the object to see a preview of the smoothing.



Adding points to a straightline

When you select a straight line and choose the Smooth tool,

additional points are added to that line. Also, the line is smoothed (and no longer straight) according to Amapi defaults.

1. With a straight line(s) selected, choose the Smooth tool.
A data box with the range appears and points are added to the line.

2. Use the + or - Keys to change the number of segments the smoothed line will have.
If you prefer, hit the Tab Key and type a value for the range. Hit Return to enter the value.

3. Option-click to reveal an angle data box.
This angle is the largest measurement an angle between two lines can have without Amapi trying to smooth it.

4 Use the + and - Keys to increase or decrease the angle until the line is straight again.
If you prefer, hit the Tab Key and type a value for the angle. Hit Return to enter the value.

Fillet

This tool allows you to create fillets on the edges of a surface or volume or at the points of curves. The Fillet tool will create both internal and external fillets, depending on the orientation of the model's edges. You can create fillets with variable radii. The Fillet tool is also an easy way to create an arc tangent to two lines.

Using the Fillet tool

1. Use the Wand, Lasso, or Bull's-eye cursor to select the object or edges you want to fillet.

2. Choose the Fillet tool.
Fillets appear on a 2D object as points forming the fillet's

curve. Fillets appear on a 3D object as parallel lines forming the fillet's edge.

3. Use the + and - Keys on the keyboard to increase or decrease the radius of the fillet.
Notice the change taking place on the drawing. Hit the space bar and use the + and - Keys to change the number of points defining the fillet. If you prefer, hit the Tab Key and type a value for the radius and number of points defining the fillet, hitting Return to enter the values.

4. Click the drawing to see a preview of the fillets.

5. Hit Return to validate your fillets.

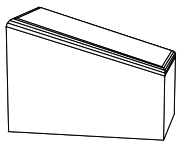
Partial filleting

If you want to fillet only parts of the model, before choosing the fillet tool, option-click to reveal the Lasso or Bull's-eye cursor. Select the edges you want to fillet and hit Return. Then choose the Fillet Tool. Filletting will be applied only to selected edges.

Variable Radius Fillets

You may need a fillet that has a larger radius at one end of the edge than at the other end.

1. Create fillets as normal.



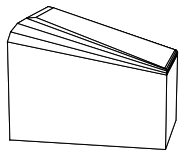
2. When one end of your edge is filleted as you want it, option click once to get the Lasso or

twice to get the Bull's-eye cursor.

3. Deselect the point whose fillet is as you want it.
Hit Return when all necessary points have been deselected.

4. Use the + and - Keys to increase or decrease the radius of the still-selected points.
The point(s) you deselected remain the same.

5. Click the model to see a preview. Hlt Return to keep tne filleting.



In this example, the right two points were deselected.

CHAPTER

6

The Assembly Tools

Move

Rotate

Snap

Lay On

Weld

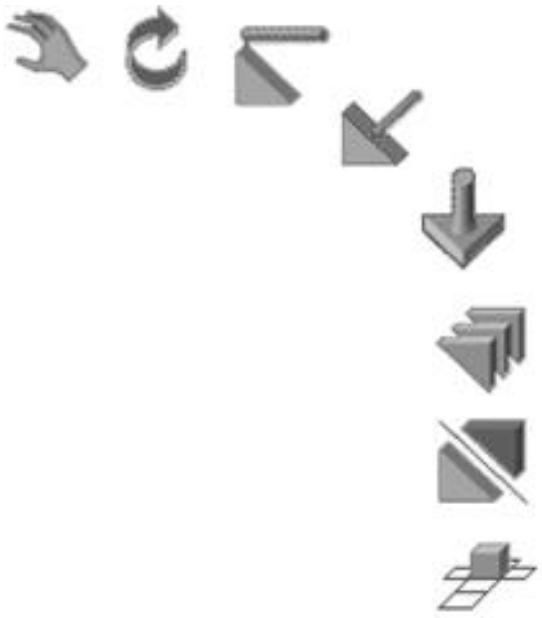
Duplicate

Mirror 3D

Unfold

The Assembly Tools

Use the Assembly Tools when you are ready to move, duplicate, combine, or separate objects on the screen.



Move

Use the Move tool if you want to change the location of the current obiect.

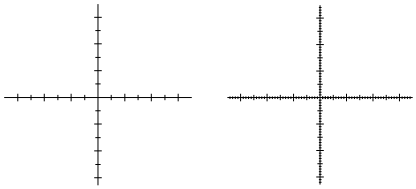
Using the Move tool

1. Click the object you want to move with the Wand.

2. Click the Move tool.

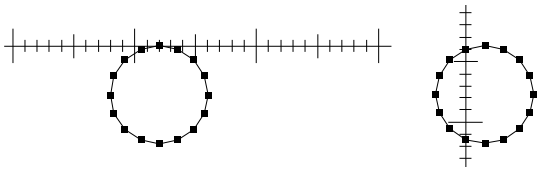
3. Click the mouse button to set an origin for the move.

Use the + and - Keys to increase or decrease the number of hash marks on the axes thus increasing or decreasing the precision of the move.



4. To move in one direction only, hit the space bar to toggle through the axes available in the current view.

With just one axis available, you are forced to keep the object on that axis.



5. Move the cursor around to relocate the object. Click at the object's new location.

If you prefer, hit the Tab Key and type a value for the new location, hitting Return to enter it.

6. Put-aside the Move tool.

While moving the bounding box of the current object, you may hold the Control key. The shape itself will be redrawn, instead of the bounding box.

Rotate

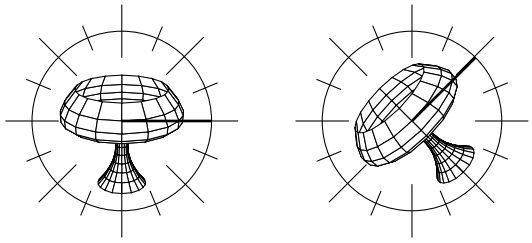
Use the Rotate tool to rotate the currently selected object. The Rotate tool allows you to change the center of rotation and change the rotation plane.

Using the Rotate Tool

1. Click the object you want to rotate with the Wand.

If you want to rotate only part of an object, option-click to reveal the Lasso and Bull's-eye. Choose the points you want rotate and hit Return.

2. Click the Rotate tool.



A circle appears around the currently selected object. You may change the plane, if you like. Use the Arrow Keys or the number pad to rotate to another view. When the working plane changes, the rotation circle changes with it. The rotation plane

is always the most perpendicular plane to the view.

3. Click a starting point for the rotation.
If you click away from the rotation circle, the circle grows or shrinks. This is just a visual convenience for you; it has no effect on the tool itself. Use the + and - Keys to increase or decrease the number of hash marks on the rotation circle.

4. Click an ending point for the rotation.
If you prefer, hit the Tab Key and type an angle of rotation, hitting Return to enter it.

5. Put-aside the Rotate tool.

Changing the Center of Rotation

By default, the rotation is centered around the object's true center of geometry. This rotation point remains fixed throughout the rotation. You may change this center of rotation.

1. Choose the Rotate tool.

2. Hold the Option Key and click the mouse button.
You see an icon that looks like an X.

3. Click a different location for the center of rotation.
The rotation point will snap to the nearest point on any object in the scene.

Snap

Use the Snap tool to snap a point on the current object onto another point or to align an object with another, along an axis.

Using the Snap tool

1. Click the object you want to snap with the Wand.

To snap part of an object, option-click to reveal the Lasso or Bull's-eye cursor. Select the points you want to snap.

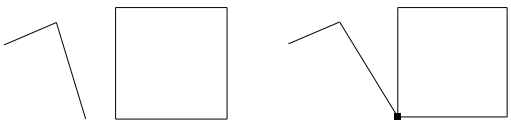
2. Click the Snap tool.

The Bull's-eye cursor and two axes appear.

3. If desired, hit the space bar to restrict the displacement to a single-axis.

This allows you to align an object with an other. Hitting space bar again toggles the single axis, hitting it a third time reveal the two axes again.

4. Click one point on the current object.



5. Click the corresponding point on another object.

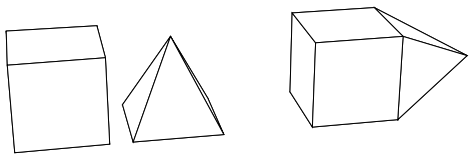
The two polnts are joined. If you do not want to snap point-to-point, click two points somewhere in space and they will serve as a vector for the snap.

If you select part of the object, the selected points snap to another object and any points that were not selected remain where they were, deforming the original shape.

Lay On

Use the Lay On tool if you want to place one object on another, most likely changing the orientation of one of the objects. An object laid on another remains a separate object.

Using the Lay On tool



In this example, the base of the pyramid was laid on one side of the cube.

1. Click the object you want to move with the Wand cursor.

2. Choose the Lay On tool.
When you choose this tool, the base facet of the current object becomes highlighted. You can change which facet is highlighted by clicking on another facet.

3. Click the corresponding facet on another object.
The first facet is laid flat on the second facet. The current object's orientation is rotated as necessary for the facets to lie flat against each other.

4. Put-aside the Lay On tool to release it.

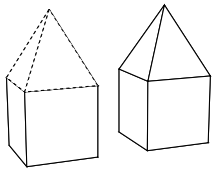
Weld

Use the Weld tool to fasten two or more elements or points

together. Welding will cause the elements to become one object. You can use the weld tool to do two things:

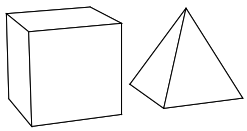
- Weld 2 or more objects together: Use the Weld tool to connect two or more objects. This creates one object.
- Weld 2 or more points on one object: Use the Weld tool to join two or more points on a single object. This causes the object to take on a different shape.

Welding 2+ objects together



1. Choose the Weld tool.
   When you choose this tool, the Lasso cursor appears.
2. Surround the area you want to weld.
3. Hit the Return key.
   The points you surrounded are welded together. Any duplicated points are eliminated.
   If you make a mistake, hit Command-Z or choose Undo from the Edit Menu.

Welding points on a single object



1. Choose the Weld tool.
   When you choose this tool, the Lasso cursor appears. Use the Lasso to surround points or option-click to get the Bull's-eye.
2. Select points that you want to weld together.

3. Hit Return when you are done choosing points.
Amapi merges the points according to the center of geometry of the selection.

In this example, the top four points of the cube were welded to form the top point of the pyramid.

Duplicate

Use the Duplicate tool if you want to create multiple copies of the current object. There are several different ways to create duplicates. You can create a single copy, multiple copies, and duplicate objects along the points of a curve or facets of a surface.

Making a single copy

1. Have any object on the screen.
The object you want to duplicate does not have to be the current object. To duplicate part of an object, option-click to reveal the Lasso or Bull's-eye cursor. Select the points you want to duplicate and hit Return.

2. Click the Duplicate tool.
The cursor looks like the Move tool.

3. Click on the object you want to copy.
A box, with the duplicate inside, appears at the location of the nearest point you have clicked.

Use the space bar to lock onto an axis to move the duplicate in one direction only.

4. Click a new location for the duplicate.
If you prefer, you can hit the Tab Key and type in an exact location for the duplicate, hitting Return to validate.

5. You may continue making duplicates of any screen object.

6. Put-aside the Duplicate tool.

Making Multiple Copies

1. Click the object you want to duplicate with the Wand.

2. Choose the Duplicate tool.

4. Hit the Tab Key to enter in the number of copies data box.

5. Type the desired number of copies.
Hit Return to enter the value.

6. Type the duplicates' displacement.
Hit the Tab and type in a value for the X, Y, Z displacement of each duplicate from the one before it. Hit Return to enter the value.

7. Type the rotation for each copy.
Hit the Tab Key and type a value for the rotation of each copy. This value is the degree rotation from the previous copy. Hit Return to enter the value.

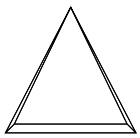
8. The duplicates appear.

By default, the duplicates are grouped together. To ungroup them, choose the Ungroup tool from the Control Panel.

Duplicate objects along a curve

1. Create a curve that will serve as a path along which duplicates will be made.
By default, the number of duplicates is equal to the number of points forming this curve.

2. Create an object to duplicate along the path.



3. Make sure that the object you want duplicated is the current object.

4. Choose the Duplicate tool.

5. Hit the space bar to indicate multiple copies.
The duplicates have not appeared yet, but now is the time to set the fixed duplication point. By default, the duplicates will appear on the curve, each base point matched to a point on the curve.

6. To change the fixed point, hold the Option Key and click the mouse. With this X cursor, you can

click a different location for the fixed point.

7. Click the curve.

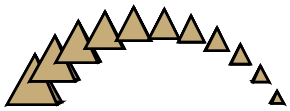
Duplicated objects appear. By default, the duplicates are oriented exactly the same as the original.

8. Hit the space bar to change the orientation of the duplicates.

- Space bar once: duplicates rotated on the X axis.
- Space bar twice: duplicates rotated on the Y axis.
- Space bar three times: duplicates rotated on the Z axis.
- Space bar four times: facets of the duplicates lie directly along the curve.

9. You can use the + and - keys to enlarge or reduce the size of the last copy or use the Tab key to define an accurate scaling ratio.

The duplicates within the first and the last copy will be scaled proportionally.



Duplicate objects on a surface

If you want to use a faceted surface as the duplication path, follow the same steps as for creating duplicates along a curve, clicking the surface instead of the curve in step 7. One duplicate will appear at the center of each facet. Hit the space bar for the duplicates to orient themselves to each facet.

The curve and the original duplicating object are hidden. They can be shown using the Show tool from the Control Panel.

Mirror 3D

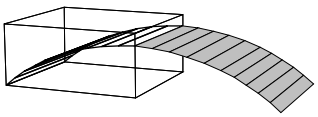
Use the Mirror 3D tool if you want to create a reflection of a 3D object or a 2D object.

Mirror a 3D object

1. Click the object you want to mirror with the Wand.
   If you want to reflect only part of an object, hold the Option Key and click the mouse button until you get the Lasso or Bull's-eye cursor. Use this to choose points that you want to reflect. Hit Return when you are finished choosing points.

2. Click the Mirror 3D tool.
   A white cube surrounds the current object.

3. Click the facet of the cube that you want to serve as the mirror plane.
   The reflection appears.



Mirror a 2D object

1. Click the object you want to mirror with the Wand.
   If you want to reflect only part of an object, hold the Option Key and click the mouse button until you get the Lasso or Bull's-eye cursor. Use this to choose points that you want to

reflect. Hit Return when you are finished choosing points.

2. Click the Mirror 3D tool.
A white rectangle surrounds the current object.

3. Hit the space bar to toggle between the two available mirror planes (one for each available axis).

4. Click on the side of the object you want the reflection to appear. Changing the Location of the Mirror
By default, the mirror is located on any facet of the surrounding white box. If you hold the Option Key and click the mouse with the Mirror 3D tool selected, you can click a different location for the mirror, creating an overlapping mirror image. This location snaps to the nearest point, however, so you may need to create a temporary mirror location with a drawing tool.

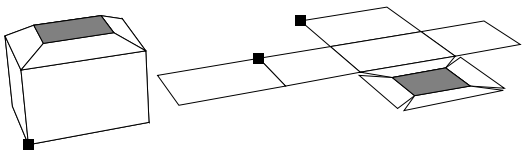
Unfold

Use the Unfold tool to create a 2D, unfolded, planar version of your 3D model. For instance, if you draw a 3D cardboard box, the Unfold command will display the flat cardboard pieces needed to construct the box. You control and manipulate the unfolding of your model through three actions:

1. Choose the lines along which the cut will take place.

2. Choose the facet to begin the unfold.

3. View which points and facets correspond between the original model and the unfolded pieces.



Using the Unfold tool

If the current object is one that has been unfolded already and you choose the Unfold tool, you are automatically working on the unfolded version. See the section on viewing the correspondances to see how you can work with an unfolded model.

Choosing the cut edges and the beginning facet

1. Select the object you want to unfold.

2. Choose the Unfold tool.

You have the Lasso cursor and will see a palette offering the options you have in the upper right corner of the screen :
• The bull's-eye and the lasso icons allow you to select the edges along which the cut will take place (by surrounding edges with the lasso, and by selecting edges point by point with the bull's-eye, ending by the Return key).

• The cut-by-section icon (like a ball in concentric vertical circles) will be used to select cut edges automatically by section (if the model's topology allows it).
• The cut-by-slice icon (like a ball in horizontal circles) will be used to select cut edges automatically by slice (if the model's topology allows it).
• The gray ball will be used to cancel all the cut edges.
• The white hand cursor will be used to select the face on the model where the unfolding operation will begin.
• The Unfold icon (showing an unfolded cube) will start the unfolding operation.

3. Option-click to toggle between the Lasso, the Bull's-eye cursor and the Hand cursor, if necessary.

Select the endpoints, of lines that will become the cut edges of the unfolded object. If, when you perform the actual unfold, you have not identified all of the necessary edges to unfold, Amapi will add cut edges as needed.
OR
if the Hand cursor is active, click in the facet you want to become the starting facet for the unfolding (Amapi selects a default facet).

To activate Lasso, Bull's-eye and Hand cursors, you may either pick them directly in the Unfold palette, or option-click to reveal each of these three cursor, in a cyclical manner.

If you want Amapi to unfold the model based on defaults, directly select the Unfold icon in the Unfold palette.

Unfolding the model

When you have defined cut edges and starting facet as you desire,

1. Choose the Unfolding icon in the Unfold palette

The origlnal object remains unchanged and an unfolded version of it appears on the horizontal plane.

The cursor becomes the Bull's-eye and you are now able to view the correspondances between the points and facets of the original model and the points and facets of unfolded pieces.

You may cancel the Unfold by hitting Command-Z or choosing Undo from Edit menu.

View Corresponding Points and Facets

Once you have unfolded your model, the Bull's-eye cursor appears and you have the opportunity to display corresponding points and facets on the original and unfolded models.

1. Click a point on the unfolded model.

The corresponding point on the original model is highlighted.

Continue to click additional points, displaying their corresponding locations.

OR

Click a point on the original model.

The corresponding point on the unfolded model is highlighted.

2. Hold the Option Key and click the mouse button to toggle between the Bull's-eye (point selection) and the gray Hand (facet selection) cursors.

This cursor allows you to click a facet on either the unfolded or original model. The corresponding facet is highlighted on the other model.

Selecting highlighted points or facets hide the vizualisation of correspondance.

Releasing the Unfold tool

Put-aside the Unfold tool when you are finished.

The Wand cursor appears.

CHAPTER 7

The Control Panel

Group

Ungroup

Show

Hide

Rear facets / hidden lines

Perspective

Working Plane

Delete Entity

Fast Shade

View Point

Zoom Window

Zoom Extents

Measure

Get Info. . .

Print

The End

The Control Panel

The Control Panel gives you the ability to choose different settings and views for your drawing so that Amapi works best for you. To gain access to the Control Panel, drag the cursor off the bottom of the screen. The Control Panel tools are also available in the Utilities Menu.

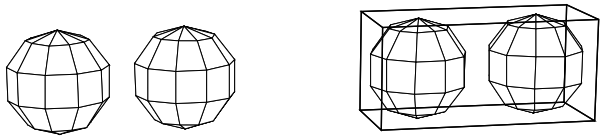
Group

Use the Group tool if you want two or more objects to behave as one object. This is not a physical association of the two objects, as welding is. Grouping is easily undone with the Ungroup tool.

Using the Group tool

1. Choose the Group tool.
   The Wand cursor appears.

2. Click the objects that you want grouped.
   The outlines of selected objects will turn white. Option-click when you have the Group tool selected to reveal the Lasso. Surround the items you want grouped and hit Return. The selected items are grouped.



3. If you make a mistake, hit Command-Z or choose Undo from the Edit Menu.

4. Put-aside the Group tool.

5. Click on the grouped objects with the Wand cursor.
   They are all selected.

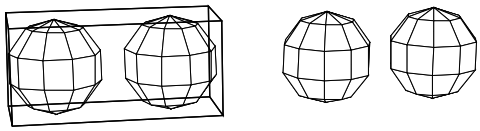
Ungroup

Use the Ungroup tool if you want to separate objects that are grouped.

Using the Ungroup tool

1. Choose the Ungroup tool.
A white cube surrounds each of the groups.

2. Click the cube.
This causes all the items in the group to become independent.



3. Put-aside the Ungroup tool.

Using the Go Into / Go Out of a group tool

If you whish to work on a single element of a group, but without having to ungroup the linked objects, you may use the Go Into / Go Out main level icons.

When the current selected object is a group, at main level, you can click on the «Go Into the group» icon. The remains of the scene will be temporarly hidden and the current group will be unlinked, allowing you to work easily on a single element.

When you are finished, clik on the «Go Out of the group» icon. The group will be automatically relinked and the scene will be restored.

Show

Use the Show tool if you want to show objects hidden with the

Hide command or objects that Amapi automatically hides. Amapi automatically hides objects such as curves used in creating sweeps and extrusions.

Using the Show tool

1. Choose the Show tool.
   You see a white phantom icon and the current screen vanishes to show only the hidden objects.

2. Click objects you want to become visible.
   Selected objects are highlighted in white. Hidden objects remain in the same position as when they were made invisible, so when they reappear, they return to their same position.

3. Put-aside the Show tool.

Hide

Use the Hide tool if you want to hide some of the objects on the screen. This is useful if you need to remove something that is in the way of another object.

Using the Hide tool

1. Choose the Hide tool.
   A gray phantom icon appears.

2. Click objects that you want to become hidden.
   Each object you click turns white.

3. If you make a mistake, hit Command-Z or choose Undo from the Edit Menu.

4. Put-aside the tool.
   The objects you clicked are hidden.

If you want to hide or show any object on the screen, hit the Return key. All objects present will be hidden / shown and you will automatically quit the tool.

Showing Hidden objects

Hidden objects remain in the same position as when you hid them, so if you bring them back, they return to their same position. Choose the Show tool and click objects you want to be visible again.

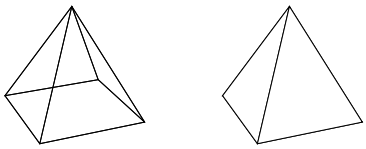
Hiding the workbench and background grid

Using the Hide tool, you can hide the workbench and background grid. Simply click them with the Hide tool. As with other screen objects, use the Show tool to bring them back.

 Rear facets/hidden lines

Use the Rear facets/hidden lines tool if you want to hide rear facets and hidden lines. You may want to do this to view your design as you would see it manufactured.

Using the Rear facets/hidden lines tool



1. Choose the Rear facets/hidden lines tool.
The view is immediately changed to show only the front facets and lines.

2. Rotate the view with the Arrow Keys.
Rear facets and hidden lines are relocated. Amapi redraws the

current front facets and lines to achieve the same effect from any angle.

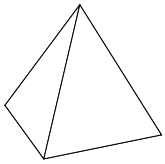
3. Hit the space bar to toggle between wireframes and a solid style of drawing.

4. Put-aside this tool to return to the previous view.

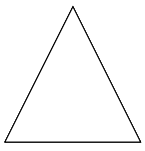
Perspective

Use this tool if you want to view your design from one orthogonal plane only.

Using the Perspective tool.



1. Choose the Perspective tool.
The view is immediately changed to show only the two dimensions forming the plane parallel to the current view.



2. Use the Arrow Keys to rotate the drawing.
You can only view the drawing planes—top, front, right, bottom, back, and left. The Arrows will not incrementally rotate in the Perspective view.

3. Choose the tool again to return to the polygonal view.

Working Plane

Use the Working Plane tool if you want to create a working plane that is not one of the three orthogonal working planes. When designing, you may create a surface on a plane other than the three traditional planes. To create more forms using this plane, identify it using the Working Plane tool.

Changing the Working Plane

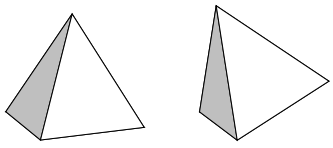
1. Click the Working Plane icon.

2. Click a facet that is on the plane you want to define.
OR

Hold option key and click the mouse button.
The Bull's-eye cursor appears and you have the opportunity to click 3 points anywhere on existing geometry to define the new working plane.

Amapi rotates the geometry so that this plane matches the nearest orthogonal plane. You are free to put-aside the Working Plane tool and use other tools to work on this plane.

3. Choose the Working Plane tool when you are through working with your custom plane.
The geometry rotates back to its original position.



Delete Entity

Use the Delete Entity command to erase an object on the screen.

Using the Delete Entity Tool

1. Choose the Delete Entity tool.
   You see a Disintegrator Gun icon.

2. Click the object you want to disintegrate.
   It disappears. If you click the mouse button without the Disintegrator Gun touching an object, it will erase the object nearest to it, so be careful that you are erasing what you want to erase.

3. If you make a mistake, hit Command-Z or choose Undo from the Edit Menu.

4. Put-aside the tool.

Erasing the Entire Scene

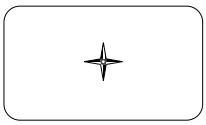
If you want to erase everything in the scene, your best choice is to use the Black Hole in the Catalog. If you choose the Catalog from any Toolbox and immediately click the Black Hole, the entire scene is erased. Note that by doing this, you are not deleting the file itself but only its contents. You can undo this operation if you decide you want everything back.

Fast Shade

Use this tool if you want to paint an object or change the color of its outline. When you use the tool to create solid color on an object, the color Amapi uses is the outline color of the object.

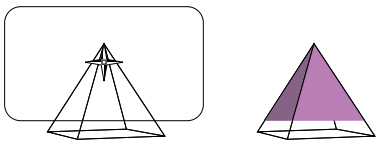
Creating solid color

1. Choose the Fast Shade tool.
You see a rectangle whose center is marked with an X. Use this to outline an area you want to color.



2. Click a location for the center of the rectangle.
Move the cursor to expand the box.

3. Click the mouse button when the box is the size you need.



The area inside the box becomes shaded with solid color. If an object was smoothed (either with permanent on-screen smoothing, either only tagged), it is displayed using Gouraud or Phong smooth shading, depending on the relevant preference (see Amapi preferences section). Otherwise, it is displayed in flat shading, e.g. using one color by facet.

If you want to paint the entire scene, hit the Return key immediately after choosing the Fast Shade tool.

Choosing an outline color

1. Choose the Fast Shade tool.

2. Hit the space bar to reveal the Wand cursor.

3. Click the object you want to have a different color.

A color palette appears.

4. Choose the color you want to change it to and click OK.
The outline changes color and if you choose to create solid color for the object, this is the color you get.

5. To keep the original color, click Cancel in step 4.

View Point

The center of the workbench is the default center of the screen. To return to this default after using the View point tool, click the Zoom Extents tool.

Use the View Point tool if you want to be able to change the center of the screen. The View Point tool also changes the pivot point used in rotating the drawing area with the arrow keys. This will allow you to view your design from any angle necessary.

Uslng the Vlew Polnt tool

1. Choose the View Point tool.
You see a cursor that looks like an eye.

2. Click a location to become the center of the screen and the view rotation pivot point.
If you prefer, hit the Tab Key and type a location, hitting Return to enter the value.

3. Hit the 3 Key on the number pad.
The scene is zoomed toward the new center. Hit the Decimal Point Key to zoom out again.

4. Try using the Arrow Keys to rotate the view.
The point you clicked is now the pivot point for the rotation.

5. Put-aside the View Point tool.

Zoom Window

Zoom In Shortcut: Hitting the 3 on the number pad will zoom in on the drawing

Use the Zoom Window tool if you want to zoom in on all or part of the drawing.

Using the Zoom Window tool

1. Choose the Zoom Window tool.
You see a rectangle with its center marked as an X.

2. Click a location to serve as the center of the zoom.
Move the cursor to expand or shrink the zoom box.

3. Click when the zoom box encompasses the geometry you want to zoom.
The area inside the box zooms to fit the screen.

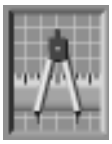
Zoom Extents

Zoom Out Shortcut: Hitting the decimal point on the number pad will zoom out.

Use the Zoom Extents tool if you want to back off from the drawing and view the whole design at once. This tool will zoom so that the center of the screen is the center of all geometry.

Using the Zoom Extents tool

Click the Zoom Extents tool and the screen immediately changes to show you the entire design.



Measure

Use the Measure tool to add dimensions to your design. Amapi allows for three types of dimensions: linear, angular, and volume/area/circumference measurements.

You may also reposition or delete measurements. A palette offering these different possibilities appears in the upper right corner of the screen when you choose the Measure tool.

Linear Measurements

When you choose the Measure tool, the cursor looks like the Bull's-eye. With this cursor, you can dimension linear distances. If another cursor is active, pick the bull's-eye icon in the upper right palette.

You must click very near the point you need, because the Measure tool will snap to the closest point. You may not get an accurate measurement if you are not careful.

1. Click two points at opposite ends of the dimension you want.

The default dimension is a single-axis measurement between the two points.

a. Hit the space bar once.
You get the other-axis measurement between the two points.

b. Hit the space bar again.
You get the oblique (3D distance) measurement between the two points.

2. Move cursor and click a third point to indicate the location of the dimension line.

 Angular Measurements

By default, the first type of measuring tool that appears is the Linear dimension tool. If you option-click, you will see the Angular dimension icon. You may also pick the Angular measure cursor from the upper right palette.

1. Click the endpoint of one leg of the angle.

2. Click the vertex of the angle.

3. Click the endpoint of the other leg of the angle.
The dimension appears near the vertex.

4. Move the cursor and click a location for the angle measurement.

 Volume / Area / Circumference Measurements

If you option-click again, you will see the Volume/Area/Circumference icon. You may also pick this icon from the upper right palette.

1. Click on the object with this tool and it calculates automatically:
• If the object is a closed surface, you will get the volume and surface area.
OR
• If the object is open, you will get the area and circumfe-

rence.

2. Click a second point to fix the location of the measurement.

 Repositioning a measurement

1. Pick the Hand icon from the upper right palette.
You must have some measurements displayed on the screen.

2. Click near the measurement you want to reposition.
It becomes attached to the cursor and follows its moving.

3. Click to define the new location of the displaced measurement.

 Deleting a measurement

1. Pick the Lightning icon from the upper right palette.
You must have some measurements displayed on the screen.

2. Click near the measurement you want to delete.
It disappears and is removed from the measurements attached to the current drawing.

3. If you make a mistake, hit Command-Z or choose Undo from the Edit Menu.

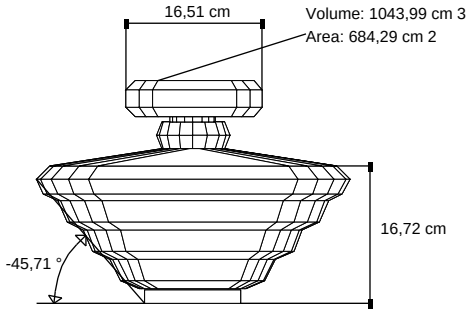
 Deleting all measurements

If you want to erase all measurements displayed on the screen:

1. Click the Black Hole icon in the upper right palette.

All measurements disappear and are removed from the current drawing.

2. If you make a mistake, hit Command-Z or choose Undo from the Edit Menu.



Measurements are persistent, as long as any modifications made to the relevant elements do not change the overall shape of the objects. Otherwise, a message informs you that it is impossible to retain these measurements.

The measurements are saved with the model and may be retrieved in a later session.

Get Info...

Use the Get Info command if you want to see and / or modify informations about the current object .

1 Click the object of interest with the Wand cursor.

2 Choose Get Info.

The following information is displayed :
• Name of the object : click the name of the object and type a new name, if you like Hit Return when you are finished typing.
• Object type : volume (closed surface), surface, open or closed curve, group of elements.
• Number of points, edges, and facets.
• Maximum size in X, Y, and Z.
• Range of Smoothing (Click Suppress to remove the applied Smoothing).
• Number of filleted edges (Click Suppress to remove the filleted edges).
• Number of curved facets (Click Triangulate to divide them into flat triangles).
• Number of facets that have more than 4 points (Click Triangulate to divide them into triangles).
• Number of Mixed points and Defective facets (Click Suppress to get rid of Mixed or Confused points and Defective facets).
• NURBS description (click suppress if you want to remove them, e.g. to make the model polygonal).
• Normal modifications (click on this button to show / modify normal vector of facets).

3 When you are ready, click OK to accept any changes you have made or Cancel to return to defaults.
The dialog box is dismissed and you can continue working.

Viewing / Modifying the normal of facets

Normal of facets determines how a facet is oriented, either outwards or inwards. Normally, facets of a model are outwards. If you want to visualize or change any facet orientation, use this tool :

1. Click the object of interest with the Wand cursor.

2. Choose Get Info.
The information dialog is displayed.

3. Click on «modify normal».
A Hand cursor appears.

4. Hit the Return key to inverse all the facets of the model.
You come back to the Information dialog. Click OK to accept the modification.
OR

Click on a facet of the model.
A line showing its orientation is displayed. You may use arrow keys to move around the model and visualize this line from any view angle.

5. Hit the Space bar to toggle the direction of the normal (e.g. the orientation of the facet).

6. Click another facet you want to see or inverse and repeat step 5 if necessary.
OR

Put-aside the cursor to come back to the information dialog. Click OK to accept the normal modification.
OR

Hit Return key to propagate the facet orientation to all the others (e.g. to orient all the facets of the model like the choosen one).

Print

Use this tool to print or 2D-output the current scene. A print settings dialog appears, allowing you to choose :

- The size of the output page.
- The margin dimensions.

• The ratio scale applied.
• The driver of output (Clipboard, Illustrator, Printer, PICT, DXF 2D, HPGL).
• The depth of printing.
• The number of desired copies.
• If you want to export color and color scale informations.

When you have defined the print parameters, click OK to continue or Cancel to abort printing.

If you choose to continue, a rectangular page icon representing the page appears.

Printing the Scene

1. Choose the Print tool.
A print settings dialog appears.

2. Set the parameters you want to use for printing and hit OK when ready to continue.
A rectangular page icon representing the page appears.

3. Hit the space bar to toggle between landscape and portrait orientation.
Place the center of the page over the center of the geometry you want to print.

4. Click the mouse button when the center is located.
Move the cursor to expand the size of the page.

5. Click when the geometry you want to include is within the page boundaries.
The geometry you include on the page is sized to fit within the page boundaries.

6. If you are using the Printer driver, the system printing dialog box brings up.
Depending on the type of printer you have, you are able to specify printer settings, or cancel printing.
OR

If you have specified a 2D file format (Illustrator, PICT, DXF 2D or HPGL), the system file saving dialog box appears
Choose a name and a location for the generated file and click OK or cancel printing.

If you are in axonometric mode, the size of the printing page icon is automatically adjusted to print according to the specified scale and current unit. So step 4 of the printing operation does not exist in this case.

The context in which you choose the Print command determines the type of output geometry. E.g. to print shapes in hidden lines with measurements, choose the Hidden lines tool, followed by the Measurement tool, then finally choose the Print command.

The End

Click The End to close the current window. You will be asked if you want to save changes before closing.

1. Click yes to save and quit.
2. Click no to not save and quit.
3. Click cancel to not save and not quit.

If only one window is open, closing it will quit Amapi.

CHAPTER

8

The Other Menus

The Tools Menu

The Render Menu

The Animation Menu

The Macros Menu

The Toolbar Menu

The Other Menus

The Tools Menu provides acces to all Amapi's tools (same functions as the Amapi graphic icons). Macros and Help menus offer the opportunity to define macro-commands and to get on-line help.

The Tools Menu

The Tools Menu contains :

Construction

All the tools of the Amapi Construction toolbox are accessible here.

Modeling

All the tools of the Amapi Modeling toolbox are accessible here.

Assembly

All the tools of the Amapi Assembly toolbox are accessible here.

Utilities

All the tools of the Amapi Control Panel are accessible here.

Reenter last tool (Cmd-Y)

Choose again the last tool used.

More tools ...

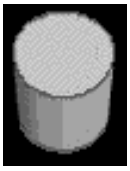
Provides an access to the Extention Toolbox. This additional Toolbox is rather different. It consists of external tools written in TCL script, interfaced with AMAPI. It includes all the external tools contained in the MACROS folder of AMAPI 2.0 Folder. It may, therefore, be extended and customized (you may also write your own interactive tools for AMAPI, with access via this Toolbox). Several tools are included in this version, both as utilities and examples.

TESSELATE : Select Tools / More Tools / Tesselate

Useful to divide a facet of an object or a whole object to create more points to work with (i.e. to select and stretch some points).

You can toggle between Triangle or Quadrangle tesselation.

ORIENT provides a direct access to the faces orientation tool which can be called using GetInfo tool from Control Panel and «modify normals» button in the GetIfo dialog. Please refer to «Viewing / Modifying the normals of facets» section in Chapter 7 to use this tool.



Close an Object is a generic tool for closing openings in a shape. E.g. if you have extruded a closed curve but have forgotten to close the ends of the solid, they will be displayed in red and you can close them by clicking near the red contour (just like in the Extrusion tool). CAP may be used to close up any gaps (holes, erased faces, etc ...).

General Settings opens the preferences dialog box.

The Render Menu

The Render Menu contains :

Set Up Render

To define Render main parameters (See Chapter 9 for more informations).

Shader

To edit a shader for the current selected object (See Chapter 9 for more informations).

Set Texture Position

Gives you access to an interactive tool handling the texture position, scale and orientation.

New Light / New Camera

Adds a light or a camera into the current scene.

Hide Lights and Cameras

Hides all lights and cameras present in the scene. Allows you to have a better control of your drawing. This is a toggle. Selecting again this command will unhide all lights and cameras.

Viewer

Let you open a real-time viewer window, using QuickDraw 3D (Mac version) or OpenGL (PC version). You will be able to have a «solid» view of your models while modeling.

Render Now

Will shade the scene on screen, according to current Rendering parameters. This enter the same command than pressing the Return key when Toolbox are displayed.

Render Selection

Will shade a selection of the screen.

Click to fix the window center. Then expand the selection window and click again. Rendering will be performed only inside the selected area.

Render File

Performs the rendering on a file, allowing you to save a rendered picture. You will be able to choose between several file formats (PICT, BMP, TGA) and to choose a location and a file name

for your image file.

The Animation Menu

The Animation Menu contains :

Set Up Animation

You will be able to set the pixel size of the animation result, as well as the specific parameters for each platform (AVI settings for PC and QuickTime settings for the Macintosh).

Assign a Path

Assign a path to the current selected object (See Chapter 10 for more informations).

Key Framer

Open the KeyFramer tool for the current selected object (See Chapter 10 for more informations).

Play animation

Plays the current animation in wireframe mode, allowing you to have a quick preview of your animation.

Play on file

Plays the animation and records it into a movie file (AVI or QuickTime), according to the Animation settings.

View animation

Open an animation player, allowing you to view a recorded animation file. Choose an AVI file for PC platform and a QuickTime movie for the Macintosh.

The Macros Menu

This menu allows you to use the command oriented interface of Amapi.

Shortcut Editor

«Shortcut Editor» let you access another way to the BINDED tool (see page 8-4 above)

Shortcut Delete

«Shortcut Delet» allows you to remove the function you associated with a keyboard key using the Shortcut Editor.

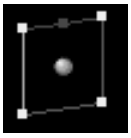
Open Macro

«Open macro» is used to open an existing macro (sequence file).

Macros

Gives access to a list of external macros:

CUT BY PLANE is a tool combining Cut and 3D Line Extraction, creating cross-sections in a solid. Specify the starting point for the cut, then a second point for the end of the cut. Finally, enter the distance between 2 successive cuts.



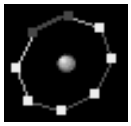
ADD A POINT TO CURVE allows you to create a point in the middle of a segment of a curve. Select the curve in which you want to add a point, then select this tool. Simply click on the segment you want to divide. Repeat the operation if wanted or leave the tool by putting-aside the cursor.

CONE is a macro command combining extrusion and smoothing. It automatically creates a conic shape, with specified number of slices, height and base radius.

CYLINDER operates in the same way to produce a vertically-extruded cylinder.

HELICO is a tool for creating a helicoidal curve automatically from the current curve. Before using this tool, you must have a curve as current selected object (draw a circle for a regular helico). Then choose this tool and begin by selecting the starting point on the current curve, then the second point. If the second point is in a vertical line with the first, and the current curve is a circle, you will obtain a perfect helix. If the second point is off-center, the curve will develop in 3 dimensions.It is also possible to start with a non-circular curve and produce other effects.

INVERT A CURVE allows you the reverse the sense of the current curve. It may be useful to create some Coons surfaces ...



OPEN A CURVE will be used if you want to open a closed curve. Have a closed curve as current selected object and take this tool. Then click on the segment you want to remove. This will open the curve, removing the selected segment.

The Help Menu

Help Level

If you choose «Help Line», you will be drived in all your manipulations by sensitive help icons and by an on-line help. Each time you will move the cursor on an icon, the help-line (displayed in the bottom-right corner of the screen), will tell you which tool is associated. At any time, the current action will be displayed, as well as help icons (in a left bottom arc of circle), which will allow you to access to tools options (+ and - keys, Space Bar and Option-click actions), in a graphical way.

If you are not familiar with the Amapi interface, it is highly recommended to enable the «Help Line» option.

The Toolbar Menu

Render / Modeling

This will allow you to toggle between Modeling Toolboxes and Render / Animation Toolbox. You can also press the Space Bar to toggle the current ToolBox (See Chapter 1 - The Toolboxes)

Utilities

will open the Control Panel as well as if you sweep the cursor of the bottomest right icon.

View

will open an additional 3-icons palette on the bottom of the screen, containing interactive icons to handle your displacement in the workspace

CHAPTER

9

Rendering Tools

(Studio version only)

The Render Set Up

Edit a shader

The Shader Screen

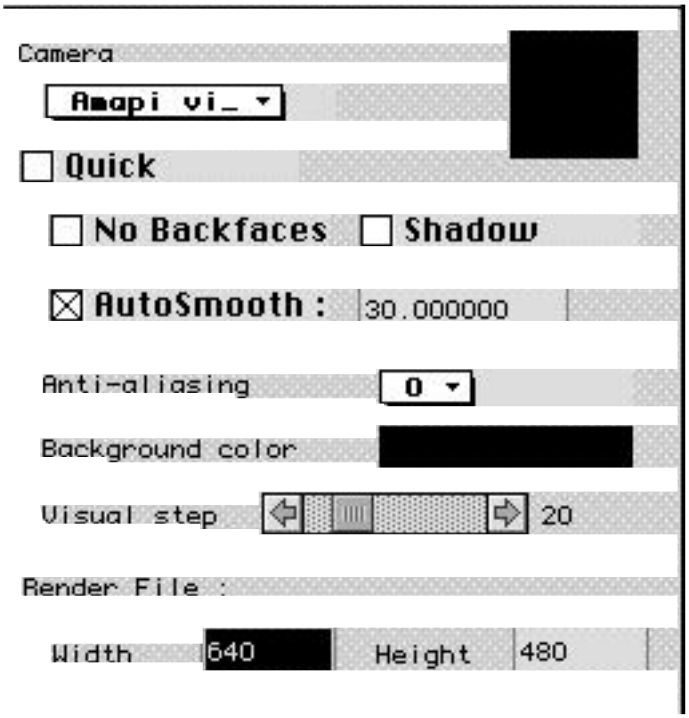
Texture Parameters Tuning

Rendering, Camera

& Lights controls

Render Set up

Open Render/Set up render menu command.



Camera

Amapi view (default).
You can select camera 0 or camera 1 view (if 1 or 2 cameras are defined in the scene) and you will see the scene trough with the selected camera in the real-time viewer as well as for image calculation, both for rendering and animation.

Quick checkbox

If selected you will obtain a fast rendering without shadows and textures.

Auto Smooth

By default, Amapi creates a smooth shading between faces. The angle parameter is the angle under which two connected faces will be smoothed. You may either de-activate the autos-mooth option, as well as you can modify the auto smoothing angle (0 will produce always flat render, 180 will smooth all edges of rendered shapes)

Anti-aliasing

Anti-aliasing will help smooth jagged edges.
You can choose between a value of 0 (no anto-aliasing per-formed) and a maximum value of 4.
The use of Anti-aliasing when rendering is time consuming.

Background color

You can select a Background color with the color selector.

Visual step

The rendered scene is displayed using raw pixels (default= 20). If your computer has low RAM capacity, select 3 or 4.

Render file : width and height

Enter the pixel size of next rendered picture.

Edit a shader for the current object

Open Render/Shader menu command to edit a shader for the current selected object.

Definitions

The object appearance is defined by 3 main parameters:

- Ambiant component.
- Diffuse component.
- Specular component.

Ambiant component

Is the same on each point of the object, regardless of the lights. It helps to reveal dark objects on dark backgrounds, or to raise the overall luminosity or hue of the whole object. Don't set it with too high, or the object will be "burned".

Diffuse component

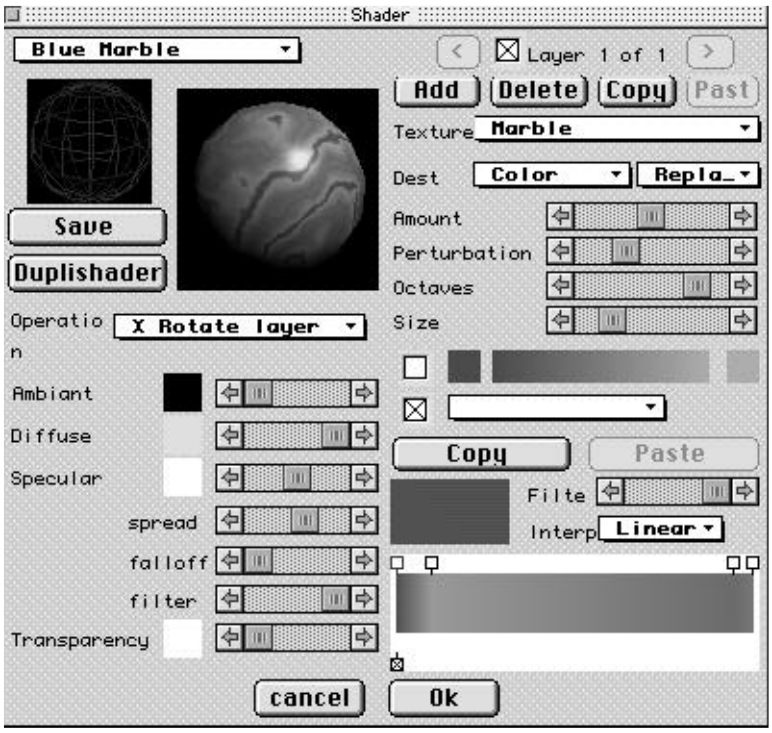
Is added by each light that lit the object, producing a soft shade and a "self-shadow" (as the moon is only lit on one side by the sun). If you turn the object around, the shade stays the same.

Specular component

Produces highlights on objects, specular component stands for "the reflection of the lights on a shiny object": metallic or plastic objets have a high specular component. Diffuse materials (paper, raw wood) have a very small specular component.
As specular stands for the light's reflection on the object, that highlight will move when you move around the object (assuming the light doesn't move).

These 3 components are added together to produce the final color of the object.

The Shader screen



Texture basic parameters tuning:

Material

Select the kind of texture you want to work with (for the current object).

Current object preview

Interactive tuning window.

Save shader button

Click on it to save the new texture name (after creating it)on the hard disk.

Duplishader button

Copy the current shader and add a number after the name (i.e. to modify it).

Operation on texture

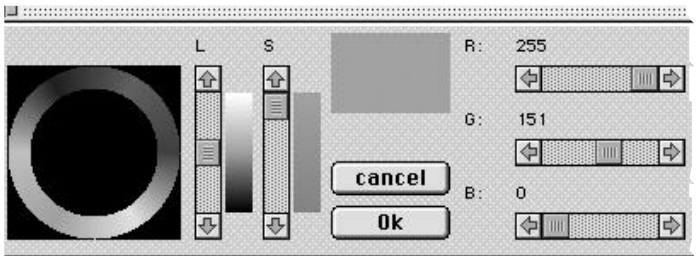
- Rotate current layer.
  You can select to rotate the current layer on X only, Y only, Z only or XYZ together.

- Translate current layer.
  You can select to rotate the current layer on X only, Y only, Z only or XYZ together.

- Scale current layer.
  You can select to rotate the current layer on X only, Y only, Z only or XYZ together.

Color components

Each of the 3 components illustrated below has a specific color which can be edited (just click on the color square), and a slider to adjust the component value.



Remember: the Diffuse Color is the main color of the object. Usually, the Specular Color is white and the Ambiant Color is rather dark.

- Ambiant slider : edit the Ambiant value
- Diffuse slider : edit the Diffuse value
- Specular slider : edit the Specular value
- Spread: Controls the wideness of the specular on the surface: a low value gives a very wide highlight, and a high

value gives a very tight highlight.

- Falloff: Special control to reduce the highlight wideness: the higher the value, the less wide the hoghlight is (set it to 0 to disable it). It is used with low values of spread (wide highlights) to reduce them but keep their shape.

  Example: to obtain a nice metal, use low spread and the falloff: you get a dense highlight and control its wideness with the falloff.

- Filter: Used to control the influence of the lamp color on the specular color.

  If the filter is set to 0, the color selected for the specular is ignored: the specular highlight will be the one of the lamp color. Otherwise, if the filter is set with this higher value, the specular highlight will be its own color. You can mix the lamp and specular colors within these limits.

  Example: a yellow brass cup will have a yellow highlight (Specular), even if the light is blue. Usually, metals have the same specular highlights than their main color (Diffuse).

  So, use a high filter for metals ; for plastics use a filter value 0: a yellow light gives a yellow highlight, even on a blue plastic box.

- Transparency: Allows transparency to the objects

  A white color means the object is not transparent (default)

  A black color means the object is fully transparent (you will not see it in the scene).

  You can edit the transparency color (just click on the color square), and use the slider to adjust the transparency level. The use of transparency is time consuming.

All of these parameters allows you to design basic shaders with monotone colors.

The right hand screen (texture layers tuning)

Layer checkbox

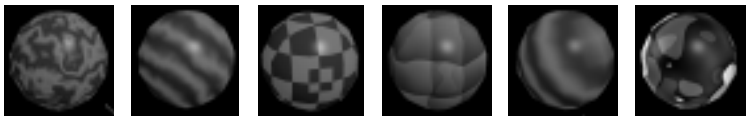
Enable-Disable the layers parameters.

Layers

- Add button: You can add a new colormap layer. Do it before modifying anything, otherwise you are alterating the current layer.
- Delete button: Used to delete the current layer.
- Copy button: Used to make a copy of the current layer.
- Paste button: Used to paste the copied layer on the current layer.

Texture

- Marble: Strata of colors (like stacks).
- Wood: Concentric rings of colors.
- Checker: 2 colors alternated squares.
- Straight ramp: 3D repeating gradation between colors.
- Smooth Straight ramp: The same without discontinuity.
- Radial ramp: Radial repeating gradation between colors.
- Smooth Radial ramp: The same without discontinuity.
- Noise: 3D noise (chaos in the colors).



Marble Wood Checker Straight Radial Noise

Destination

Left choice

- None: Disable the texture (diffuse color only).
- Color: Apply the texture on the main color (diffuse color).

- Ambiant: Applied to Ambiant, it is an easy way to mix textures layers: one for the color, one for the Ambiant.
- Diffuse: Only the red component of the texture is applied to the diffuse parameter. Only the intensity is affected (not the object color).
- Specular: The texture is applied on the specular (just to get a noisy highlight).
- Transparency: The object becomes more or less transparent (smoke, glass,...).
- Bump: Add bumps on the texture.

Right Choice

- Replace: This is the default option: the textures replace the color of the object. This is the best way to test textures.
- Mix: The texture is mixed with the color of the object (more or less, see Amount, below).
- Add: The texture is added to the color of the object.
- Sub: The texture is substracted from the color of the object.
- Mult: Multiply color component by color component.
- Clearer: Take the texture if it is clearer, otherwise do nothing.
- Darker: Take the texture if it is darker, otherwise do nothing.

Amount slider

Controls the amount modification level between a texture and its destination.

Perturbation slider

(No effects if set to 0) Perturbs the texture (chaos).

Octaves slider

(No effects if set to 0) Adds complexity on texture. Try it with

marble and pertubation (increases the rendering time).

Size slider

Modify texture size.

Check boxes: Color / Colormap

- Color: Simple grading within 2 colors.
- Colormap: The best way to achieve wonderful textures: you can work with many colors, subtle shades visibles on the objects.

The colormap is designed by interpolation between colors. Each color can be modified or moved along the colormap window. The colors interpolation can also be controlled by a menu. The easiest way to start is to choose an existing colormap in the first menu (left hand screen: Material window).

Colormap

The colormap is a color ramp with a second black and white ramp below. This black and white ramp is the “filter” which allows you to mix the colors.

Option window (Presetted colormaps)

You can choose between: Fire, Classical, Miami, Toronto, Crazy cow.

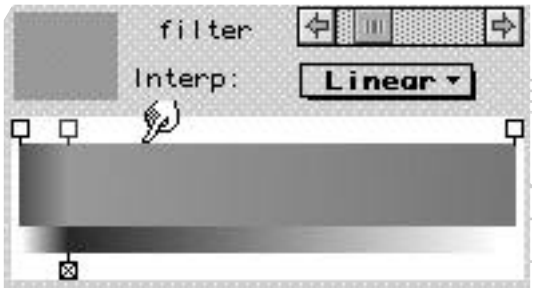
- Copy button: you copy the colormap in a special buffer.
- Paste button: you could paste it later.
- Filter slider: This is the Colormap filter ramp (see below).

Interpolation window

- Linear: Means linear degrade between colors stripes.
- None: Means colors stripes without degrade.

Colormap ramp

Select the “Blue marble” texture in the first menu (left hand screen: Material window). On the Colormap ramp, you will see a blue degrade color.



Above this ramp there are small square black buttons. One is red: it is the current one, and to modify its color you have to click on the blue square above.
Now, a color palette appears and you can adjust the color you want.
2 possibilities: HLS or RVB tuning (i.e. choose yellow).

When done, click on the OK button and the main screen appears, now you can see the new color in the Colormap ramp and the effect on the current object preview.

To add a new color button, just click on the Colormap ramp where you want add a new color (i.e. between 2 existing colors).

Under the Colormap ramp, there is a small square black cross hatched button: it is the Kill button. When clicking on it, you kill the current (red) color button.

Between the Colormap ramp and the Kill button, there is the filter (black and white ramp): it shows the filter ramp.

Rendering, Camera & Lights controls

How to render a scene

- 1st method: Press the Enter key of the keyboard and the rendering works with the current view of the scene and default lights.
- 2nd method: With the current scene :

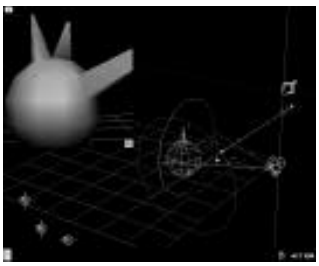
1. Open Render/Viewer/GLViewer or QuickDraw 3D Viewer (if not displayed).
2. Press the space bar to access to the Rendering and Animation tools.
3. Place one or more lights and adjust them, (feedback in the Viewer window is near real time).
4. Create a camera and open Render/Set up render
5. In the Render Set up window, under camera, select camera view instead of Amapi view.
6. Choose options like Shadows, 3D textures, anti aliasing level, back color.
7. In the Viewer window you will see the scene through the camera lens. When ajusting the camera, the real-time viewer will show the new sight.
8. When the scene is ready, press the Enter key.

Alternate methods: You can work within the 2 previous methods by placing lights, or not placing cameras or Amapi view.

How to adjust the current light

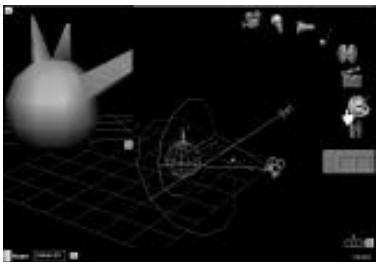
1 Take the stretch tool ; control points (white) appear on the light-object.
2. Rescale, modify the distance and falloff of the light.
3. You can see a preview in the real-time viewer.

How to adjust the current camera

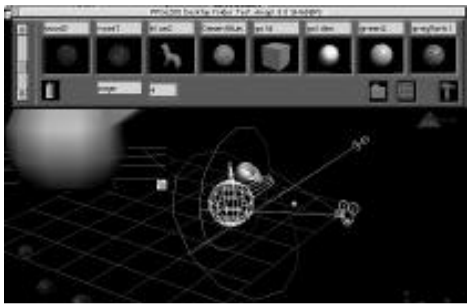


1. Open Render/Set up render
2. In the Render Set up window, under camera select camera view instead of Amapi view.
3. Select the stretch tool, the control points (white) appear on the camera.
4. Click-drag the control points to rescale, modify the distance and falloff of the camera.
5. You can see a preview in the real-time viewer.

Drag & Drop Textures



1. To open the shaders catalog, press the space bar (you will see the Rendering and Animation tools).
2. Click on the Shaders icon.
3. In the shaders catalog, you only have to select a texture, pick it by clicking on it, hold down the mouse button. Select an object in the scene by browsing the icon of the texture over it (the object is then displayed in white when adressed with the texture).
4. Release the mouse button to assign the texture to the object.



CHAPTER

10

The Animation Tools

(Studio version only)

The Key Framer

Assign a path to an object

Record your animation

The KeyFramer

You will edit Key Frames, e.g. key positions or appearances you want your model to follow throughout the time.
Editing keyframes means that you will apply deformations on your model (move it to a different location, modify its scale, pull vertices or bend it) and you will define at which time this new appearance of your model will be displayed. Between two key frames, the Key Framer will make a linear interpolation to compute all intermediary steps of the shape of your model, building this way an animation.

Opening the key framer

1. Toggle the current ToolBox by pressing the Space Bar, or by choosing Render/Animation in the ToolBars menu


2. Click on the Key Framer icon

OR
Choose the KeyFramer command in the Animation menu.

The Object time line

It represents the evolution of your object throughout the time, showing you small previews of the key frames and of some intermediary steps.
The first time you open the Key Framer with an object, only the first Time Line box (Frame) is displayed, with the current appearance of your object.
You will store the modified object in empty boxes to build the animation key frames sequence. But we will explain it in detail below.

The Object time line also contains a Trash icon, which will

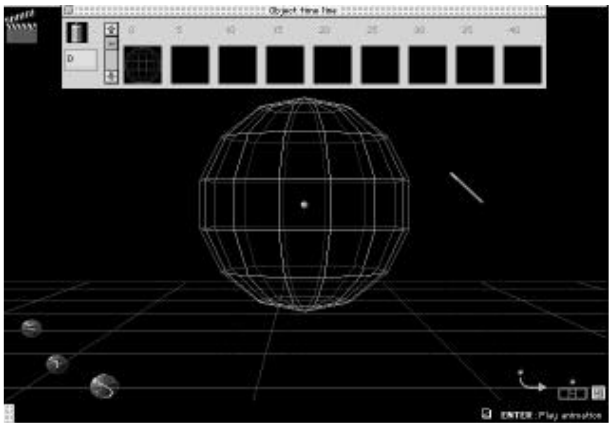
allow you to delete key frames, a page number selection box, as well as a slider which is useful to browse the Time Line pages (like the Catalog).

Control commands

The Space Bar, which will allow you to display subsequently and cyclically all key frames.
The + / - keys with which you can play the animation step by step, or just visualize the next or previous frame.

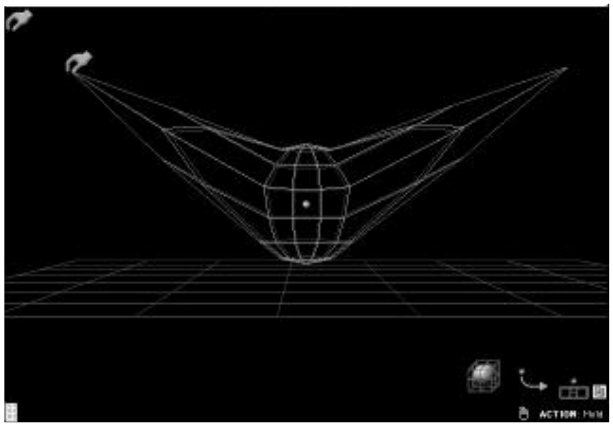
How to build an animation

1. Open the Key Framer with a current object selected.
You see the Object Time Line with only the first box showing a small preview of the object.
The current appearance of your object is now recorded as the first frame of your animation.



2. Leave the KeyFramer Tool

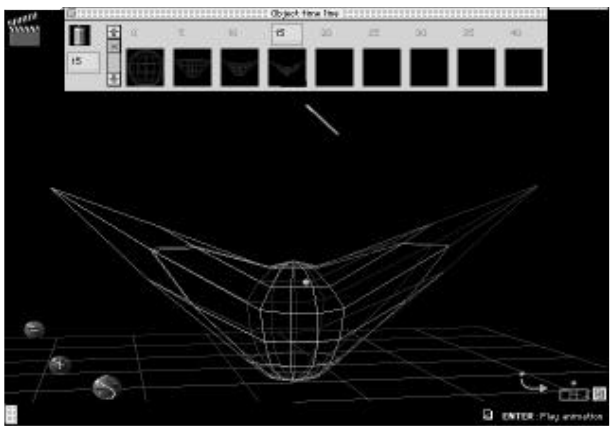
3. Take any deformation tool and apply some manipulation on your object



4. Open the Key Framer again.

5. Click inside an empty box

The current appearence of your object is recorded as a new key frame (with the frame number you choose before and which is displayed in the Frame Number Edition box), and intermediary steps are computed and displayed in the intermediate boxes.



6. Repeat steps 2 to 5 to complete your animation steps

How to preview your animation

Once you have recorded at least 2 key frames, pressing the Return key will play the animation between the first and the last defined frame.

You may interrupt the animation by pressing the ESC key.
You may also move around the scene as well as in the modeling context, by using the arrow keys or numeric key pad.

Quickly view your key frames

By pressing the Space Bar, you Toggle cyclically bewteen all defined key frames.

Play your animation step by step

From the current edited frame, by pressing the + or - keys, you can select respectively the next or previous frame and display it onto the screen.
It allows you to play your animation frame by frame, as well as go to a specific frame to edit it.

How to modify an existing frame

1. Press the Tab key (or click inside the frame number edition box)
The Page Number is being edited.
2. Type in the number of the frame you want to edit (modify) and press Return.
The selected frame is displayed.

OR

1. Click in a full box (where a small preview is displayed) and drag it into the scene
The current object takes now the appearance of the object recorded at the frame you took.

3. Leave the Key Framer

4. Use any deformation tool to modify the shape of the object
5. Go back to the Key Framer
6. Click on the modified object in the scene
   A small preview appears under the cursor
7. Click onto the full box you have taken before.
   The new object is recorded, replacing the modified key, and all intermediary steps are updated.

How to delete an existing key frame

You may want to delete an existing key frame (you cannot delete an intermediary frame, since they are generated automatically).

To do so, simply drag and drop the content of the key frame to be deleted into the Trash Icon.

How to move a key frame

We mean by “moving a key frame”, giving a specified key frame a new number, so the corresponding appearance of the object will be displayed at a different time.

To do this, simply edit the number of the key frame which is displayed on the top of the key frame. The edited key frame will automztically be moved into the corresponding box.

How to change the current Object time line page

Use the Slider located on the left side of the Object Time Line box and browse to display the desired page.

Assign a path to an object

How to assign a path to an object

1. Have a current object selected.

2. Choose Assign a Path command in the Animation menu
OR

2. Toggle current tool palette by pressing the Space Bar or selecting Render / Animation in the Toolbars menu
and click on the Animation Path Icon

3. If you have an already drawn curve in your scene, you can click on it to select it as the desired path.

If you want to draw the path of the object by hand, click on the object itself. You are now in the Bezier curve construction tool. Build the curve and leave the tool as usual.

The selected curve or the drawn curve is now assigned as the animation path of the currently selected object.

Two things will happen :

- The current object will be snapped to the first point of the curve (first frame of path animation).
- The curve will be “tesselated” so its number of points will be the number of desired animation frames (50 by default).

How to choose a different reference point

By default, the reference point which is snapped to the first point of the path is the Geometric Center of the object.

With the right button of the mouse (Option-Click on the Mac), you get the Cross cursor. Click any other point in the scene, which will be used as the reference point for object displacement along the curve.

How to choose the object orientation on the path

By default, the X axis is aligned on the segments of the Path.

By pressing the Space Bar, you can toggle this default axis

cyclically : X axis, Y axis, Z axis, no orientation. The last choice means that the object will not be rotated during the animation along the path.

You can also choose a target point that your object will follow during the animation (very useful for example to target a camera on an object).

Click on the Eye icon. You get the bull's-eye cursor. Select an object. The center of geometry of this object will be the target point for the animated object.

How to choose the number of frames associated with the path

Press the Edit key. You get a dialog box in which you can type in the number of frames you want to associate to the Path animation.

How to save your animation and play it

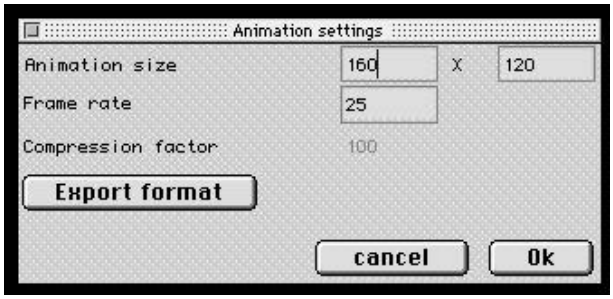
When finished, you can save your animation in the catalog, like an object.

To play it again, take it from the catalog and click on the Play icon in the Render / Animation palette

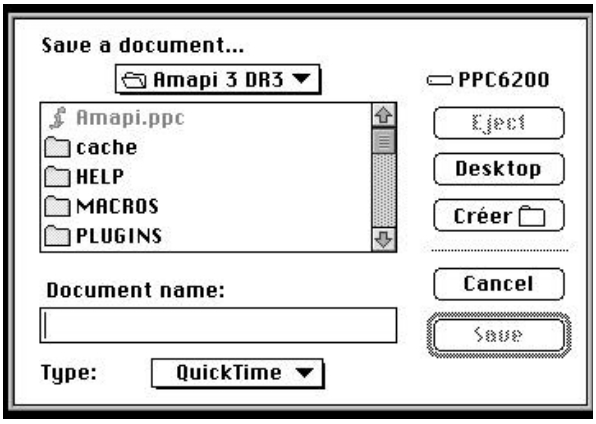
Play on File

To create a rendered movie, you must first give a path to your object or create key frames.
Then select Animation/Play on File. The file manager will ask the movie name and a rendering window appears and displays the picture while calculating.
Animation file is recorded as an AVI file on the PC version and as a QuickTime movie for the Mac version.

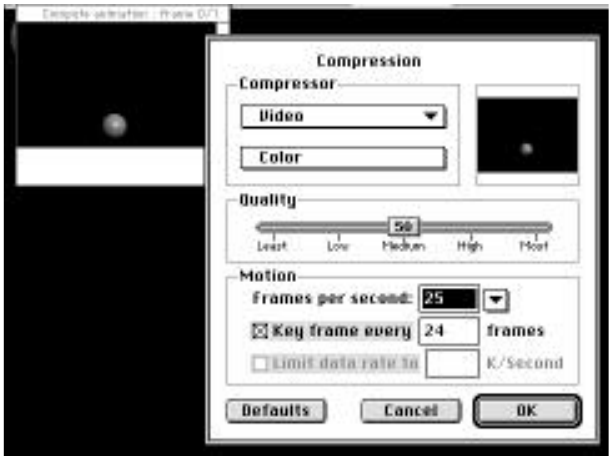
You can stop the calculation process by pressing on ESC key.



Animation settings window



Saving in a file dialog box



Animating parameters dialog box

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