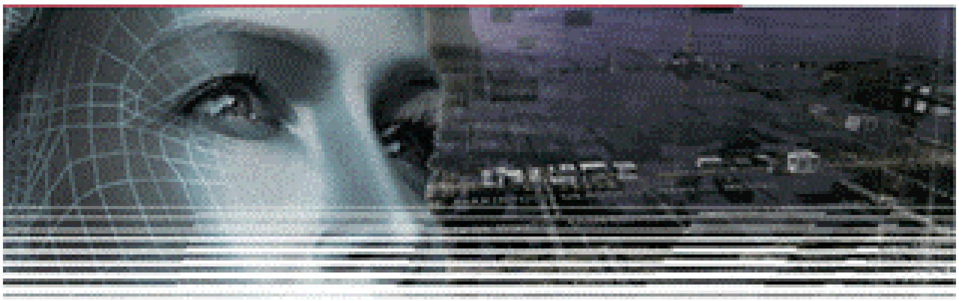

AMAPI 3D™

SHAPE YOUR MIND

February 2001

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Attribution

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Thanks

This manual would not have been realized without the help and the support of the entire AMAPI 3D development team:
Laurent Billy, AMAPI 3D product manager
Fabrice Sadaune, Olivier Tubach, Xavier Durand, Mickael Gasrel, Thierry Duvignac, Maxime Rouca, Manuel Jouglet, Emmanuel Rémia, Blaise Zapparata, Philip Staiger, Kathy Tinoco
Pascal Doux, TGS 3D Technologies manager
Thierry Dufour, TGS R&D manager

A special thanks to Pierre Bretagnolle for his active involvement in the formal and functional specifications of the program, and for implementation of the graphical user interfaces. Pierre also took part in the program validation phase and the design of the 3D objects provided with the AMAPI 3D gallery.

Thanks also to: Olivier Drion, Richard Enjalbert, Cedric Nevians, Thomas Roussel, John Childs, Garry Phillips, John Balestrieri, Ken Citron, Stefan Hörberg, François Roussel, Pierre De Poucques, Nicolas Lootgieter, Gilles Iung Lancrey, Olivier Ffrench, Richard Courcet, Eric Vaudet, Olivier Jansem, Henry Elophe, Stéphane Valette, Hervé Genriès …

Cover: Ideano
Production: Graphic Systems

Table of contents

Introduction

1 Welcome

AMAPI 3D™ is the ideal 3D workshop for creating content for a wide variety of fields, including industrial design, packaging, architecture, illustration, multimedia, video games, film and television, as well as the Web.

Its advanced modeling capabilities (NURBS, Dynamic Geometry, Surface Subdivision, and more) make AMAPI 3D a powerful modeler that simplifies the creation and editing of complex geometrical shapes. It includes tools for rendering, animation and interactive 3D dynamic web and multimedia publication.

AMAPI 3D files can be exported in numerous standard file formats, including DXF, STL, IGES, OBJ, VRML, and others. AMAPI 3D also exports 3D scenes rendered with cameras, lighting, and textures, as well as 3D animated scenes.
AMAPI 3D includes a brand new technology specifically focused on the Internet: the 3Space technology. It allows you to add interactive 3D dynamics to your HTML documents, making them more user-friendly and more efficient in terms of communication.

AMAPI 3D is also the ideal companion program for 3D Studio Max, Softimage, Lightwave, Cinema 4D, Carrara, Ray Dream, Bryce, Artlantis,…

During the San Francisco Macworld Expo – January 9th, 2001 – TGS and EOVIA announced their merger to create a leading 3D graphics software company. This new organization will offer a unique and global 3D creation product line including advanced modeling, animation, and 3D web and multimedia authoring.
To learn more about EOVIA software and solutions, visit www.eovia.com.

A leader in the 3D graphics development tools market (Open Inventor, volume rendering, scientific visualization, Java, OpenGL, VRML,…), TGS offers solutions for major international industrial companies, CAD/CAM developers, scientific computing and simulation developers, as well as government and university research centers. You can contact TGS at the following address: www.tgs.com.

Thanks for using AMAPI 3D and welcome to the world of 3D creation!

2 How to use your manual

AMAPI 3D™ has, in addition to the qualities described previously, the great advantage of being very fast to master. To master your new software even more quickly, we strongly advise you to proceed as follows:

To have a trouble-free installation and to avoid possible mistakes, follow the instructions.
Read the "Introduction to AMAPI 3D" chapter very carefully. This introductory text was designed to give you the flavor of the software in a few short pages and to highlight the benefits that AMAPI 3D can provide.

Then you can begin the exercises in the tutorial. These exercises progressively increase in complexity. Repeat each exercise until you can go through each step of the model construction quickly and easily.

Once you are familiar with the software, you will be able to create models on your own and will only need to refer to the User Manual from time to time. This manual explains each feature clearly. If you follow this learning scheme thoroughly, reading the entire User Manual will be unnecessary. You will already know what you can expect from AMAPI 3D and will only need to read the relevant part of the manual.

If you run into difficulty using a particular tool, remember: AMAPI 3D provides a practical exercise for each of its tools using supplied models (see the chapter "**Practical exercises**" on page 448). This type of exercise will help you fully understand each tool.

You will come across many pictograms throughout this documentation. Their usefulness will quickly become apparent: They can be quickly spotted on the page. You are already familiar with most of the pictograms – it will be easy, almost effortless, for you to learn their meaning.

Additional information

Constraints and limitations

Caution, warning message

AMAPI 3D tricks and tips

Reference to an exercise of the tutorial

If you follow this training scheme closely, you will understand the philosophy of the software in a couple of hours and become a true maestro in a matter of days. Now, it's up to you!

3 Technical support

There are several ways to reach the Eovia technical support service:

Web support

You will find answers to your questions at the following address: www.eovia.com.
In addition to the FAQ, the website provides numerous technical notes, tutorials, tips and tricks, and more to help you to make the best use of AMAPI 3D.

Phone and email support

Registered AMAPI 3D users can get help with installation, configuration, and program usage questions via phone or email.
The best way to register is to go to the Eovia website, www.eovia.com, or mail in the registration card you will find in the AMAPI 3D box.

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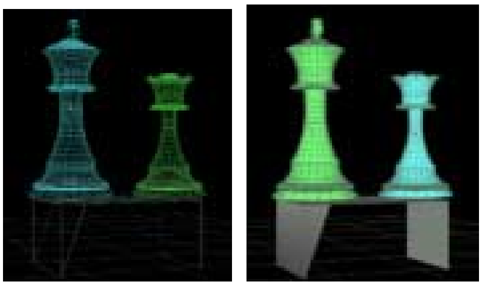
europe_support@eovia.com

Presenting AMAPI 3D

The AMAPI 3D screen displays a working scene around which the user moves freely to create his or her models. AMAPI 3D provides a rich set of tools to create and modify these models.

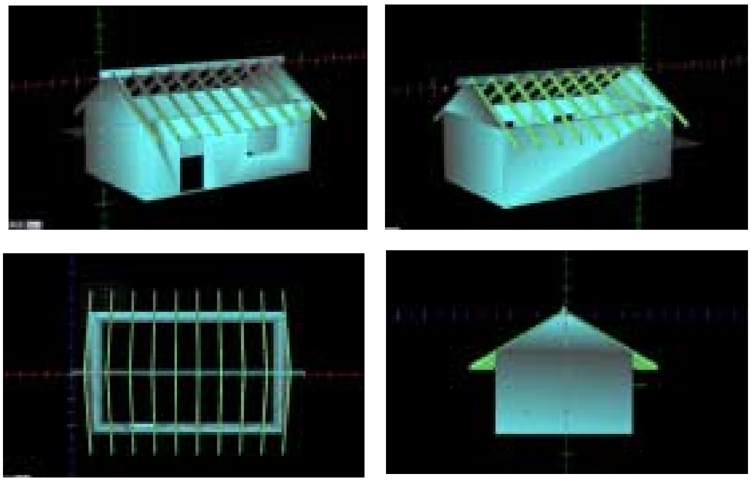
1 The Work Space



An empty scene displays a **table** (workbench) on top of a **grid.**
Your models will be built on the table. You can use the table and the grid as a reference point when moving in the scene. But you can also ask to have the table and grid not be displayed. (See chapter "Preferences / Interface" on page 435.)
The **scene** includes all of the **objects** created in the same work space.

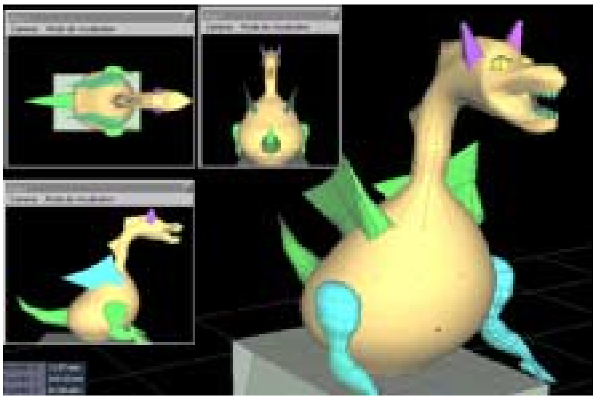
You will be able to display those objects in **wireframe mode** or in **shaded mode.** (See chapter "Preferences / Interface / Work Space / Display Mode" on page 439.)
The advantage of the shaded display mode is that it makes manipulations more interactive and more realistic. The wireframe display mode is better suited to precise work.

2 The Views and Planes



AMAPI 3D offers you a full-screen perspective display of your models.
The ease with which you can move around in AMAPI 3D – rotating around objects, zooming in and out on specific details – simulates the natural movements of an artist working on his / her creation.
(See chapter "The Views" on page 133.)

The **ruled axes - X (red), Y (green), Z (blue) - represent the main working planes.** They help you to orient yourself in space and to place and size objects precisely. You can easily and at any time change the step size used: just press the "+" and "-" keys.
The X, Y and Z axes give you an indication of your current viewpoint in the scene and of the corresponding working plane. This working plane is always the one that is most perpendicular to the current viewpoint.



AMAPI 3D allows you to **save** different **viewpoints** as cameras**.** You can view the scene from any one of those custom viewpoints.

You will also be able to display an unlimited number of **viewer windows.** They will display different user-defined viewpoints of the current scene. (see chapter "Viewer" on page 94).

3 The Modeling Tools

3.1 Interface

The user has access to three main tool palettes. AMAPI 3D provides two different interfaces for the display and use of these tools:

- One interface follows the **"workshop"** paradigm: it is specially designed to allow the user to move freely about the AMAPI 3D work space, simulating as closely as possible the natural movement of a designer at the drawing table, or the movement of a sculptor in his workshop.
- The other interface has the advantage of being more familiar to most users, being more of a **"standard"** interface.

For more information on the choice of interface, see the chapter " Preferences / Interface / Tool palettes" on page 435.

How do you pick up a tool?
Before using a tool, you must select the object you wish to edit. It is the current object (see "Current object concept" on page 166).
Then, click on the desired tool.

How do you change palettes?

⇒ If you selected the Workshop interface, move the cursor outside the right side of the scene and then back into the scene.

⇒ If you selected the Standard interface, you do not have to change the palette as all the tools are grouped into a single Tools Palette.

How do you end the action of a tool?
There are two ways to do this:

Validate:

⇒ In the Assistant Palette: Click on the "OK" button.

Or

⇒ On the keyboard: Press the Return key.

Validating an action will quit a tool. The cursor will switch back to the object selection accessory, and you will be able to select a new tool or object.

Putting the tool aside:

⇒ If you selected the Workshop interface: Move the cursor outside the right side of the scene and then back into the scene to put the tool aside. You can then select another object or pick up a new tool.

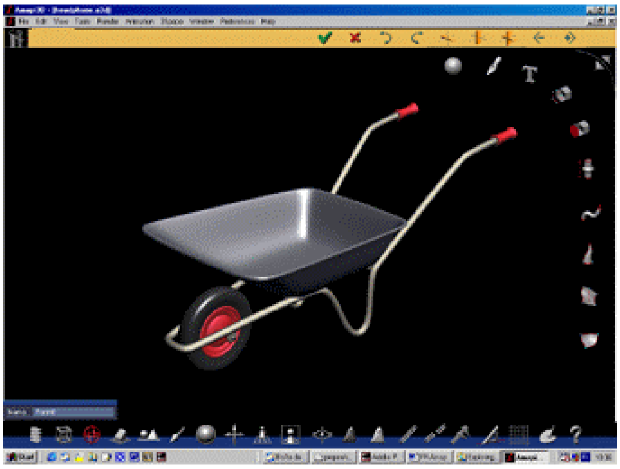
⇒ If you selected the Standard interface:

⇒ Select another tool in the Tools Palette to keep on working with the current palette.

Or

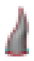
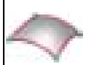
⇒ Select a construction tool.

i Selecting another tool will automatically drop the previous tool (standard interface). See chapter "Tools" on page 165 For more information.



3.2 The Construction palette

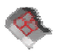
This tool palette contains the tools used to draw the shapes that will be the basis for subsequent modeling operations.
For more information see chapter “Construction” on page 168.

Icon	Tool name	Description	See
	**3D Primitives**	Sphere, Cone, Cube, Platonic solids, Grid, Height Fields, Cylinder	en page 169
	**Drawings**	Circle, Arc, Rectangle, Polyline, Curve, Interpolated Curve, Sketch, Helicoid, Symmetry.	on page 185
	**Text Editor**	The Text Editor allows you to insert 2D or 3D text (with a specified font) into the scene.	on page 203
	**Extract curves**	The Extract curves tool creates a new curve from points you select from existing objects.	on page 204
	**Facet extraction**	Create a facet. That is, generate a surface from several points.	on page 206
	**Extrusion**	Curve extrusion. Facet, edge or vertex extrusion.	on page 209
	**Sweeping**	Sweeping of a section Facet, edge or vertex sweeping	on page 220
	**Double sweeping**	Generates a surface from a section and two profiles.	on page 234
	**Ruled Surface**	Between curves. Between surfaces.	on page 234
	**Surfaces**	Coons, Hull, Gordon	on page 236

3.3 The Modeling palette

This palette includes the tools with which you can model the primitives. With them, you can stretch, smooth, bevel, and so forth.
For more information, see chapter “Modeling” on page 243.

Icon	Tool name	Description	See
	Deformers	**Global deformers:** They allow you to deform an entire object by moving or deforming one of the faces of the object’s surrounding control box. Spherical Taper Twist Bend	on page 245
		Local deformers: They act on the control points of a bounding box to deform a specific area of an object. Mold Stretch Scale Rotate	on page 254
	Bend	The Bend tool distorts the current object according to the path drawn by a reference curve.	on page 262
	Wrap	The Wrap tool allows you to deform an object by mapping it onto a shape (Grid, Cylinder or Sphere).	on page 265
	Stretch	The Stretch tool is used to move single vertices or a group of vertices, thus distorting the object.	on page 268
	Delete	The Delete tool supports four delete modes: ♦ Deleting a facet. ♦ Deleting an edge with generation of a new facet. ♦ Deleting a point by removing all the adjacent facets to the point. ♦ Deleting a point with generation of a new facet.	on page 272
	Smooth	The Smooth tool is used to control the number of facets defining a surface and the number of points defining a curve. The higher the smoothing value, the smoother the object looks.	on page 276
	Chamfer (Bevel)	This tool allows you to create bevels.	on page 290

	**Thickness**	 Apply a uniform thickness to a curve, surface, or volume.  Create an offset of the object,	on page 294
	**Cut**	The Cut tool provides several ways of cutting an object: ♦ Punch: Punching a surface or a volume using a reference curve. ♦ Boolean: Performs Boolean operations between curves, surfaces, or volumes. ♦ Extract: Extracts a part of the current object to make a new object.	on page 299
	**Decimate**	The Decimate tool allows you to reduce the complexity of an object and the size of the file while preserving the object’s general appearance	on page 306
	**Tessellate**	This function subdivides a facet into four facets.	on page 307
	**Surface Relief**	The Bump tool allows you to modify the surface relief. There are two subtools:  Bump  Soften	on page 309

3.4 The Assembly palette

This palette includes the tools to place and orient the elements. Rotate, Weld and Duplicate are examples of actions you can do with the Assembly tools.
For more information, see chapter "Assembly" on page 313.

Icon	Tool name	Description	See
	Duplicate Repeate	Use the Duplicate tool to create copies of the current object. You can: Duplicate: Create multiple copies of the current object Repeate: Duplicate the current object along a path or on the facets of another object	on page 314
	Symmetry	Use this tool to create a mirror image of an element.	on page 323
	Rotate	Use the Rotate tool to rotate the current object.	on page 326
	Move	Use the Move tool to change the position of an object.	on page 330
	Scale	This tool is used to change an object's dimension, either keeping its original proportions or distorting it horizontally or vertically.	on page 332
	Snap	Use this tool to: ♦ Move an object so that a point of this object is positioned exactly on a point of another object. ♦ Move only a part of the object (a point or a group of points) so that a point of the selection is positioned exactly on a point of another object. Of course, this will distort the current object. ♦ Align an object relative to another one. Specify a horizontal or vertical constraint for the Snap tool so as to align a point of the current object horizontally or vertically with the point of another object.	on page 336
	Lay On	Use this tool to lay a facet of an object onto the facet of another object.	on page 339
	Weld	The Weld tool is used in two completely different cases: When you want to weld two or more objects together: the welded objects become a single entity. When you want to merge several points of the same object into a single point.	on page 341
	Unfold	Use the Unfold tool to create a 2D flat, unfolded version of your 3D object.	on page 345

4 The Data Window

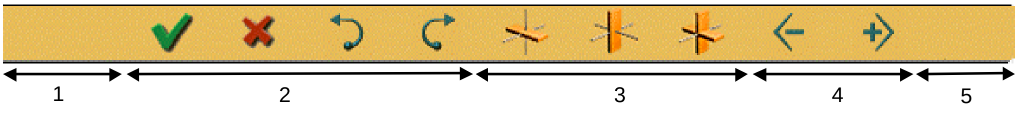
This window displays information about the current object and the tool currently used. It displays:

- The name of the current object
- Numerical data about the current operation

See chapter User "The Data Window" on page 108 For more information.

5 The Assistant Palette

The Assistant Palette has been specifically designed to give you information and guide you through your first projects with AMAPI 3D. It will help you get acquainted with your software quickly. Once you are familiar with it, you can turn off the Assistant Palette, which will give you a larger work space. (See chapter "Preferences / Interface / Assistant Palette" on page 438.)
The Assistant Palette is displayed at the top of the screen. It is divided into different parts.

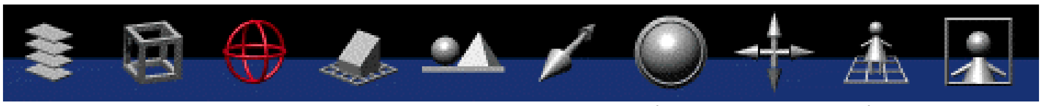


1. The Online help provides information and guides you through any modeling step.
2. The command button icons allow you to quit an action at any time, validate it, undo it, or redo it.
3. This set of three buttons allows you to specify constraints on the movement and position of the cursor.
4. A "+ / -" Tuner allows you to control at any time the precision of an action, number of points, axes step size, definition of values, etc. or the range of action of a tool.
5. Finally, this area displays the different modes available for the current tool.

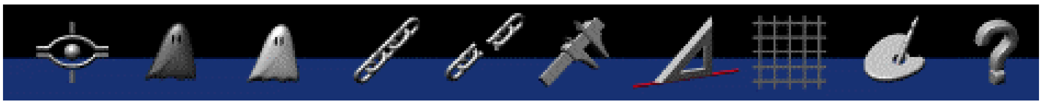
See chapter " Assistant Palette" on page 96 For more information.

6 The Control Panel

The Control Panel displayed at the bottom of the screen provides modeling support features. These features will help you get the most from your AMAPI 3D software.



1 2 3 4 5 6a 6b 6c 6d 6e



7 8a 8b 9a 9b 10 11 12 13 14

1. Organize the different elements of your scene into groups and sub-groups of objects, layers, or materials with the Scene Manager. Organizing scene elements is particularly useful when working on complex scenes.

2. The Display Hidden Lines command will help you visualize your objects as if they would be seen in the real world.

3. You can request a simplified display of the objects. Complex objects will be clearer and the display time will be shorter.

4. You can change the Working Plane.

5. Use the Perspective tool to toggle between perspective and orthographic views.

6. You can define the view with tools such as the Zoom (6e) and the See all (6d) and tools used to navigate around the scene (6a,b,c).

7. Change the center of rotation of your scene with the ViewPoint tool. It specifies the user point of view.

8. The Hide (8a) tool will make selected elements invisible. The Unhide (8b) command will make them visible again.

9. Use the Group (9a) tool to make different elements behave as one, until you Ungroup (9b) them.

10. Edit the Measurements of your objects. You can edit three types of measures with AMAPI 3D: length, angle, and volume / surface / circumference.

11. AMAPI 3D allows you to constrain cursor motion to a particular axis.

12. Magnetization allows you to choose if you want your cursor to be magnetized or not.

13. Use the Material Editor to assign a color to an object or to a material.

14. Get information on the current object with the Get Info command.

See chapter “ Control Panel” on page 111 For more information.

You can choose how to display the Control Panel: either have it displayed permanently or only when you ask it to be, thus freeing up more space for you to work in. If it is displayed only upon request, to display it, just drag the cursor at the bottom of the screen until the Control Panel pops up. (See chapter “ Preferences / Interface / Control Panel” on page 438.)

7 The Pulldown Menus

Different commands grouped by topic are always available at the top of your screen.

- **File:** Contains the file management features.
- **Edit:** Provides access to the editing tools and to user preferences.
- **View:** Groups the features used to manage the view.
- **Tools:** Groups features found in the Control Panel and in the tool palettes (Construction, Modeling and Assembly palettes).
- **Render:** Provides access to the Material Editor, and the creation and setting of cameras and lights.
- **Animation:** Groups the commands used to animate a scene.
- **3Space:** Provides access to the 3Space Dynamics Editor and other 3Space features.
- **Windows:** Used to manage the open AMAPI 3D documents.
- **Preferences:** This menu allows you to customize your program interface and set numerous parameters (Units, Import-Export, Printing, Recovery, Constraints…).
- **Help:** Guides you through the different operations if necessary.

To gain working space, you can hide the pulldown menus by pressing the “2” key at the far left corner of your keyboard. Pressing it a second time will bring back the menus.
Read the corresponding chapter of the User Manual for more information.

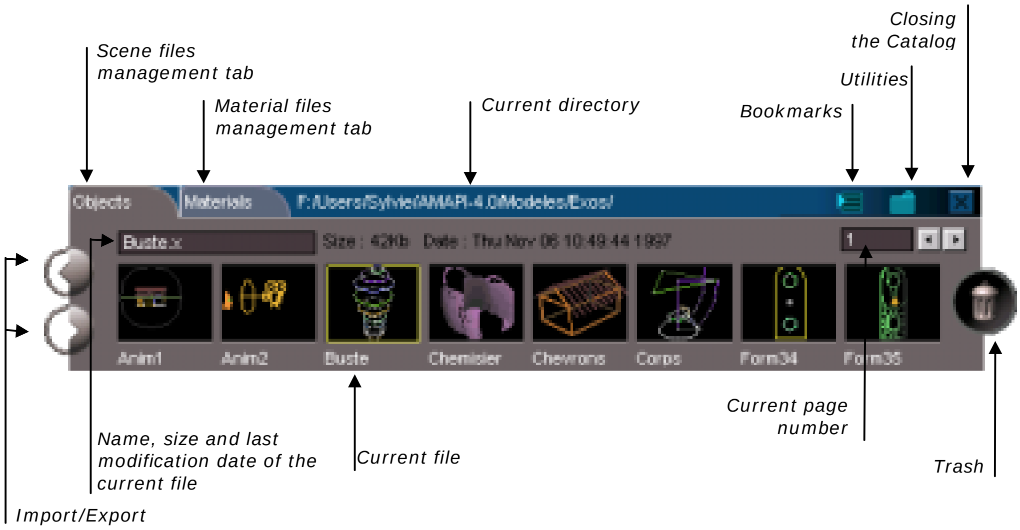
8 Mouse / Keyboard Access

Numerous features in AMAPI 3D can be accessed through the keyboard. Indeed, you may find that using the keyboard dramatically speeds up your work and frees up “real estate” that can be used for your work space.

Whatever tools you are using, a same key will always trigger the same action. For instance, you will always access the numerical input window with the Tab key.

9 The Catalog

The Catalog is a **scene file management system**. It is also used to manage the **Materials Library**. Just click on the corresponding tab to switch from one system to another.
Both management systems follow the same general principles (see chapter "The Catalog" on page 78). See the chapter " Rendering / the Materials / The Catalog of Materials" on page 361.



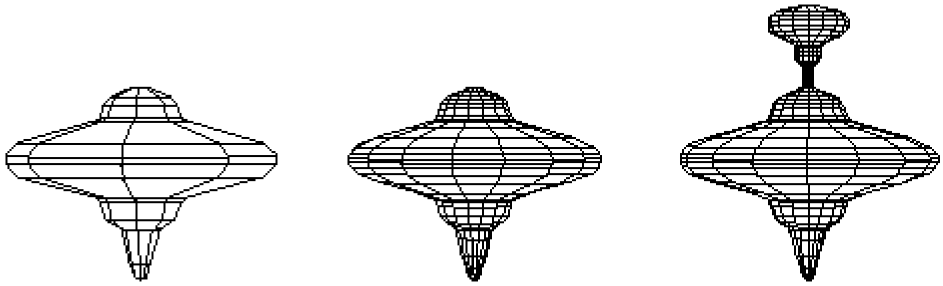
10 Work with AMAPI 3D

To create an object or a scene,the user will follow these different steps:

10.1 Modelling

The Modeling is made following tree steps which correspond to the AMAPI 3D tree main tool palettes:

- *Construction*
- *Modeling*
- *Assembly*



10.1.1 Construction

This palette contains the tools necessary for constructing:

<u>Construction curves</u>: using the "**DRAWING**" tools.
With simple mouse clicks, you will draw precise POLYLINES, NURBS CURVES, ARCS and RECTANGLES. They will be the basis of your creations, as you will use them as sections, profiles or contours of your future models. (See chapter "Construction / Drawing" on page 185, For more information.)

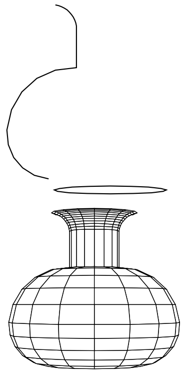


Figure 1:
An extrusion created from a section and a profile

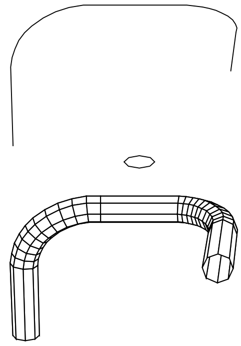


Figure 2:
Tube created from a section and a profile

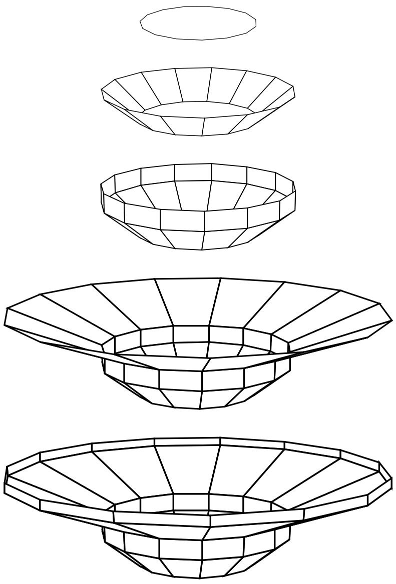


Figure 3: Single section extrusion

<u>Volumes:</u>
AMAPI 3D puts at your disposal tools to quickly create and position <u>basic shapes</u> such as SPHERES and CUBES, or 3D TEXT. (See chapter "Construction / 3D Primitives" on page 168, For more information.)

You will also be able to create complex volumes by extruding or sweeping a basic section, as follows:
- Creating directly with the mouse each section of the object (Figure 3).
- Designating a reference curve or profile. Each point of the profile curve will determine a section of the object (Figures 1 and 2).

(See chapter "Extrusion" on page 209 For more information).

10.1.2 Modeling

This palette contains the tools necessary to modify the shapes you have built

For instance, it is a child play to move a point or a group of points, with or without constraints, thanks to the **Stretch** tool. Just select a point and drag the cursor to the point's new position.
To move a group of points, just select and move one point; the others will follow. (See chapter "Stretch" on page 268 For more information.)

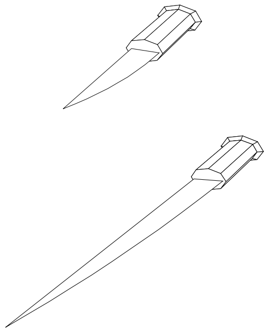


Figure 1:
The Stretch tool in action

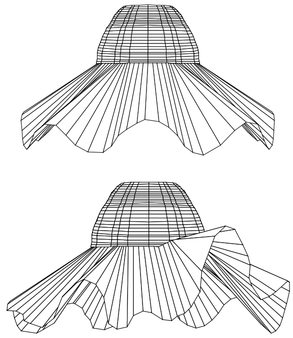


Figure 2:
The Mold tool

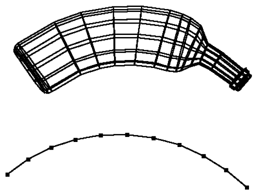


Figure 3:
Example of application of the Bend tool

The **Bend** tool will bend an object according to the path drawn by a curve. (See chapter "Bend" on page 262 For more information).

The **Smooth** tool is used to increase the number of polygons defining an object and simultaneously to round edges, thus giving a more organic look to your creations. Like the other tools, you can always specify the Smooth tool action numerically. (See chapter "Smooth" on page 276 For more information). The Smooth tool allows you to work on a low resolution version of your model, while editing the high resolution one automatically. Fewer points means more speed and the ability to create very complex meshes without the inconvenience.

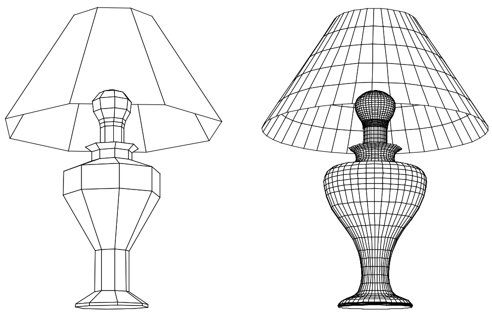


Figure 4:
Use of the Smooth tool

10.1.3 Assembly

This palette includes the tools needed to compose the scene: scale, rotate, lay on, move…

The **Move** tool is the first tool of the palette. (See chapter "Move" on page 330 For more information.)

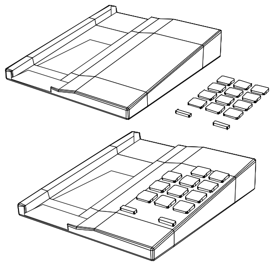


Figure 1: Example of use of the Lay On tool

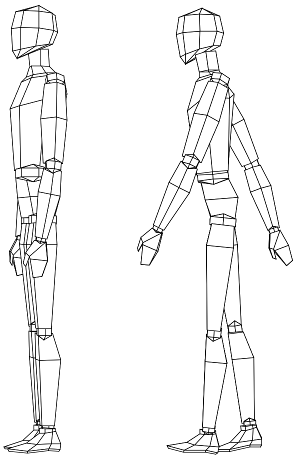


Figure 2: Example of application of the Rotate tool

The **Snap** tool is used to precisely position a point of an object on a point of another object or to align objects together. (See chapter "Snap" on page 336 For more information.)

The **Rotate** tool is used to rotate all or part of an object. (See chapter "Rotate" on page 326 For more information.)

You will be able to create copies of all or part of an object and program the position and orientation of each of the copies, using the **Duplication** tool. (See chapter "Duplicate" on page 314 For more information.)

The **Scale** tool is used to modify interactively or precisely through numerical input, the dimensions of an object.
(See chapter "Scale" on page 332 For more information.)

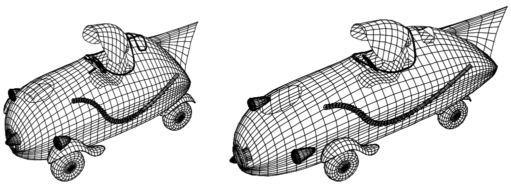


Figure 3: The Scale tool

10.1.4 Dynamic Geometry

The tools that generate surfaces from curves (Extrusion, Sweep, ...) can now "retain" the initial curves and also remember how the wireframe was generated.

.

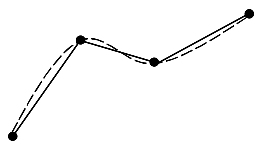
This allows you to edit a surface—not from the surface wireframe—but from the construction curves, which become the control curves of the surface. The surface is automatically regenerated when you edit the curves (like NURBS control polygons).

The surface smoothing is now dynamic, since it is regenerated at each "initial" surface or curve manipulation.

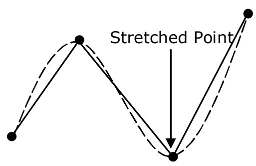
The interpolated or smoothed polyline curves also retain the originating curve.

Dynamic Geometry properties are stackable and create control levels. You can choose to work on one of the object finishing levels.

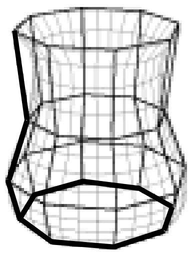
For more information see chapter "Dynamic Geometry" on page 155.



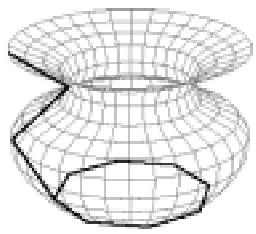
Original object:
The original object is a smoothed polyline.



Transformed object:
We transform the object by moving a point of the construction polyline.
The smoothed polyline is affected by this transformation.



Original object:
The original object has been generated by extruding a circle (polyhedral) along a path (polyline).
The result has been smoothed



Transformed object:
We transform the object by moving some points of the construction polyline.
The rough object (not smoothed) and the smoothed object are affectedy by this transformation.

10.1.5 Basic principles

The user will usually go through the following steps to create an object or an entire scene:

Before going any further into the AMAPI 3D methodology, it is very important for you to keep in mind the following information, which is applicable to any tool and any modeling step.

In numerous tools, **the user can position a point or a group of points** through:

- Successive mouse clicks.
- Entering numerical coordinates for the selected point or group of points.
- Combining mouse clicks and keyboard entries.

The Data Window displays data about objects or actions and allows you to edit the data directly by entering numerical values through the keyboard (points coordinates, dimensions, angles…).

AMAPI 3D lets you work in either **absolute or relative mode.** (See chapter "Preferences / Units" on page 441.)

- In Absolute mode, the position of a point is specified relative to the origin. The origin can be user-defined. By default, it is set at the center of the table.
- In Relative mode, the coordinate of a current point is relative to the last point entered.

Tools can be applied to all or part of an object. The user can apply a tool to a subset of the points defining an object.

The user can **define, at any time, the level of precision** (number of points of a curve, axis step size, fine tuning of the values entered using mouse clicks, etc.) and set motion constraints.

The user can, of course, **check, at any time, the dimensions** of his models so as to make any necessary corrections.

The user can change the point of view at any time and continue his work on a different plane.

10.2 Apply rendering effects

The rendering module is divided into three parts:

The Materials (see chapter "Rendering" on page 351)
With the Material Editor you can:

- Assign a material to one or several objects of the scene
- Create a brand new material
- Specify a new material based on a basic material from the Materials library
- Manage the assignment of materials in the scene

The Lights (see chapter "The lights" on page 389).
The lighting correspond to the propagation of rays of light from a natural or artificial source. There are three kinds of lights:

- Sun
- Bulb
- Spotlight

The cameras (see chapter "The cameras" on page 396).
You will create and adjust the cameras using this module.
For more information, see chapter "**Rend**" on page 351.

10.3 Animate a scene

With this animation module, you record key frames on a recording track. Your program is responsible for creating all intermediate frames itself. You can specify an animation path for an object. To see the effects, play the animation. When you are satisfied, you can save the animation.

For more information, see chapter "Animation" on page 400.

10.4 "Dynamize" a scene

More than to export**:**

- 3D geometry (see chapter "Objects" on page 151)
- 3D rendered scenes: with cameras, lights, and textures (see chapter "Rendering" on page 351).

3D animated scenes: with pre-programmed dynamics (see chapter "3Space Dynamics" on page 410).

AMAPI 3D offers a brand new, high performance technology which is particularly suitable for communicating on the Internet today: **3Space dynamics.**

The 3Space technology is an outstanding solution that allows you to put **3D interactive dynamics** into your HTML documents, making them more user-friendly and able to communicate more efficiently and effectively.
You will be surprised by the ease with which you can use this technology and will discover it is no less than a new way of communicating, to be added to the existing ways (text, images, animated GIF, Java applets, Flash effects, and so on.)

The goal of 3Space dynamics is to **reproduce, in a realistic way, the natural laws of physics** (gravity, damping, collisions,…) based on the properties you assign to each object (mass, stiffness, roughness…), the action it executes at time "t" (translation, rotation…), and its parameters (orientation, speed…).
An object will react to user interactions (mouse click, mouse over,…) depending on the behavior (reaction to an event) you have assigned to it.
The user can manipulate the scene with the mouse or the keyboard arrows – if you have allowed this behavior when building the scene.
Fpr more details see chapter "3Space Dynamics" on page 410.

10.5 Print

You can print the current scene at any time. (See chapter "Print" on page 77.)

10.6 Save

There are two ways to save a scene:

- Selecting the "Save" or "Save as" command of the "File" pulldown menu. (See chapter "Save or Save as" on page 73.)
- Using the Catalog, which is AMAPI 3D's file manager. It is used to, among other things, save and retrieve files. (See chapter "Saving a model using the Catalog" on page 83.)

In both cases you will be asked to specify a filename for your file before saving it.

10.7 Export

There are two ways to export a file:

- Selecting the "Export" command of the "File" pulldown menu. (See chapter "Export" on page 75.)
- Using the Catalog, which is AMAPI 3D's file manager. It is also used to import or export files. (See chapter " Catalog / Export" on page 84.)

You will select the desired output file format from a list of available formats. (See chapter "Export" on page 75.)

10.8 Opening a file

There are two ways to open a file:

- Selecting the "Open" command of the "File" pulldown menu. (See chapter "Open" on page 72.)
- Using the Catalog. (See chapter "Catalog / Copying a file from the Catalog into the current scene" on page 83.)

In both cases you can open a file from the selected directory.

Tutorial

AMAPI 3D™ is a very innovative piece of software. There are many ways to quickly master this simple yet powerful tool. It's best NOT to start off by tediously learning each and every feature.

You will benefit more by studying the following exercises closely. They were designed to quickly introduce you to most of the navigation and manipulation principles that apply to the AMAPI 3D tools.

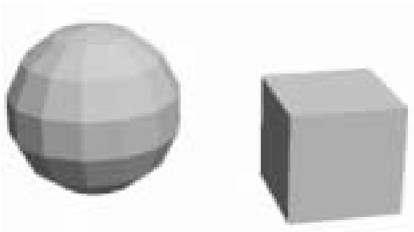
Repeat each exercise several times until you can go through each construction without hesitation.

Once you are familiar with the software, you will be able to build your own creations and will only need to refer to the User's Manual occasionally. It explains in detail how each tool operates.

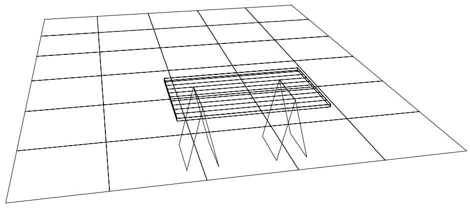
You can work with your models displayed in basic wireframe mode, or in various lit and shaded mode (based on OpenGL). While the lit and shaded modes may help in better perception of intricate details, it is true that the basic wireframe mode has benefited from better optimization in absence of high end graphics accelerators and are less prone to deficiencies found in low- to mid range gaming oriented graphics cards with limited OpenGL support.
Therefore, we strongly recommend that you initially use the basic wireframe mode when doing the tutorial exercises. Later, you may want to repeat each exercise using the shaded modes such as the Wireshade mode.
How can you switch from one display mode to another? See chapter "Preferences / Interface / Display Mode" on page 439.

1 A Sphere and a Cube

The first thing you will do in this exercise is get familiar with the AMAPI 3D user-interface. To make this as easy as possible, we suggest you choose the Workshop interface (See chapter "Preferences / Interface" on page 435.)



The work space and the interface



1. When Amapi starts up, it displays the **table** and the **grid**. They are provided to help you orient yourself in space.

2. **Depending on the interface you selected** (see the interface description in the chapter "Preferences / Interface / Tool palettes" on page 435), **there are two possibilities:**

⇒ If you selected the Workshop interface you will see the Construction Palette displayed on the right-hand side. Move the mouse to the far right, as if you wanted the cursor to leave the screen. You will see the Modeling Palette. Do it again: the Assembly Palette appears. Repeat this process a few of times: the various tool palettes are displayed one after another. Return to the Construction Palette.

⇒ If you selected the Standard interface, on the left-hand side you will see a floating palette that you can move around.

Selecting a unit system

Choose "centimeters" in the "Preferences / Units" menu (see chapter " Preferences / Units" on page 441).

Building a sphere

Sphere tool

1. **In the Construction Palette** click on the **Sphere tool icon** to select it. Two **axes** appear; since the scene is empty, their origin is at the center of the table. If an object is already in the scene, you can set the origin yourself.

2. **To facilitate object creation and modification**, you can increase or decrease the step size along the axes. To do so.
   - ♦ 1st method: By clicking on the icons of the Assistant Palette at the top of the screen.
   - ♦ 2nd method: By clicking on the "+" or "-" keys of the numeric keypad.

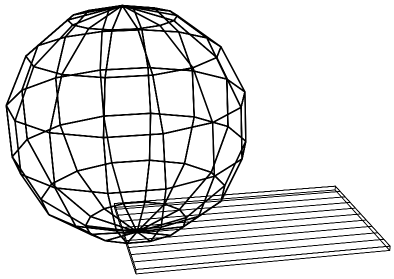
3. Creation of the sphere:

⇒ A first click in the scene will define the base of your sphere.

⇒ Next, move the mouse upward: the sphere is being created and is growing larger as the mouse moves upward.

⇒ At the same time, you will see a window at the bottom left corner of the screen. It is the Data Window; it displays the sphere's radius. This value is modified in real time as you move the mouse. Try to set a radius of approximately 15 cm.

⇒ Then click. You have just created a sphere!



⇒ A Tuner is then displayed. It indicates that you can modify the number of sections defining the sphere.

- ♦ 1st method: By clicking on the icons of the Assistant Palette at the top of the screen.
- ♦ 2nd method: By clicking on the "+" or "-" keys of the numeric keypad.

⇒ Press the "-" key three or four times: you can see the sphere being modified in real time. The number of sections defining the sphere is displayed at the bottom left corner of the screen.

⇒ Press the "+" key a couple of times. Do not add too many points! (Smoothing an object increases its complexity and memory requirements. It is better to smooth an object with the appropriate tool once the modeling is done.) For this example, set the number of sections to 8 or 9.

4. Quit the Sphere tool.
This can be done in two ways. We will put the tool aside:
⇒ **If you have chosen the Workshop interface**, move the cursor outside the right side of the Amapi window and then back in to put the tool aside. The Tools Palette reappears.
⇒ **If you have chosen the Standard interface,** selecting another tool will automatically quit the previous one. Go to the next paragraph.

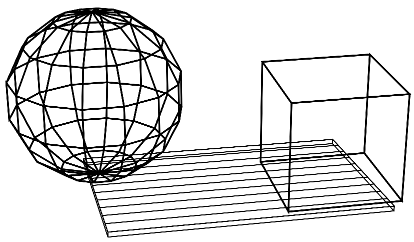
Building a cube

1. Drag the cursor on top of the sphere icon  in the Construction Palette to open the **3D Primitives Palette**.

2. Click on the **Cube tool** icon to select it: 

3. Again you will see the axes being displayed. This time you can set their origin using the mouse. This creates a frame of reference to help you create your cube. Click, for instance, near the bottom of the sphere. The origin of the axes is automatically set to the nearest point in the scene.

4. Building the cube:
⇒ Set the center of the base of the cube.
⇒ Move the mouse: the cube's size changes as you move the mouse.
You are now going to enter precise dimensions:
⇒ Press the Tab key. (This command indicates that you want to enter numeric values. It is accessible in most tools.)
⇒ The cursor switches to a hand; it confirms that you now can enter a numeric value in the window displayed at the bottom left corner of the scene.



⇒ Type a value for the X axis, for instance, 10. (Be careful not to press the Return key, as this would validate and end the unfinished entry.)
⇒ Press the Tab key again to enter a value for the Y axis, 15, for instance. (Be careful not to press the Return key, as this would validate and end the unfinished entry.)
⇒ Press the Tab key once more to enter a value for the Z axis, 20, for instance.
⇒ Press the Return key to validate. The cube is created. Validation automatically quits the

Cube tool. You now have a scene made up of a sphere and a cube.

Changing the viewpoint

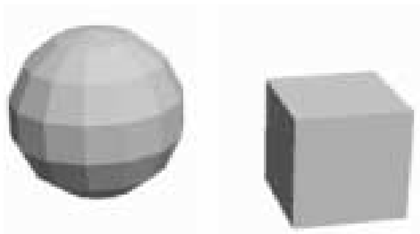
1. **You can rotate around the scene** using the **arrow keys** of the keyboard. This will change the viewpoint accordingly. Holding down an arrow key will rotate the viewpoint continuously.

2. **Let us now zoom in on the scene.**
   ⇒ Press the "3" key of the numeric keypad a couple of times; we are getting closer to the object.
   ⇒ Zoom out using the "." Key.
   ⇒ Click on the icon  in the Control Panel to zoom in on a detail of the scene. (You could also use the hotkey "1" on the numeric keypad.) A white rectangle is displayed. This is the zooming window. Click on a point to set it, the top of the sphere for instance. This point will be the center of your new view. Move the mouse to define the size of the window. Click to validate the operation.
   ⇒ Click on the icon  in the Control Panel, or press the "0" key of the numeric keypad to view the entire scene.

3. **You can switch planes to change the viewpoint.**
   This is also done through the numeric keypad:
   ⇒ Press the **"5"** key to go to **top** view.
   ⇒ Press the **"4"** key to go to **left** view.
   ⇒ Press the **"6"** key to go to **right** view.
   ⇒ Press the **"8"** key to go to **rear** view.
   ⇒ Press the **"2"** key to come back to the **front** view.

Rendering the scene

You now know how to navigate in AMAPI 3D virtual space. To visualize a rendered view of your scene, press the Return key.



You can move around your scene once your objects have been built. ***However, you can also move around your scene while your objects are being created.*** *Do the exercise again, but move* *around the scene as you build the sphere and the cube. Try, for instance, to set the origin of the cube on the side of the sphere.*

2 A Suitcase

Let's now move on to a more complex object. You are going to build a suitcase using a rectangle (a 2-dimensional curve, as on a sheet of paper) that you will extrude and later modify.

First make sure that the scene is empty

If there are any objects in the scene, you can delete them using the Backspace key. This key deletes the **current object** (the cyan object). You must press this key as many times as there are objects in the scene in order to clear the scene.

Drawing the rectangle, the basic suitcase shape

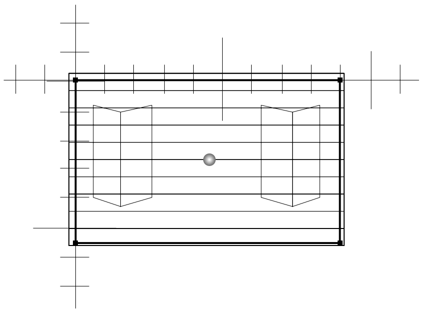
1. Click on the icon in the Control Panel or use the hotkey (the "0" key) to view the entire scene.

2. **Go to the front view** ("2" key).

3. **Go to the top view** ("5" key).

4. **Select the 2D drawing tool** in the Construction Palette. A sub-palette is displayed.

5. **Select the Rectangle tool** in the sub-palette.



6. **Draw the rectangle**:
Click on a corner of the workbench to specify the first point.
⇒ Then click on the opposite corner to specify the second point. The suitcase will be built using this profile curve.

Rectangle

7. **End the Tool action:**
There are two ways to end an action: validating the operation (we will see this later on) or putting the tool aside. Here, we will **put the tool aside**. There are two ways to do this:
⇒ **If you are using the Workshop interface,**

moving the cursor outside the right side of the scene and then back in will **put the tool aside**. The tool palette reappears.

⇒ **If you are using the Standard interface,** selecting another tool will automatically drop the previous tool used. Go to the next paragraph.

Extruding the bottom of the suitcase from the basic shape

1. Go to front view ("2" key).

2. Select the Extrusion tool  in the Construction Palette. The object selection accessory  cursor appears.

3. Extrude the shape:

⇒ Click on the rectangular profile you created.
⇒ Move the mouse so as to create the bottom of the suitcase (see diagram).
⇒ Click to set the first segment.
⇒ Apply a vertical constraint on the cursor movement.
⇒ There are two methods:

- ♦ 1st method: By using the Assistant Palette (recommended for beginners). In this palette, select the vertical movement constraint button .
- ♦ 2nd method: With the keyboard (when you are an expert).
  - ⇒ Press the spacebar once. (This is the "toggle" feature, which is used in many of AMAPI 3D's tools.) This will constrain the cursor movement to the horizontal plane.
  - ⇒ Press the spacebar a second time. This will constrain cursor movement to the vertical plane.

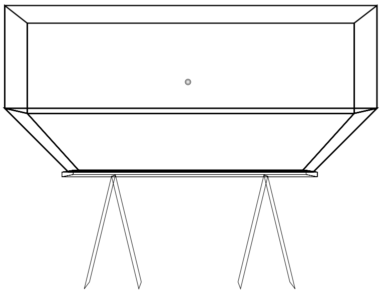
⇒ Move the mouse slightly upward so as to create the second segment of the extrusion.
⇒ Mouse click.
⇒ If you are satisfied with the extrusion, validate by pressing the Return key, or pressing the "OK" button of the Assistant Palette.
⇒ The top and bottom extremities are displayed in red. AMAPI 3D highlights them in red to indicate that you may cap them.
⇒ In order to build our suitcase, we need to cap the bottom; so click only on the bottom red extremity.

4. End the tool action

We will put the tool aside. There are two ways to do this:

⇒ **If you are using the Workshop interface,** moving the cursor outside the right side of the scene and then back in again will **put the tool aside**. The tool palette reappears.

⇒ **If you are using the Standard interface,** selecting another tool will automatically drop the previous tool used. Go to the next paragraph.



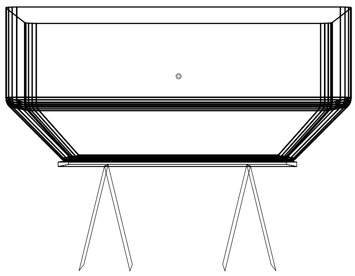
Applying a bevel to the bottom of the suitcase

1. **Switch to the Modeling Palette** (only if you are using the Workshop interface. If you are using the Standard interface, go to the next paragraph). Move the cursor out the right side of the Amapi window and back in to switch palettes.

2. **Select the Chamfer tool in the Modeling Palette.** A red preview of the bevel is displayed on the suitcase.

3. **With the group-of-points selection accessory**, completely surround the object. You will see a preview of the fillet drawn in yellow on the selected edges.

4. You can **adjust the fillet radius.**
   Two methods are available:
   - ♦ 1st method: By clicking on the "+" or "-" keys of the numeric keypad. Press the "+" key three times to increase the fillet. You can decrease it with the "-" key.
   - ♦ 2nd method: By clicking on the icons of the Assistant Palette.



5. You could validate to end the action, but let's practice **setting a precise value for the radius of the bevel:**

   ⇒ Press Tab. This gives you access to the numerical input window at the bottom left corner.

   ⇒ Enter "2" in the numerical input window to specify a bevel radius of 2 cm.

   ⇒ Press Return to validate this input.

6. End the tool action.
   There are two ways to end the action of a tool: validating the action, or putting the tool aside.
   We will here validate the action:

   ⇒ In the Assistant Palette: Click on the "OK" button.

Or

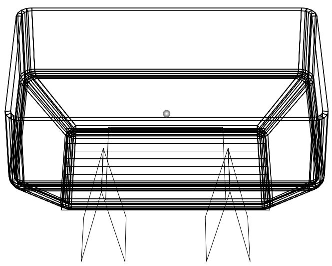
⇒ On the keyboard: Press the Return key to validate the action and put the tool aside.

⇒

Note: In this case, if you had put the tool aside without validating, you would have canceled the action of the Chamfer tool.

The bevel is applied to the entire suitcase.

Applying a thickness to the object



1. **Select the Thickness tool** in the Modeling Palette. A preview of the thickness is displayed in red.

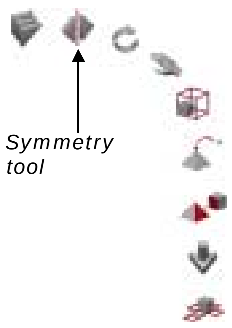
2. **You can specify the thickness precisely**. There are three ways:
   - ♦ 1st method: By clicking on the "+" or "-" keys of the numeric keypad. Press the "+" key three times to increase the thickness. You can decrease it with the "-" key.
   - ♦ 2nd method: Press the Tab key to enter a precise numerical value.
   - ♦ 3rd method: By clicking on the icons of the Assistant Palette.

3. **Validate.** Press the Return key. This will validate and put the tool aside, just like you saw previously with the Chamfer tool.

   Note: If you had put the tool aside without validating, the thickness operation would have been canceled and the thickness would not have been applied.

   The thickness value is applied to the entire suitcase.

Creating the top of the suitcase

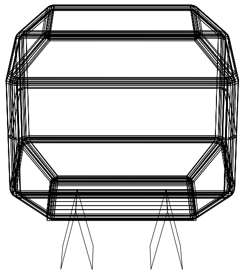


1. **Switch to the Assembly Palette** (only if you are using the Workshop interface. If you are using the Standard interface, go to the next paragraph). Move the cursor out the right side of the Amapi window and back in to switch palettes. You are back to the Assembly Palette.

2. **Select the Symmetry tool.** A white bounding box is displayed around the object. It helps you to visualize the planes of symmetry you may use.

3. **Click on the top face of the bounding box.** You now have two separate objects: the top of the suitcase and the bottom.

4. **End the action** by validating or putting the tool aside as you've done with previous tools.



Rescaling the suitcase

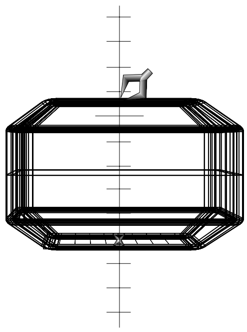
1. **Switch to a Left view** ("4" key).

2. Your suitcase is probably slightly too tall. To solve that:
   ⇒ Select the Group Tool in the Control Panel.
   ⇒ Select the bottom part of the suitcase,
   ⇒ and the top part.
   ⇒ Each selected element is displayed in white.

3. **Complete the action by releasing the tool** (depending on the interface).
   The two objects are now considered a single object.

4. **Select the Scale tool**  **in the Assembly Palette.**

5. **To scale along a single axis:**
   ⇒ Press the spacebar twice to set a vertical constraint or click the appropriate button  in the Assistant Palette.
   ⇒ Click on the top of the suitcase and move the mouse downward until you reach the proper height of your suitcase.
   ⇒ Click to validate the new scale**.**



6. **End the action the usual way.**

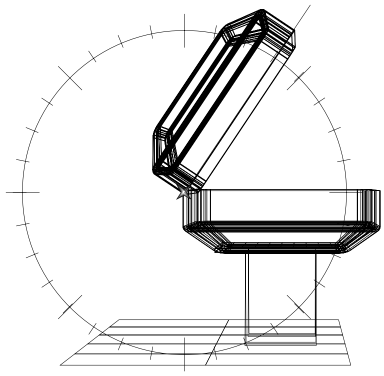
Opening the suitcase

1. **Select the Ungroup tool in the Control Panel.**

2. **Click on the box surrounding the suitcase**: the top and bottom parts of the suitcase are once again two separate objects.

3. **End the action.**

4. **Be careful: The Rotation tool is active only on the current object** (displayed in cyan). Make sure that the current object is the top of the



suitcase. **If this is not the case, click on it.**

5. Select the Rotation tool in the Assembly palette. **A graduated circle is displayed on top of the current object.**

6. **To rotate the object:**
Select the "Center of Rotation setting tool":
PC: By clicking on the right mouse button. Mac: Press and hold the Option key and click on the mouse. The cursor "hand" (to allow the rotation) will become a "cross".
Move the center of rotation:
⇒ Set the new position of the center of rotation: Set it at the bottom left corner of the current object.
⇒ Click to validate the action.
Rotate:
⇒ The hand cursor is displayed and the circle of rotation is set at the new location.
⇒ Click on the circle to define the starting point of the rotation. Set the angle of rotation moving the mouse in the desired direction.
⇒ The angle value is displayed in the bottom left numerical value window, as it would be for any tool. You can define the rotation increment with the "+" and "-" keys. Or access this numerical window using the Tab key and type in a value. Set a value of 50° for instance.
⇒ The suitcase is now open.

7. **End the action.**

Construction of the handle

1. **Switch to top view** ("5" key).

2. **Switch to the Construction Palette** (only if you are using the Workshop interface. If you are using the Standard interface, go to the next paragraph.
⇒ Move the cursor out the right side of the Amapi window and back in to switch palettes. The Tools palette reappears

3. **Select the Drawing tool in the Construction Palette.** You will use it to create the basic outline of the object.

4. Click on one of the top right corners of the bottom part of the suitcase **to set the origin of the axes.**

Circular arc

5. **Select the Arc drawing tool.**

6. **Draw the arc.**
   ⇒ Click on the red axis (X axis) to set the center of the arc.
   ⇒ Move the mouse to set the radius of the arc.
   ⇒ Click precisely on the red axis, as it is the starting point of the arc.
   ⇒ Move the mouse to the opposite point.
   ⇒ Click again on the red axis.
   ⇒ The  Tuner icon appears. AMAPI 3D allows you to modify the number of points defining the arc (using the "+" and "-" keys or entering numerical values after pressing the Tab key).
   ⇒ Put the arc tool.

7. **Put the Drawing tool aside to end the action (depending on the interface).**

8. **Switch to the Assembly palette** (only if you selected the Workshop interface. If you are using the Standard interface, go to the next paragraph).

9. **Click on the Snap tool**  . We will use it to place the handle.
   ⇒ Click on the center of geometry of the arc (the small gray sphere): a green circle is displayed around the sphere.
   ⇒ Click twice on the spacebar to set a vertical constraint or click on the "vertical constraint" button in the Assistant Palette.
   ⇒ Move the mouse cursor near the center of the suitcase and press on the Shift key to activate the automatic cursor-snap feature.
   ⇒ Click. The handle is automatically centered.

10. **End the action** (depending on the interface).

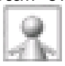
11. **Switch to the Modeling Palette** (only if you are using the Workshop interface. If you are using the Standard interface, go to the next paragraph).

12. **Select the Thickness tool** . It will be used to give volume to the handle.

    ⇒ A red preview of the thickness applied to the handle profile is displayed. You can edit the size of the thickness using the "+" and "-" keys.
    ⇒ Press Tab and enter a value of 2 cm, for instance.
    ⇒ Press Tab again and enter 8, the number of points for the circumference of the handle.
    ⇒ Press Return to validate the entries.

⇒ The thickness preview displayed is now more rounded.
⇒ Press the Return key to validate. The specified thickness is applied to the whole handle.

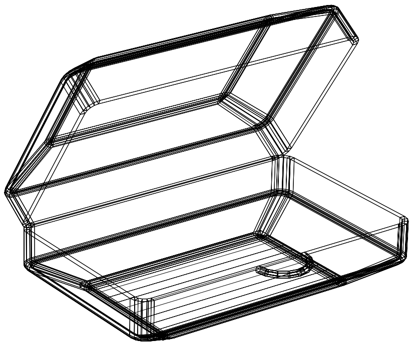
13. Put the tool aside to end the action (depending on the interface).

14. Zoom in on the handle.
⇒ To zoom in on a detail of the scene, you can either click on the  icon in the Control Panel, or use the hotkey (the "1" key).
⇒ You will see a white rectangle that you will use to surround the area of interest.
⇒ Place it where you want and click.
⇒ Drag the mouse to define the rectangle's dimensions.
⇒ Click.

15. Go to the Left view ("4" key)

16. **Switch to the Assembly palette** (only if you are using the Workshop interface. If you are using the Standard interface, go to the next paragraph).

17. Select the Snap tool  You will use it to set the position of the handle.
(Aligning an object is the same thing as moving it with a constraint along an axis (vertical or horizontal), so that a point of the selected object is on the same horizontal or vertical plane as the point of another object).
⇒ Click on a point on top of the handle. It is highlighted in red.
⇒ Press the spacebar twice to set a vertical constraint.
⇒ Click on a point on the edge of the suitcase.



18. Put the tool aside **to end the action (depending on the interface).**

Checking the alignment

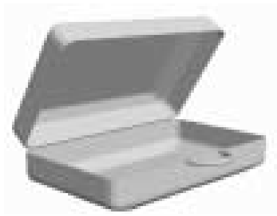
⇒ Click on the orthogonal view icon  in the Control Panel.
⇒ Check that both objects are indeed aligned.
⇒ Click on the icon:  to switch back to a perspective view.

View the entire scene

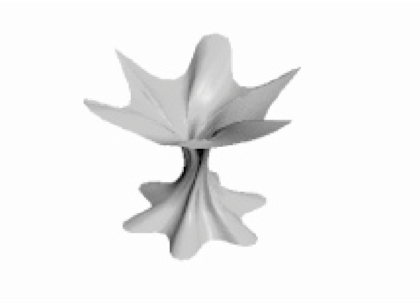
Click on the "See all" icon  in the Control Panel or use the hotkey (the "0" key).

Render the scene

Press the Return key to render the scene. This works because no tool is currently selected.



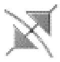
3 A Vase



In this exercise, we will work directly on the 3D object, moving points and vertices, reshaping the object as a sculptor would.
If you followed the previous exercises closely, by now you should be familiar with the user-interface of AMAPI 3D. Therefore, from now on, you will not be given instructions for every single step.

First, make sure that the scene is empty

This time we will use the Trash icon of the Catalog to clear the current scene**.**

⇒ Click on the Catalog icon to open it .

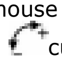
⇒ Click on the Trash icon .
All of the objects present in the scene disappear.

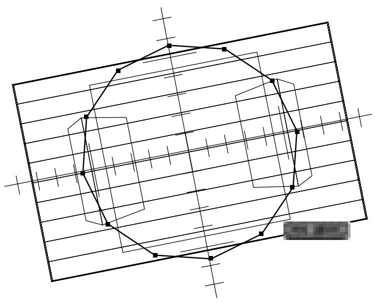
Put the tool aside to end the action (depending on the interface).

Creating a circle, the basis of the shape

1. **Go to top view** (“5” key).

2. **Select the Drawing Palette**  in the Construction Palette. The sub-tools palette is displayed as well as the reference axes centered on the table.

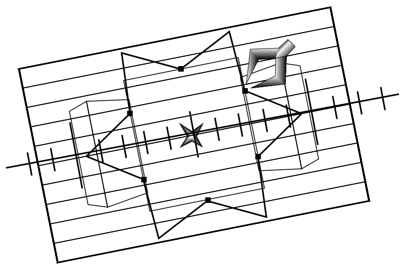
3. Pick up the Circle tool.
⇒ Click to specify the center of the circle and drag the mouse to define a radius of 20 cm.
⇒ Click. The  cursor appears to let you edit the number of points of the circle.
⇒ Press Tab and enter a value of 12 in the bottom left window.
⇒ Press Return to validate this entry. Please note that you can also edit this number of points using the  keys.
⇒ Press Return or put the tool aside to end the action and drop the tool.



Modifying the circle to define the cross section of the vase

1. **Limiting the action to a part of the current object.**
   The defaut selection accessory is the object selection accessory ; we will take the point selection accessory **.**
   ⇒ PC: By clicking on the right mouse button. Mac: Press and hold the Option key and click on the mouse.
   ⇒ The cursor will turn into the group-of-points selection accessory .
   ⇒ Do it once more, and cursor will turn into the point selection accessory . This is the one we need.
   ⇒ With this accessory, select every other point on the circle (they will appear in red).
   ⇒ Validate with the "Enter" key.

2. **Select the Scale tool** in the Assembly Palette. Only the points previously selected will be affected.
   ⇒ Click on one of the selected points.
   ⇒ Drag the mouse toward the center of the circle: a white box surrounding the circle follows the cursor's movements.
   ⇒ Click to end the action. The circle is transformed into a star.
   ⇒ Put the tool aside (depending on the interface).
   You can see that the tool action is applied only to the selected points.

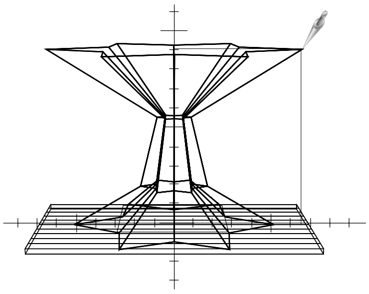


3. **Deselect the points:** Using the object selection accessory , click on the star you just created.

Extruding the star

1. Go to top view ("2" key").

2. **Select the Extrusion tool** in the Construction Palette.
   ⇒ Click on the star.
   ⇒ Drag the mouse upward and toward the center of the star.
   ⇒ Click: You just created the first segment of the vase.
   ⇒ Create a second segment slightly above the first segment.
   ⇒ Click above the second segment to create the



third segment.
⇒ Press Return to end the extrusion.
⇒ Both extremities are displayed in red, allowing you to cap either or both of them.
⇒ Click on the bottom of the vase only.
⇒ Put the tool aside to end the action (depending on the interface).

If, while building an object, you are not satisfied with your creation, you can always cancel prior construction steps (undo).Ctrl-Z (on PC) or Command-Z (on Mac) will cancel.

- ♦ Within a tool: the last operation done by that tool.
- ♦ No tool selected: all of the operations done by the last tool used.

 In the first case, there are as many undos possible as there were operations done with the tool. In the second case, the number of possible undos is user-defined in the Preferences menu.

Extrusion modification

1. Select the Stretch tool  in the Modeling palette.
The Dynamic Geometry palette is displayed in the left hand of the screen. It informs you may work on two finishing levels of the object (the structure and the rough object).
We will work on the structure (default level). The editable points of the section and the path are highlighted.

2. Pull a point of the path.
Click on a point of the path and move it.
Click again to release this point.
You may repeat this step

3. End the action by putting the tool aside (depending of the chosen interface).

Modifying the top part of the vase

1. **Switch to a perspective top view** using the up arrow key. Zoom out using the "**.**" if necessary.

2. **Selecting points on the object.** (The current object will not be the entire object but only the selected points.)
The defaut selection accessory is the object selection accessory ; we will take the point selection accessory **.**
⇒ PC: By clicking on the right mouse button.

Mac: Press and hold the Option key and click on the mouse.

⇒ The cursor will turn into the group-of-points selection accessory .

⇒ Do it once more, and cursor will turn into the point selection accessory . This is the one we need.

The Dynamic Geometry palette appears on the left side of the screen. It indicates that you can work on two finishing levels of the object (the structure and the rough object).

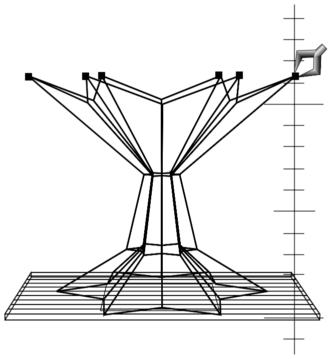
We will work on the rough object.

Click on the icon, displaying the rough object. The editable points are highlighted. Using the point selection accessory

⇒ select every other point on the top edge of the vase. (They will be displayed in red.)

⇒ Press Return to validate the selection.

3. Go back to front view ("2" key).



4. Select the Stretch tool in the Modeling Palette.

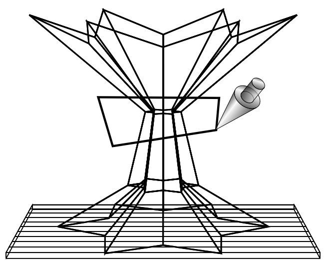
⇒ We can apply a vertical constraint to the movements of the cursor either through:

- 1st method: On the Assistant Palette click on the icon.
- 2nd method: By using a keyboard shortcut: Press the spacebar twice to toggle on the horizontal constraint, then on the vertical constraint.

⇒ Click and drag the selection upward.

⇒ Click again to set the selection at the desired location (see opposite illustration).

⇒ Put the tool aside to end the tool action (depending on the interface).



5. Using the object selection accessory , click on the vase to **deselect** the six points.

6. **Twisting the vase.** We want only part of the object to be affected by this operation, so we need to designate those points before selecting the tool.

⇒ PC : Click on the right hand button of the mouse. Mac : Press and hold the Option key and click the mouse.

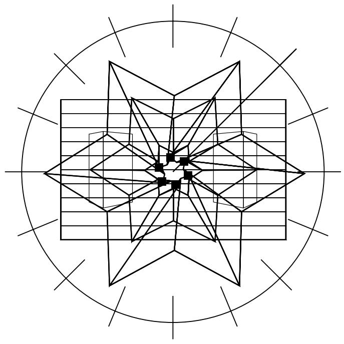
⇒ The cursor is changed to the group of points selection accessory .

⇒ Surround the group of points to be selected by successive clicks.

⇒ Validate the selection by pressing the « Entrer » key: the selected points are red.

7. **Go to top view** ("5" key).

8. **Select the Rotation tool** in the Assembly Palette. Centered on the object you will see a circle with tick marks.
   ⇒ Click on the circle at the location where you want to start the rotation.
   ⇒ You can define the rotation increment (as indicated by the ticks on the circle) using the "+" and "-" keys of the numeric keypad.
   ⇒ Drag the cursor in the desired direction for the rotation. The angle value is displayed in the Data Window like any other data.
   ⇒ You can click to validate the angle of rotation, but in this example we will enter the angle value directly. Press the Tab key to edit the Data Window and use the keyboard to enter an angle of 45°. Press the Return key to validate the entry.
   ⇒ End the action (depending on the interface).



9. Go to front view ("2" key).

10. **Deselect the selected points.**
   Click on the vase to select the entire vase and thus deselect the points previously selected.

Smoothing the vase

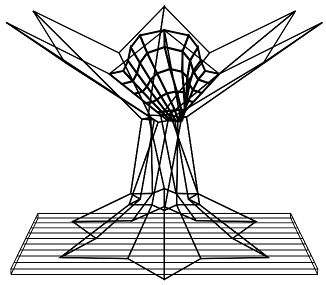
Take the Smooth tool in the Modeling Palette. AMAPI 3D can generate additional facets to smooth the object's surface depending on the smoothing value you specify The number of polygons will be multiplied by the square of the smoothing value (i.e., a smoothing of 3 will multiply the number of polygons by 9). The higher the smoothing value, the smoother the object, but also the bulkier the file.

⇒ Set the smoothing range to 5 by using one of the following methods:
   - 1st method: By clicking on the icons of the Assistant Palett.
   - 2nd method: By clicking on the "+" or "-" keys of the numeric keypad.
   - 3rd method: Press the Tab key to enter a precise numerical value.

⇒ Click on the icon depicting the broken edges selection accessory, and with the group-of-edges selection accessory surround the lower section of the vase. These edges will be excluded from the smoothing.
⇒ Put the tool aside to end the action (depending on the interface).

Broken by edges

The object appears as it was before, but the smoothing is not lost; it is saved in memory and will be applied only when rendering, so as to not degrade object manipulation performance.



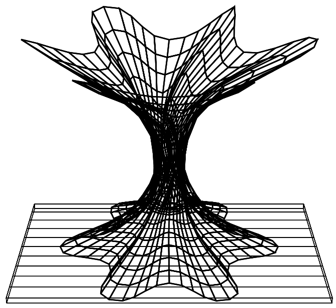
Defining sharp edges

Broken by point

You can define points where the smoothing will not be applied – at these points the edges will stay sharp.

Reselect the Smooth tool . AMAPI 3D displays the smoothed object.
Selecting the sharp edges:

⇒ Go to top view.
⇒ Select the point selection accessory .
⇒ With this selection accessory, select every other edge of the top part of the vase.
⇒ Press the Return key to validate.
⇒ Click on the vase to display the smoothing. The selected edges are still sharp while the other are smoothed and rounded.
⇒ Complete the action by releasing the tool (depending on the interface).

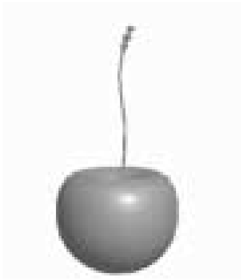


Rendering the scene

Make sure that no tool is selected, then press the Return key to render the scene.

4 A Cherry

After having created such a splendid vase, let's do something a little different. AMAPI 3D will help us create a tempting cherry. In this new exercise, we assume that you are now familiar with AMAPI 3D. The goal here is to show you that you can, using the tools provided by AMAPI 3D, keep your current working habits.



Make sure that the scene is empty.

Ask to view the entire scene to make sure that it is completely empty. Click on the icon in the Control Panel to do that (or press the "0" key).
If the scene is indeed empty, go to the next step.
If not, we will erase all the objects using the Catalog's Trash tool.

⇒ Click on the Catalog icon to open it .
⇒ Click on an object of the scene and hold the mouse button down. The object selection accessory is transformed in a thumbnail image representing the object selected.
⇒ Drag the cursor toward the Trash icon .
⇒ Release the mouse button when the thumbnail is over the Trash icon. The selected object will disappear from the scene.
⇒ Repeat the operation until there are no objects left in the scene.
⇒ Put the Catalog tool aside (depending on the interface).

Creating a sphere, the basis of the body of the cherry

Select the Sphere tool  **in the Construction Palette**. Two axes that intersect at the center of the table are displayed.

⇒ As part of the Assistant Palette, AMAPI 3D displays in the "Modes" area two buttons used to switch from Polygonal drawing mode to NURBS drawing mode. Click on the NURBS button. (You can also use the keyboard hotkey to switch mode: Ctrl+B on PC, or Command+B on Mac).

⇒ Set the origin of the sphere at the intersection of the two axes.

⇒ Drag the mouse so as to define a sphere of radius 120 mm (check the numerical window at the bottom left corner of the scene).

⇒ Click. The sphere is created.

⇒ This cursor  is the Tuner accessory. It indicates that you can change the smoothing of the sphere.

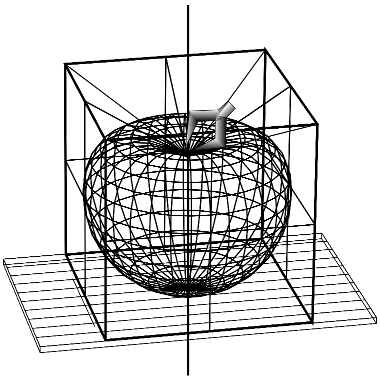
⇒ In this example, we will use the default settings. Press the Return key to end the tool action and drop it.

Modifying the sphere shape

Select the Stretch tool  in the Modeling Palette.

The sphere created is a NURBS sphere. A NURBS object has a surface that is always smooth even if you modify the object's shape.

Instead of editing the object's points directly (which is the case for polygonal objects), you will manipulate control vectors external to the shape. Here, the control vectors take the shape of a cube.

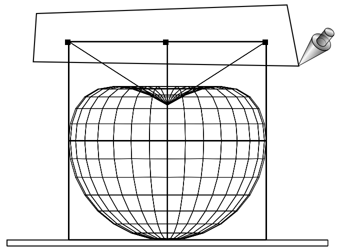


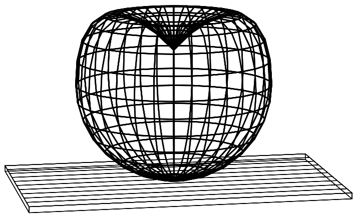
⇒ We can apply a vertical constraint to the cursor's movements, either through the Assistant Palette or using the hotkey:
- ♦ 1st method: On the Assistant Palette click on the  icon.
- ♦ 2nd method: Using a keyboard shortcut: Press the spacebar twice to toggle on the horizontal constraint, then on the vertical constraint.

⇒ Click on the center of the top face of the control cube and pull downward by 80 mm.

⇒ Click to set the point to its new position.

⇒ Open the Control Panel and click on the

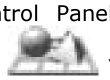




Orthogonal button to set this viewing mode. 

⇒ Select the group-of-points selection accessory. PC: By clicking on the right mouse button. Mac: Press and hold the Option key and click on the mouse. The cursor will turn into the group-of-points selection accessory .

⇒ Select the top part of the control cube and press Return to validate: The three top points of the control cube are displayed in red and the cursor switches back to the Stretch tool cursor.

⇒ Re-open the Control Panel to go back to perspective view.  You can see that you in fact selected the 8 points of the top face of the control cube.

⇒ Click on one of the points: All the selected points can be moved simultaneously.

⇒ Drag the mouse upward 60 mm. (You can apply a vertical constraint to the cursor movement by clicking on the icon of the Assistant Palette or by pressing the spacebar twice.)

⇒ Click to set the points to their new position.

⇒ Put the tool aside to end the action (depending on the interface).

⇒ The cube (representing the control vectors) disappears, leaving only the modified sphere.

Hiding the body of the cherry

(to have more working space for creating the cherry stalk).

Select the Hide tool  **in the Control Panel.**

⇒ Click on the cherry (it becomes white).

⇒ Put the tool aside to end the action (depending on the interface). The cherry disappears in the hidden scene. We will bring it back later.

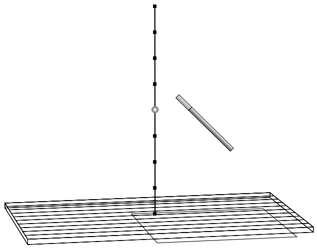
Building the stalk

1. **Click on the**  **icon in the Control Panel** to view the entire scene, or use the hotkey (the "0" key). You will come back to the default viewpoint, as there are no objects in the scene.

2. **Select the Drawing tool**  in the Construction Palette. Two axes are displayed at

Construction Palette. Two axes are displayed at the center of the table. Click on the NURBS/Polyline toggle button to switch to polyline mode. (You can toggle from one mode to the other by using the keyboard shortcut: Ctrl+B on PC or command-B on Mac.)

3. **Select the Polyline tool.**
   ⇒ Click on the axes origin to set a first point.
   ⇒ Click on the  icon in the Assistant Palette or press twice on the spacebar to apply a vertical constraint.
   ⇒ Move the cursor upward (by about 300 mm) and click to create a second point.
   ⇒ Validate to end the tool action.
   ⇒ Put the tool aside (depending on the interface).

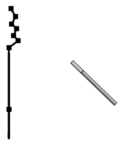


4. **Take the Smooth tool**  in the Modeling Palette. A red preview of the smoothing is displayed on the object.
   ⇒ Press Tab, and enter a value of 4 in the numerical window at the bottom left corner of the screen.
   ⇒ Press the Return key to validate. The segment is now divided into 8 parts.
   ⇒ Press the Return key to validate. (If you had put the tool aside without validating, the smoothing would not have been applied).

Modifying the end of the stalk.

1. **To zoom in on the top of the curve:** Click on the  icon of the Control Panel or use the corresponding hotkey (the "1" key).

2. **Take the Drawing tool**  in the Construction Palette.
   ⇒ Set the origin of the axes at the top end point of the straight line.
   ⇒ Press the spacebar: The cross displayed indicates a connection point which means that you can continue the drawing using another curve.



3. **Select the Polyline tool.**
   ⇒ Add a few points connecting to the top part of the cherry stalk, as shown on the opposite illustration.
   ⇒ Press Return to end the profile.
   ⇒ Put the tool aside to end the action (depending on the interface).

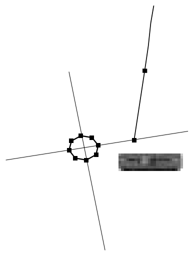
4. **Click on the icon** in the Control Panel or use the corresponding hotkey (the "0" key) to view the entire scene. You can see the whole profile of the cherry stalk.
5. **Zoom in on the bottom part of the segment:**

   Click on icon in the Control Panel or use the corresponding hotkey (the "1" key).

6. Press the Up arrow key a couple of times to display a **top perspective view**.

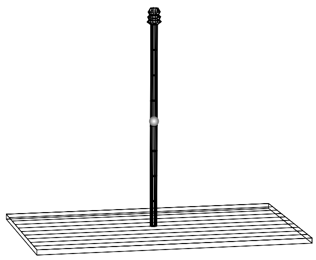
7. **Select the Drawing tool** .
   Set the axis origin at the bottom end of the segment.

8. **Select the Circle from the Drawing tool sub-palette.**
   ⇒ Click to set the location of the center of the circle.
   ⇒ Drag the mouse to specify a radius of 5 mm.
   ⇒ Click to validate the location.
   ⇒ Press Return to validate the default number of points of the circle.
   ⇒ Put the tool aside to end the action (depending on the interface).



9. **Select the Snap tool** (to attach the end of the stalk).
   ⇒ Click on the far right point of the circle; a red dot is displayed.
   ⇒ Click on the end of the profile (stalk). The circle snaps to the profile.
   ⇒ Put the tool aside to end the action (depending on the interface).

10. **Go to front view** (the "2" key) and zoom in on the connecting point (click on the icon in the Control Panel or use the corresponding hotkey (the "1" key).

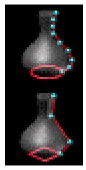


11. **Select the Extrusion tool** in the Construction Palette. Check that the circle is indeed selected (displayed in cyan).
   ⇒ Click on the profile. The extrusion is generated and the ends of the stalk are displayed in red.
   ⇒ Click on the top one to close the shape.
   ⇒ Put the tool aside to end the action (depending on the interface).

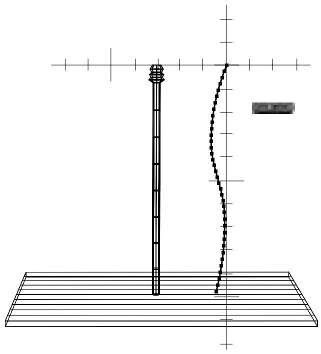
Bending the cherry stalk.

Select the Bending tool in the Modeling

Palette. AMAPI 3D displays the Dynamic Geometry levels on which you may work on the left hand of the screen.



- ⇒ Click on the  to work on the upper Dynamic Geometry level (and not on the construction curves).
- ⇒ Click 3 points to draw the stalk curving.
- ⇒ Press Return to validate.
- ⇒ The "+ / -" Tuner is displayed. Press the "+" key to add points to the curve.
- ⇒ Validate; the cherry stalk is bent according to the profile of the curve.
- ⇒ Put the tool aside to end the action (depending on the interface).

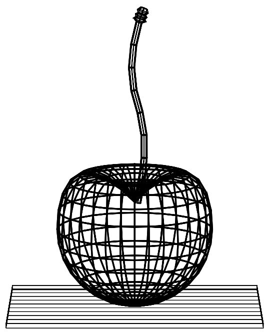


Snapping the cherry to its stalk.

1. **Select the Unhide tool**  **in the Control Panel:** The hidden scene is displayed (in our case, the body of the cherry).
   - ⇒ Click on the cherry.
   - ⇒ Put the tool aside to end the action (depending on the interface).
   - ⇒ The body of the cherry is displayed in the main scene.

2. **Select the cherry stalk using** the object selection accessory . The stalk becomes cyan.

3. **Take the Snap tool**  in the Assembly Palette.
   - ⇒ Click on the base of the stalk: a red dot is displayed.
   - ⇒ Click on the point of the cherry as indicated on the opposite illustration. Use the arrow keys to get a better view.
     Use the "1" key to zoom in on the area if necessary.



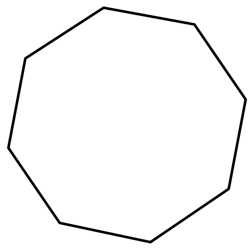
Defining the color of the cherry

- ⇒ AMAPI 3D assigns a default color to each object. You can render the scene by pressing the Return key.
- ⇒ Of course, you can customize those colors. In the Control Panel click on the  icon of the Material Editor. A dialog box opens allowing you to assign custom colors to the current object. We will assign a simple red color to the cherry in this exercise.
- ⇒ Make sure that the cherry is the current object (it must be displayed in cyan). If not, click on it using the object selection accessory .
- ⇒ Double-click on the colored button labeled "Diffuse". The color picker opens up, allowing you to choose a color.
- ⇒ Select a red.
- ⇒ Click on the "OK" button to validate the choice.
- ⇒ You can check your choice in the preview window, modify it, or make other adjustments.
- ⇒ Once satisfied with the color setting, click on the  button to validate the current object's new color. The window of the Material Editor closes and you are back to the main scene.
- ⇒ Press the Return key to render the whole scene.
- ⇒ You can proceed the same way to define the color of the cherry stalk.

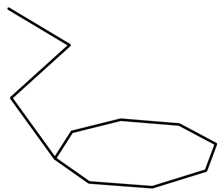
5 A Carafe

We encourage you to try out the Dynamic Geometry features. In this exercise, you can modify the general shape and the proportions of the object at any time by operating on the original construction curves.

Drawing the section and the profile.

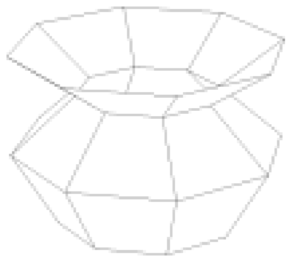


1. **Switch to Top View**: Key "5".
2. **Select the Drawing tool** in the Construction Palette. A sub-palette as well as the axes centered on the table appear.
3. **Select the Circle tool.**
   ⇒ Click to set the center of the circle, then move the mouse to modify the radius.
   ⇒ Click. The cursor appears. You can now modify the number of points defining the circle. Here, we will keep the default number which is 8.
   ⇒ Validate by pressing the Return key.
   ⇒ End the action by putting the tool aside.
4. **Switch to Face View**: Key "2".
5. **Select the Drawing tool again**.
6. **Select the Polyline tool**
   ⇒ Hold down the Shift key and click on a point of your circle. By doing this, you will apply a constraint and the first point of your polyline will be connected to the point on the circle.
   ⇒ Draw three polyline edges, as shown on our model. Don't try to set exact measurements as we will modify this line several times in this exercise.
   ⇒ Validate by pressing the Return key.
   ⇒ End the action by putting the tool aside.



7. **Select the circle again:** With the object selection accessory, click on the circle: its color will turn to cyan. This is the current object now.

Extruding the shape.



1. **Select the Extrusion tool**  in the Construction Palette.

2. **Click on the polyline.** The mesh of the carafe appears.

3. **Click on the lower red circle:** This caps the bottom of your object. You will get an object similar to our picture.

   With AMAPI 3D, there are several ways to model an object like this one. We will show you two other methods to acquaint you with other tools.

4. **Draw a circle,** like before. You can undo your previous actions (with the Undo icon in the Assistant Palette). Note that you can choose the number of Undos you want through the Preferences / Security menu. If your system has enough memory (RAM) available, you can set 25 or 30 Undo levels. If you have made a mistake, do not hesitate to go back to the previous operation.

5. **Select the Extrusion tool**  in the Construction Palette.
   ⇒ Click on the circle,
   ⇒ Move the mouse diagonally up and to the right.
   ⇒ Click: You have made the first section of your carafe.
   ⇒ Make a second section by clicking a little bit higher.
   ⇒ Then click even higher and on the right to get a larger third section.
   ⇒ To finish the extrusion, press the Return key.
   ⇒ Both ends are red now: Amapi asks you if you want to close them.
   ⇒ Click on the bottom only.
   ⇒ Put the tool aside. Your carafe is the same as the previous one.

   Now, a third way to make this carafe. Instead of extruding a circle following a profile, you will do the opposite: you will rotate the profile along the circle. To do this, you will use the Sweep tool. You will get the same object as before and it will have the same deformations as the others. Choose whichever method you prefer.

6. Take the Circle and the Profile previously drawn.
   ⇒ Like before, you can delete the object or undo

the actions. To delete the carafe:
⇒ Select the object with the object selection accessory .
⇒ Press the Delete key. The object is deleted.
⇒ Click on the Show icon in the Control Panel.
⇒ The circle and the profile are displayed on the screen. When Amapi makes a shape from curves, it automatically hides them. The Show tool unhides them. You can recall the curves any time if you want to modify them.
⇒ Click on these two curves. Their color turns to white.
⇒ Put the tool aside. The two curves are now in the working screen.

7. **Select the profile** with the object selection accessory Its color turns to cyan. It is the current object. Note that before, the circle was the current object.

8. **Select the Sweep tool** in the Construction Palette.

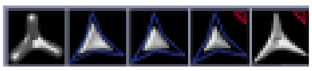
9. **Click on the circle.** The carafe appears again. The both ends (circles) are red now.

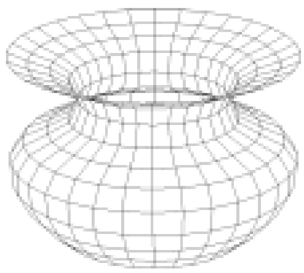
10. **Click on the red circle:** By doing this, you are capping the bottom of your object. You will get an object similar to our picture.

11. **Put the tool aside.**

Smoothing the carafe

1. **Select the Smooth tool .** Amapi gives you five smoothing methods to choose from. You can try different smoothing types by clicking on one of the five icons in the smoothing palette. The characteristics of these methods are explained in your User Manual. (See chapter "Smooth" on page 276.)
⇒ We will use the first method for our exercise. So, click on the first icon.
⇒ With the "+" and "–" keys, you can modify the smoothing range. Here, we will set a range of 2.
⇒ You can also enter the number 2 by pressing the Tab key, then entering the value you want.





2. **The carafe is smoothed now.**
⇒ By pressing the Return key, you can launch a rendering and see your carafe being constructed.

Deforming the carafe (method (1)

⇒

⇒ **Come back to wireframe mode** by putting aside the object selection accessory or pressing an arrow to turn your object.

⇒ **Take the Stretch tool** in the Modeling palette. When you do this, your object is grayed out; the construction curves are displayed in cyan.

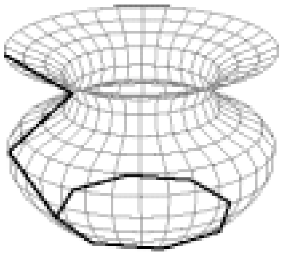
⇒ Click on one point of the profile and move it. Your object is deformed and the smoothing is automatically regenerated as you move the point.

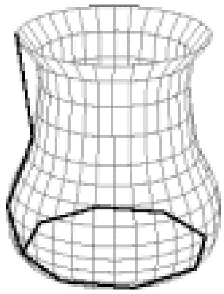
⇒ Click again to stop moving the point.

⇒ With the same tool, click on one of the three upper points of this curve and move it to the desired location.

⇒ By moving the three upper points of the profile one by one, you will modify the general shape of your carafe.

⇒ Stretch it until it looks roughly like our illustration.



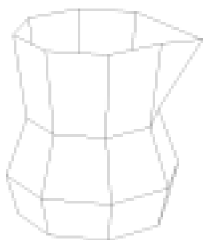


Deforming the carafe (method 2)

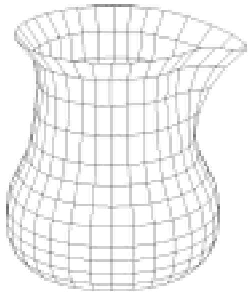
1. **Change the control level:** Stay in the Stretch tool. Up to now, you have used the construction curves as control curves. You will now use the wireframe of the rough object to deform it and create the spout. When you select the Stretch tool, a new palette appears; it shows you with which finishing level you are controlling your shape. The polyline at the bottom shows the mode you had worked in before.

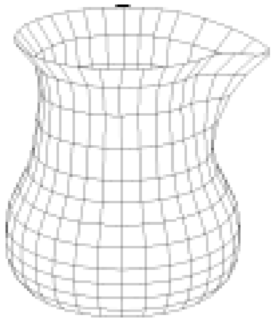
   ⇒ Click on the icon in the center of the palette. Warning: You will lose the ability to work with the control curves. So, we don't need this level any more.

2. **Click on a point of the top of the carafe**, move it outside, then click to set the new position of the point.



Finishing





Take the Smooth tool again . In spite of all you have done on the shape, the smoothing is always dynamic: you can make your carafe smoother or go back to a rougher object. You can always go back and change the smoothing method too.
For this carafe, we will chose Bezier smoothing (smoothing 1), and a higher smoothing range to avoid seeing the polygon breaks when rendering.
When you are more proficient with this program, you will be able to add a handle in less than three minutes.

Thanks to these tutorials, you have now mastered the basics of AMAPI 3D.
You can navigate in space, rotating around the object, zooming in and out, even while using a tool. You have learned to create objects from "scratch" using precisely specified dimensions or intuitively. You have learned that you can modify a whole object or only a part of it. And, finally, you know the principle of toggling and the tools options (constraint along an axis, switching the selection accessory from the object selection accessory to the point selection accessory, etc.) and the level of undos.
These are the fundamentals of AMAPI 3D. If one day you are confronted with a modeling problem, think back to these fundamentals: they will help you find the solution.

User Manual

1 File

This chapter describes the "classical" menu bar at the top of the screen which is used for managing files.
AMAPI 3D also provides another file management system which is more visual, easier to use, and faster. This is the "Catalog" (see chapter "Catalog" on page 78).

1.1 New (PC: Ctrl+N; Mac: Command+N)

This command creates a new empty AMAPI 3D document.
The new document has no name (the title bar displays "Untitled *n*" where *n* is the document number). You will be able to give it a name when you save it. (See chapter "Save or Save as" on page 73.)
Note that you can have several documents open at once; you can switch from one to another using the "Document" command in the "Window" menu. (See chapter " Document" en page 434.)

1.2 Open (PC: Ctrl+O; Mac: Command+O)

This command opens an existing document.
The dialog box allows you to define your search.
You can select a file format from the list of choices. (See chapter " Import" on page 74.) The AMAPI 3D format is the default format.

How do you open a document?
1. Select "Open" in the "File" menu.
2. Once the dialog box is displayed, choose the file format.
3. Open the correct folder.
4. Click on the file name.
5. Click on "Open".

1.3 Merge (PC: Ctrl+M; Mac: Command+M)

This command opens an existing document and adds the object(s) from that file into the current scene.
When you select Merge, the Open dialog box is displayed. It allows you to select the file format of the document you wish to merge.
See chapter "Open" above for details.

1.4 Close (PC: Ctrl+W; Mac: Command+W)

This command closes the current document.
If there are any unsaved modifications applied to your document, AMAPI 3D will ask you:

Do you want to save the modifications?

You can click on:
- "Save", if you want to save the modifications.
- "Don't Save", if you want to close the document without saving the modifications.
- "Cancel", if you do not want to close the document.

If another document was already open, it becomes the current document. If no other document was open, the application still runs and you can open an existing document or create a new one.

1.5 Save (PC: Ctrl+S; Mac: Command+S)

This command saves the current document of AMAPI 3D.
- If the document has already been saved, it is updated in the same folder.
- If you wish to save it in a different folder or under a different name, select "Save as" in the "File" menu.
- If you select Save when the document has never been saved, the Save as... dialog box is displayed. It allows you to specify the file name and the location where you want to save it. (See chapter "Save or Save as" above.)

The scene you are working on is not saved until you ask AMAPI 3D to save it. Hours of work can be lost because of a power failure or other mishap. It is therefore very important to save an object before attempting massive modifications or operations involving multiple steps. By doing so, you can go back to the previous stage if you are not satisfied with the result. You can simply close the document without saving it.

It is recommended that you save your work regularly or to use the automatic backup feature of AMAPI 3D. Use the command Preferences / Recovery in the Edit menu to activate the automatic backup option. AMAPI 3D will save the document on the hard drive at the user-defined interval.

When AMAPI 3D saves a scene, it includes all the materials used in this scene.

1.6 Save as (PC: Ctrl+E; Mac: Command+E)

This command saves the current document. It allows you to:

- *Rename the document.*
- *Specify the destination folder.*

How do you use the "Save as" feature?

1. Select "Save as" in the "File" menu. The "Save as" dialog is displayed. (If the document has already been saved, the dialog will display the current file name and folder name.)
2. Specify a folder name if the default folder name does not suit you.
3. Modify the document name if necessary.
4. Press Return or click on Save.

⚠ As you read previously, it's important to save your work regularly. If you want to do massive modifications, you can save your project at different stages of development, using different names. This way you can come back to a specific stage just by opening the corresponding document.

1.7 Import

This command is used to import documents that are not in AMAPI 3D format. It can be accessed through the pulldown menus but also through the Catalog (see chapter "Catalog / Import" on page 84).
This command allows you to specify the name and type of the file you wish to import.
You can specify how AMAPI 3D manages the different import and export formats. For more information, see chapter " Preferences / Import-Export" on page 442t.

1. The list of supported file formats is displayed:
   - 3DMF (on Macintosh),
   - 3D Studio,
   - AMAPI 3D,
   - DXF,
   - IGES,
   - Illustrator 3.0,
   - OBJ
   - Open Inventor,
   - STL,
   - VRML (1 and 2),
2. Click on the type of file you want to import.
3. A dialog box opens, listing all the files of the selected type in the directory.
4. Change directory if necessary.
5. Select the file that you want to import. Only files of the type previously selected are listed.

1.8 Export

This command is used to export documents. It can be accessed through the pulldown menus but also through the Catalog (see chapter " Catalog / Export" on page 84).
This command allows you to specify the name and type of the file you wish to export.

1. The list of supported file formats is displayed:

• 3D Studio	Rendering and animation program from AUTODESK. This format is becoming a new standard for 3D files.
• 3DGF	Extreme 3D file format.
• 3DMF (Mac)**	QuickDraw3D format.
• 3Space	3Space file format (for dynamics on the web)
• AMAPI 3D**	AMAPI 3D files.
• AMAPI 3D 4.1**	Allows backward compatibility with files created by old versions of AMAPI 3D.
• Artlantis Render	Rendering and animation program from ABVENT.
• BMP	Native Windows 2D image format.
• Cinema 4D	The MAXON Cinema 4D native format file.
• DXF	The most famous PC and Mac 3D graphic file type. Used by all the 3D programs.
• DXF 2D	Another AUTODESK format, used by AutoCAD Corel Draw! and others 2D CAD programs.
• FACT (Mac) **	The Electric Image Animation System (EIAS) file format.
• HPGL	Printing format.
• IGES**	Industry standard used by CATIA, Pro Engineer, Euclid,…
• Illustrator 3.0	Well known 2D format for graphical artists. Used as EPSF output.
• Lightwave	Rendering and animation program from NEWTEK
• NeMo	The VIRTOOLS NeMo native format file (program to create interactive real-time 3D contents).
• OBJ	Allows exchange with programs such as: ♦ Nendo ♦ Carrara ♦ Maya ♦ Vue de d'Esprit ♦ Alias/Wavefront ♦ Softimage ♦ ArchiCAD ♦ Electric Image

• Open Inventor**	CAD format file (was used as the basis of the VRML format).
• PICT	Standard 2D vector files for Mac OS.
• POV 3.0**	The most famous of the freeware renderers.
• RayDream Studio	Rendering and animation program from METACREATIONS.
• RenderMan**	Rendering and animation program from PIXAR.
• Strata Studio Pro (Mac)	Rendering and animation program from STRATA.
• STL	Stereolithography file format
• Truespace2.0	Rendering and animation program from CALIGARI.
• VRML 1.0 and VRML97 (aka VRML 2.0)	The most commonly used 3D format on the Web!

** These file formats support NURBS objects. The other ones support polyhedral objects.

2. Click on the desired export format.
3. An exportation dialog box is displayed. Enter a file name and select a destination folder for the exported file.
4. AMAPI 3D will add the needed file extension, depending on the export file format you selected.

1.9 Change directory (PC: Ctrl+k; Mac: Command+k)

This command allows you to change the current directory at any time.
It is available through the menu and also through the catalog (see chapter "Change Directory" on page 81).

1. In the "File" menu, select "Change directory". The dialog box appears.
2. Select the directory which will become the current one.
3. Validate the selection by clicking on the "OK" button.

1.10 Batch converter

This feature is designed to improve productivity. It allows the user to convert a group of files saved in one file format into another file format in a single operation. For instance, you can convert .3DS files into .a3d (AMAPI 3D) files.
The procedure is very simple: just designate the source folder containing the files to be translated (e.g., .3ds), the output file format, and the target folder where the converted files will be saved (e.g. .a3d). All files with the specified file format found in the source folder will be translated.

1.11 Page setup

Use the Page Setup command to set the printing parameters of your document.
Depending on the printer you use, a dialog box will appear asking you to define standard printing parameters such as page orientation, paper size or margins.
If no printers are installed on your system, the Page Setup and Print command will have no effect.
Click on the "OK" button when you have finished specifying the page setup.

1.12 Print (PC: Ctrl+P; Mac: Command+P)

The Print command will print all or part of the current scene in wireframe.

Usage:

1. The first time that you print an AMAPI 3D document, you will be asked to specify the Page Setup (type of printer, paper size and margins…). See chapter " Page Setup" above.
2. A white rectangle representing the printing area is displayed and follows the cursor's movements. Click to set the rectangle at the approximate center of the scene you want to print.
3. Drag the cursor to adjust the size of the white rectangle and enclose the area of the scene you want to print. Click on the mouse button to validate the definition of the printing window size.
4. The printing window follows the cursor's movements once again allowing you to precisely enclose the area of the scene you want to print. Click when it is positioned: the printing will begin.

You can define the print parameters through the Preferences / Printing menu: You can choose to print the dimensions, to print in hidden line mode, or to set a scale factor. (See chapter " Preferences / Printing" on page 443.)

1.13 Quit (PC: Ctrl+Q; Mac: Command+Q)

The Quit command closes AMAPI 3D.
If there are any unsaved changes in your document, AMAPI 3D will ask you:

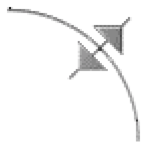
"Do you want to save the modifications?"

In this case, you can click on:
- **"Save"**, if you want to save those modifications before quitting the application.
- **"Don't save"**, if you want to quit the application without saving the modifications.
- **"Cancel"**, if you do not want to quit AMAPI 3D.

1.14 Quick access to recent documents

The last four most recently opened documents are listed at the end of the File menu. This is convenient for re-opening a recently used document. Just click on the document name to open the file.

2 Catalog



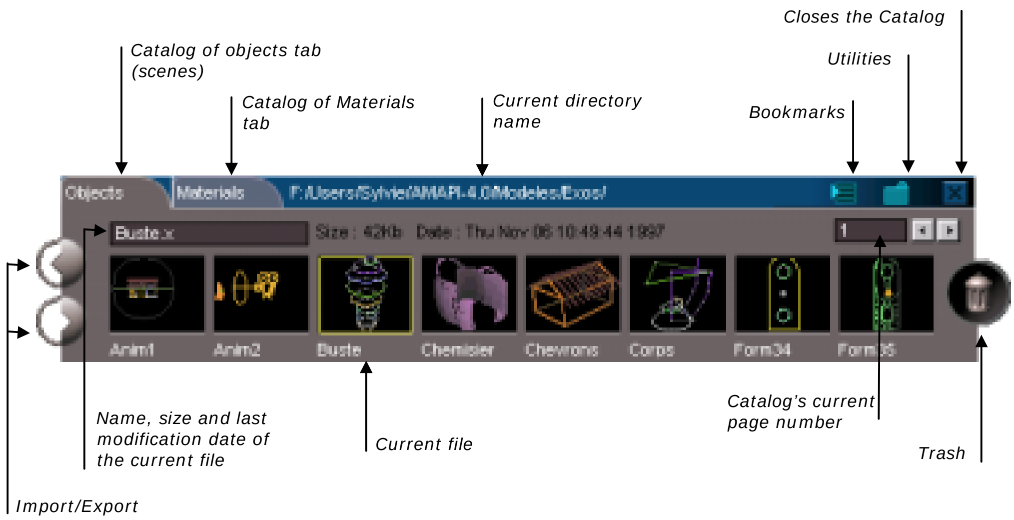
The Catalog is AMAPI 3D's own file manager. Using graphical representations, it quickly and easily allows the user to store and retrieve documents from a library and to import and export documents.

The Catalog greatly improves your productivity by graphically representing the contents of each of your files (which may contain whole or partial scenes). Selecting the graphical representation of a file in the Catalog and placing it into the scene will open the document for you. Moreover, you can erase part or all of a model using the Catalog.

The Catalog also manages the materials supplied with the software and also those created by the user. (See chapter " Rendering / the Materials / The Catalog of Materials" on page 361).

Because the AMAPI 3D Catalog is a very visual file manager, you may end up using it very often, possibly more than the classical file management provided by the pulldown menus.

You can access the Catalog by clicking on the catalog icon at the top right corner of the screen.



2.1 Object Catalog / Materials Catalog

The Catalog is a scene file management system and is also used to manage the materials library. You will switch from one to another by clicking on the corresponding tab.

Both management systems follow the same basic principles. See the chapter " Rendering / the Materials / The Catalog of Materials on page 361 for the features specific to the Catalog of Materials.

2.2 Browsing the Catalog

AMAPI 3D provides different ways to browse through the Catalog's pages.

2.2.1 Displaying a page of the Catalog

Thumbnail images show each file of the current directory. Each thumbnail shows its file name.
If you click on one of the thumbnails, the file its represents becomes the current file. AMAPI 3D then displays the file name in an edit window, along with the file size and date of the last modification.

2.2.2 Scrolling through the pages of the Catalog

When you scroll the catalog pages, you will replace the complete line of thumbnails with thumbnails from the next page or the previous page.

You can:

- Use the Tuner (or the "+" and "-" keys of the numeric keypad) (see chapter "The Tuner" on page 110).
- Enter a page number: A box displays the current page number in the Catalog. Click on the box and type the number of the page you wish to see. Press Return to validate and display the page.
- Use the scrolling cursors: Click on the right arrow to display the next page; click on the left arrow to display the previous page.

2.3 Bookmarks

Clicking on the Bookmarks icon opens the bookmarks management window. A bookmark is a shortcut used to quickly access favorite directories. AMAPI 3D allows you to organize bookmarks into classes. You will be able to add bookmarks to a classes, delete others, or create new classes.

2.3.1 Specifying a bookmark

The specified bookmark will become the current directory in the Catalog.

1. through the list of available bookmarks.
2. Select the one you want.
3. Click on the "OK" button.

You can also just double-click on a bookmark to open the directory.

2.3.2 Adding a bookmark

1. Click on the class where you want to add a bookmark.
2. Click on the "Add" button.

2.3.3 Deleting a bookmark

1. Click on the Bookmark you want to delete in the list of bookmarks.
2. Click on the "Delete" button.

2.3.4 Adding a new class

Click on the "New Class" button to create a new group of bookmarks. The new class is given the default name "Untitled".

2.3.5 Changing a class name

1. Click twice on the class name. (Note: This is not a double-click! Click once to select the name, and once to allow renaming.)
2. Enter a new name.
3. Press the Return key to validate the entry.

2.4 Utilities

Clicking on the Catalog's utilities icon opens a menu giving access to the following features:

2.4.1 Change Directory

The Catalog always displays the thumbnail images of the files contained in the current Directory.

1. Click on the "Utilities" icon of the Catalog.
2. Select "Toggle Directory".
3. Select another directory.
4. Click on the "OK" button to validate the selection.

There are other ways to change current Directory:

- selecting the "Change Directory" command of the "File" ,
- through a keyboard shortcut (PC: Ctrl+K; Mac: Command+K) ,
- or pressing spacebar when the Catalog is open.

2.4.2 Rebuild the Catalog

This creates a new Catalog that will include the content of the selected directories and the corresponding thumbnails. This is useful when you want to import a whole project coming from a different system or when you wish to update a directory where you have added new file.

AMAPI 3D uses a file called CAT.LIST to determine which files are present in the Catalog as well as their locations. If this CAT.LIST is not present in the open folder, no icon will be displayed in the Catalog (you might have moved some files from one folder to another using the file manager of your system, for instance). To have the thumbnails of all the files of your folder displayed in the Catalog, click on "Rebuild Catalog" in the Utilities menu of the Catalog.

2.4.3 Verify the Catalog

This operation updates the Catalog so that it takes into account any changes in the file organization in the hard drive. Indeed, if you manage files through the AMAPI 3D Catalog, this update is automatic (verifying it is therefore unnecessary). But if you have used another file manager, you need to verify the Catalog to be sure you're working with an up-to-date file manager. When updating the Catalog, AMAPI 3D will erase the references to scene files that are no longer on the hard drive and add the new ones into the Catalog.

2.5 Rename a file

To change the name of a file:

1. Click on the thumbnail corresponding to the file to rename; it becomes the current file.
2. Click on the name editing area to highlight it.
3. Enter a new name.
4. Press the Return key to validate.

2.6 Erase: The trash

Use the Trash to delete files from the Catalog of objects or from the Catalog of materials. The Trash can also be used to delete some or all of the elements of a scene.

2.6.1 Erasing a file from the Catalog

Proceed as follows:

1. In the Catalog, click on the file you wish to permanently erase (hold the mouse button down);
2. A small graphical representation (ghost icon) of the file is displayed when you move the cursor outside of the file's cell.
3. Release the mouse button when the ghost icon is over the trash.
4. The file is erased.

The operation performed **erases the file from the hard drive** and cannot be canceled. Therefore, you must be sure that you want to erase the file.

2.6.2 Erasing one or several elements from the current scene

How to proceed?

1. Click with the object selection accessory on the element in the scene you wish to permanently erase.
2. A small graphic representation (thumbnail) is displayed along with the cursor.
3. Release the mouse button once the thumbnail is above the trash icon.
4. The element has disappeared from the scene.

If you erase an element by mistake, do not panic. Cancellation of the operation is possible just after you have set the Catalog tool aside: select Cancel in the Edit menu or click on the Cancel icon button in the Assistant Palette or, finally, use the keyboard shortcut (Ctrl+Z on PC; Command+Z on Mac).

2.6.3 Erasing an entire scene

Proceed as follow to delete all the objects contained in a scene:
Click on the Trash icon in the Catalog. The entire scene disappears!

If you erase the scene by mistake, do not panic. Cancellation of the operation is possible just after you have set the Catalog tool aside (select Cancel in the Edit menu or click on the Cancel icon button in the Assistant Palette or, finally, use the keyboard shortcut (Ctrl+Z on PC; Command+Z on Mac.)
Proceeding this way, the view will automatically go back to the standard AMAPI 3D view adopted when you open a new scene.

2.7 Copying a file from the Catalog into the current scene

1. Click on it with the left mouse button and hold the mouse button down
2. A thumbnail representing the file (image-file) is displayed and follows the cursor. Place it over the graphics window.
3. Just release the mouse button: the image-file is copied into the current scene-file. You can also use the command “Merge...” in the “File” menu to insert the file in the current scene. (See chapter “ Merge” on page 72.)

The objects contained in the file to be copied are added to the current scene at the exact same location they were when they were saved.

2.8 Saving a model using the Catalog

2.8.1 Saving an entire scene

1. Scroll the Catalog’s pages until you find an empty cell.
2. Click on the Empty cell. The current scene appears in the cell; it becomes the current file.
3. AMAPI 3D supplies a default name for the object, or you can enter a name yourself.
4. Press the Return key to validate.

2.8.2 Saving elements of the scene

1. Using the object selection accessory , click on the element of the scene you want to save.
2. Press on the left mouse button and do not release it.
3. A thumbnail depicting the object appears and follows the movements of the cursor.
4. Move the cursor above an empty cell of the Catalog and release the mouse button. The selected element appears in the cell; it becomes the current file.
5. AMAPI 3D gives a default name to the object but you can also enter one.
6. Press the Return key to validate.

If you want to save different elements in the same file, first group them together before dragging them into the Catalog.

2.8.3 Reorganizing the contents of the Catalog

You can modify the arrangement of the files in the Catalog simply by moving them within it.

1. Click on the file you wish to move.
2. A thumbnail image of file contents is displayed next to the cursor and follows it.
3. the mouse button above an empty cell to place the file in that cell.

2.9 Import

An Import icon is available while the Catalog is open. If you click on it, you access an Import submenu identical to the one you would get if you had selected the “Import” command of the “File” menu.

The corresponding chapter will give you a detailed explanation of file importation (see chapter “Import” on page 74).

It is not possible to import material files.

2.10 Export

An Export icon is available while the Catalog is open. If you click on it, you access an Export submenu identical to the one you would get if you had selected the “Export” command of the “File” menu.

The corresponding chapter will give you detailed explanation of file exportation (see chapter “Export” on page 75).

It is not possible to export material files.

3 Edit

3.1 Undo (PC: Ctrl+Z; Mac: Command+Z)

This command will cancel:

♦ **Inside a tool**: the last operation done with the tool.
In this case, there will be as many cancellations possible as operations previously done within the tool.

♦ **No tool selected:** all the operations done with the last tool used.
In this case, the number of cancellations (undo) possible is user-defined in the "Preferences" menu. (See chapter "Preferences / Recovery / Number of undos" on page 444.)
You can also use the Undo icon button of the Assistant Palette to cancel an action. (See chapter "The Assistant Palette" on page 98.

3.2 Redo (PC: Ctrl+R; Mac: Command+R)

This command of the "Edit" menu will re-do the last undone operation.

You can also use the Redo icon button of the Assistant Palette to redo an action. (See chapter "The Assistant Palette" on page 98).

3.3 Validate (Return key)

Selecting "Validate" in the Edit menu will validate the current action.
You can then select a new tool or a new element.

You can also press the Return key to validate an action or click on the corresponding icon button in the Assistant Palette.

3.4 Cancel (Escape key)

Select the "Cancel" command of the Edit menu to quit a tool. All the operations performed with that tool will be canceled. The tool is dropped so that you can select another one.

You can also press the Escape key of the keyboard to quit a tool or click on the corresponding icon button in the Assistant Palette.

3.5 Cut (PC: Ctrl+X; Mac: Command+X)

This command of the "Edit" menu deletes the selected elements from the current scene and copies them into the clipboard. Each time you select cut or copy onto the clipboard, the contents of the clipboard will be replaced by the new entry.

To Cut an element:

1. Click on the object with the object selection accessory to select it; the selected element turns cyan, and a small white sphere indicates its center of geometry.
2. Select "Cut" in the "Edit" menu; the element is copied onto the clipboard and removed from the current scene.

You can use the Cut feature to paste the element into the current document or into another document. (See chapter " Edit / Paste" on page 87).
AMAPI 3D will paste the object in the location (relative to the origin of the work space) it had when it was cut, even if you have switched current document (see how to toggle from one document to another in the chapter " Window / Document" on page 434).

3.6 Copy (PC: Ctrl+C; Mac: Command+C)

The Copy command will place a copy of the selected object on the clipboard without deleting it from the current scene.

To copy an element:

1. Click on the object with the object selection accessory to select it; the selected element turns cyan and a small white sphere indicates its center of geometry.
2. Select "Copy" in the "Edit" menu; the element is copied onto the clipboard without being removed from the current scene.

You can use the Copy command to paste the element into the current document or into another document. (See chapter " Edit / Paste" on page 87).

AMAPI 3D pastes an element at the location the original element had when it was copied (relative to the origin of the work space), even if you have switched current document (see how to toggle from one document to another in the chapter "Window / Document" on page 434). If you paste the element in the current document, the copy will be placed at the exact same location as the original object, and therefore will be on top of it.

AMAPI 3D also provides the "Duplication" tool which may be more suitable for copying objects in a scene.

3.7 Paste (PC: Ctrl+V; Mac: Command+V)

The Paste command copies the selected object from the clipboard into the current scene.

Elements are placed on the clipboard using the Cut or Copy features of AMAPI 3D.

AMAPI 3D pastes an object at the location (relative to the origin of the work space) it had when it was cut or copied, even if you have switched current document (see how to toggle from one document to another in the chapter "Window / Document" on page 434). If you paste an element in the same document you copied / cut it from, the copy will be placed at the exact same location as the original object, and will therefore be on top of it.

Pasting an element does not change the contents of the clipboard.

3.8 Delete

The Delete command deletes the selected object. Unlike with the Cut command, the selected element is not saved on the clipboard.

To delete an element:

1. Click on the object with the object selection accessory to select it; the selected element turns cyan and a small white sphere indicates its center of geometry.
2. Select "Delete" in the "Edit" menu; the element is removed from the current scene.

You can also use the Trash icon of the Catalog to delete an element. (See chapter "Erase: The trash" on page 82).

To delete an entire scene, it is also faster to use the Trash icon of the Catalog.

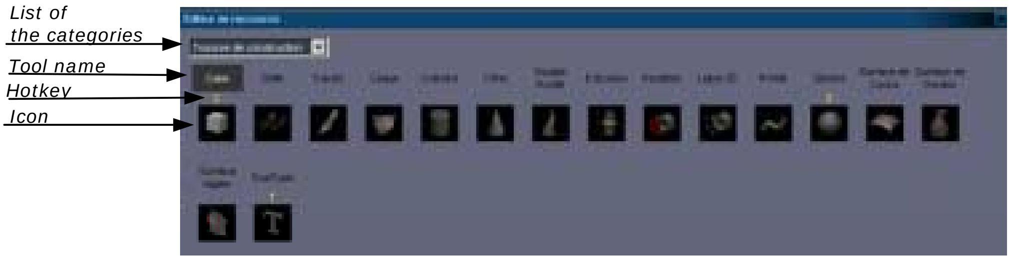
3.9 Select All (PC:Ctrl+A; Mac:command+A)

The Select All command selects all of the visible elements of the current AMAPI 3D scene

When you use the "Select All" feature, the elements are grouped into one object.

3.10 Shortcuts (PC:Ctrl+D; Mac:Command+D)

The "Hotkey Editor" can be very useful as it will allow you to program your own keyboard and thus have a faster access to the tools you commonly use.



Editing a hotkey:

1. Select the "Shortcuts…" command in the Edit menu. A dialog box appears. It gives a detailed list of all the tools for which you can edit a hotkey, grouped by category.
2. Select the category containing the desired tool. The corresponding dialog box then appears. It lists all the tools classified in this category (Name + icon). AMAPI 3D displays the assigned hotkey in yellow above the tool icon.
3. Click on the icon of the tool for which you want to edit the hotkey. Its name is displayed in white.
4. Press the key combination you want to assign as the hotkey. It is displayed in yellow above the tool icon.

Delete a hotkey:

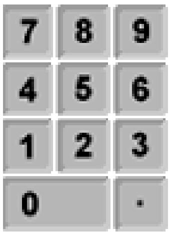
Proceed as for editing a hotkey but press the "Suppr" (delete) key at step 4.

4 View

You can work on your model from any viewpoint in AMAPI 3D. You will be able to rotate around your model, get closer or further away from it, very easily and smoothly using the following commands:

4.1 Zoom

AMAPI 3D provides four tools for zooming in and out on details of the scene. You can access them using hotkeys and also through the Control Panel.



0	See all
1	View Area
3	Zoom In
.	Zoom Out*

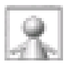
* On a Mac press the "," key.

4.1.1 See all

Click on the  icon of the Control Panel to activate this feature or press the "0" key of the numeric keypad.
The "See all" command will re-center the scene to display all the objects.

4.1.2 See detail

Use "See detail" to define an area of the scene you want to zoom on.
To use this tool:

1. Select the "See Detail" tool ("1" key or  icon of the Control Panel).
2. A white rectangle with an X at its center is displayed.
3. Place the cursor at the center of the area you wish to zoom into and click.
4. Drag the cursor to increase or decrease the size of he window.
5. Click when the whole area you want to zoom into is inside the boundaries of the white rectangle. The area contained in the white rectangle will replace the previous view on your screen.

4.1.3 Zoom in

Use the Zoom in tool to get progressively nearer (step by step) to the center of the scene.
Press the "3" key of the numeric keypad as many times as you want.

⚠ This command is not available in the Control Panel.

4.1.4 Zoom out

Use the Zoom out tool to get progressively further away from the scene.
Press the "." key of the numeric keypad as many times as you want.

⚠ This command is not available in the Control Panel.

4.1.5 Centering an object

- If you click on an object while pressing the "Ctrl" key, AMAPI 3D will center the sight on this object. It will automatically become the current object.
- If you click on an object while simultaneously pressing the "Ctrl" and "Shift" keys, AMAPI 3D will center the sight on this object and will temporarily hide all other objects of the scene. (See hidden object in the chapter "Hide-Unhide" on page 138).

To see the whole scene again, simultaneously press the "Ctrl" and "Shift" keys and click.

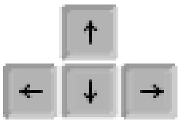
⚠ This command is not available in the Control Panel.

4.2 Navigation

You can easily rotate around the scene, zoom in on a detail or zoom out using the navigation tools. You can access these tools via the Control Panel or the hotkeys.

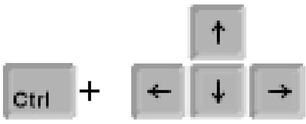
4.2.1 Through the keyboard

❑ Rotating around the scene



Use the Up, Down, Left, and Right arrow keys of the numeric keypad **to rotate the scene accordingly.**
The rotation is done step-by-step around the center of rotation (by default, the center of the scene).
As you would expect, the Left arrow key rotates the scene to the left, the Right arrow key rotates the scene to the right, etc.
See chapter " Point of view (Eye – Target point)" on page 134.

❑ Scrolling the scene



Press the Control key while pressing the arrow keys **to scroll the scene sideways or up and down.**

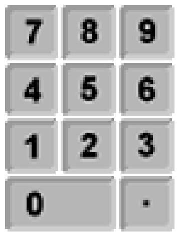
❑ Change the Point of View directly

You can change the point of view using the keyboard keys:
- Front view
- Left view
- Top view
- Right view
- Rear view

For more information about the point of view, See chapter " Point of view (Eye – Target point)" on page 134.

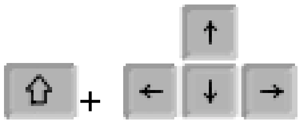
Two methods are available:
- Using the numeric keypad.
- Using the "Shift" key and the keyboard arrows simultaneously.

Using the numeric keypad:



2	Front view
4	Left view
5	Top view
6	Right view
8	Rear view

Using the “Shift” key and the keyboard arrows simultaneously:



If you hold down the “Shift” key when using the arrow keys, **your point of view will be successively switched to each main point of view**,as indicated by the arrow.

4.2.2 Keyboard + mouse

Navigation using the "keyboard + mouse" command allows you to navigate through the scene without releasing the mouse. It also allows you to get rid of the Control Panel (which is, of course, needed when navigating using the Control Panel).

Proceed as follows to use this navigation command:

1. Press the key combination corresponding to the type of navigation needed (do not release the keys).
2. Press the mouse button (do not release it).
3. Move the cursor to change the view.
4. You can use another key combination to change the type of navigation until you get the needed viewpoint.
5. Release both the keys and the mouse button when you obtain the desired viewpoint.

- To zoom

  Press "Ctrl+Shift" and the left mouse button. You will move the mouse up or down to zoom in or out respectively.

- To rotate the scene

  Press Control and the left mouse button to rotate the scene.
  Move the cursor in any direction: The scene will rotate step-by-step around the center of rotation which is by default at the center of the table. See chapter " Point of view (Eye – Target point)" on page 134.

- To pan the scene

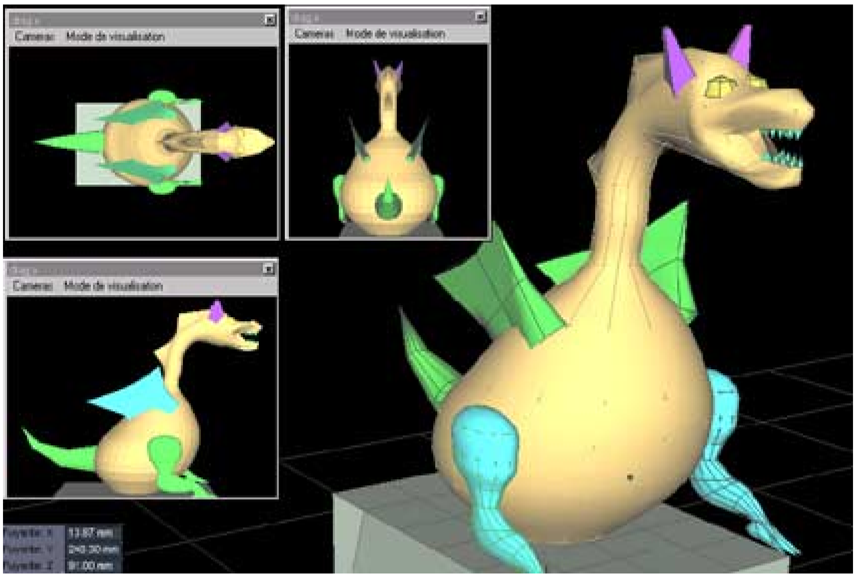
  On PC: Press "Ctrl+Alt" and the left mouse button.
  On Mac: Press "Ctrl+Option" and the mouse button.
  Moving the mouse upward, downward, left or right will pan the scene upward, downward, left, or right respectively.

4.2.3 Through the Control Panel

See chapter "The Control Panel / The views" on page 133.

4.3 Viewer

You can now display an unlimited number of viewer windows, each displaying a custom viewpoint of the scene. Using the viewer, you will be able to display the viewpoint of each camera you created. You will be able to resize these windows and change their positions.



Opening a Viewer window:
⇒ Select “New View” in the “View” menu.
⇒ AMAPI 3D allows you to choose from five standard viewpoints (front, rear, right, left and top view) and a custom viewpoint (“free view”).

Setting the viewpoint displayed by the custom Viewer:
⇒ Click on the Viewer window to designate it as current Viewer window.
⇒ In the Viewer window, click on the “Camera” menu.
⇒ Select the camera (or viewpoint) you previously created. To see how to save a point of view See chapter “ Point of view (Eye – Target point)” on page 134. And to see how to create a camera, see chapter “ Cameras / Creating and positioning a camera” on page 397.

To change the display mode of the viewer:
⇒ Click on the Viewer to designate it as the current viewer.
⇒ In the menu of the viewer, click on "View mode".
⇒ Select the display mode you need from the list of choices.

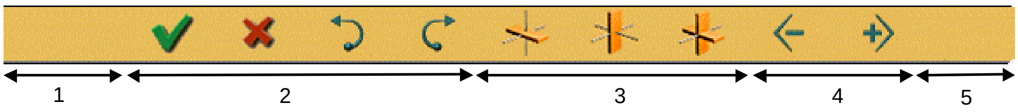
4.4 Redraw (PC: Ctrl+T; Mac: Command+T)

Redraw will refresh the screen.

5 Modeling help tools

5.1 The Assistant Palette

The Assistant Palette has been specifically designed to give you additional information and to guide you through your first projects with AMAPI 3D. It will help you get acquainted with the software quickly. Once you are more familiar with Amapi, you can turn off the Assistant Palette, which will give you a larger working space. (See chapter “Preferences / Interface / Assistant Palette” on page 438.)
The Assistant Palette is displayed at the top of the screen. It is divided into different parts.



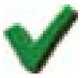
1. *The online help indicates what tool you are using (by displaying its icon), and guides you through any modeling step.*
2. *The command button icons allow you to validate an action, quit an action at any time, undo an action, or redo an action.*
3. *A set of three icon buttons define position and motion constraints for the cursor.*
4. *A “+ / -” Tuner allows you to control at any time the precision of an action, number of points, axes step size, definition of values, etc. or the range of action of a tool.*
5. *The last area is for displaying the different modes available for the current tool.*

5.1.1 Online Help

The online help provides information and guides you through any step of your work.
AMAPI 3D always displays the icon of the current tool.
A text area lets you know the different possible operations.

5.1.2 The Commands

- Validating an action



This button validates the current action.
You can then select another tool or element.

You can also use the "OK" button of the pulldown menu or press the Return key to validate an action.

- Canceling an action

Clicking on this button will quit the current action.
Any modification performed within the current tool will be canceled. It will also drop the tool, allowing the user to select another tool or element.

You can also use the Escape key of the keyboard to quit an action, or select the Quit command in the Edit pulldown menu.

- Undo a step ("Undo" button)

Clicking on this button will cancel:

- **Within a tool**: The last step performed with the tool.
  In this case there are as many undos as there were operations performed with the tool.
- **Outside of a tool**: All the operations performed by the last tool used.
  In this case, the number of possible undos is defined by the user in the Preferences menu. (See chapter " Preferences / Recovery / Number of undos" on page 444.)

You can also use the keyboard shortcut o cancel an operation (On PC: Ctrl+Z; on Mac: Command+Z).

- Redo an operation ("Redo" button)

This command re-does the last canceled action.

You can also use the keyboard shortcut to re-do an action (On PC: Ctrl+R; on Mac: Command+R).

5.1.3 Cursor movement and positioning constraints

By default, cursor movement is completely unrestricted. AMAPI 3D allows you to restrict the motion and positioning of the cursor.

- <u>Movement constraint along one axis</u>

  By default, the cursor can be moved freely along the plane defined by the two axes. However, you can set a motion constraint to restrict the cursor to move only along one axis.
  This can be particularly useful when moving an object, extruding curves, or creating perfectly aligned copies.

  i *The X axis is drawn in red, the Y axis in green, and the Z axis in blue.*

There are three ways to constrain the cursor, using either:

- ***<u>The Assistant Palette</u>***

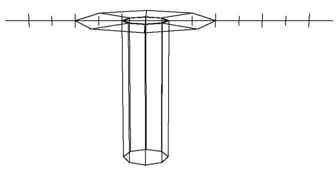
  Click on the desired axis constraint icon in the Assistant Palette.

 **Horizontal axis constraint:** Only the horizontal axis is displayed and you can move the cursor only along the horizontal axis.	 **Vertical axis constraint:** Only the vertical axis is displayed and you can move the cursor only along the vertical axis.	 **No constraint:** Both axes are displayed and you can move the cursor freely along the working plane.

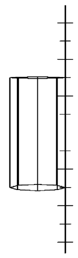
- ***<u>Through the keyboard</u>***

   The spacebar is a toggle used to constrain the cursor's movement along one of the two axes of the working plane.

1. Press the spacebar once.
Only the horizontal axis is displayed. You can move the cursor only along this axis.



2. **Press the spacebar a second time.**
   This time, only the vertical axis is displayed and you can move the cursor only along this axis.



3. **Press the spacebar a third time.**
   Both axes are displayed once again and you can move the cursor freely along the working plane.

♦ *Constraints palette*

AMAPI 3D provides various ways to constrain the movement of the cursor along an axis.

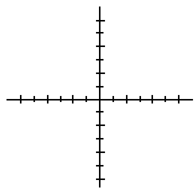
- Horizontal passing through the last drawn point.
- Vertical passing through the last drawn point.
- Passing through the last drawn point and one point to be selected.
- Passing through the last drawn point and parallel to one edge to be selected.
- Passing through the last drawn point and perpendicular to one edge to be selected.
- Horizontal passing through one point to be selected.
- Vertical passing through one point to be selected.

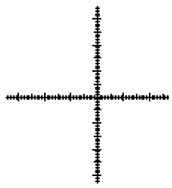
These choices are in a palette called the “Constraints Palette” which is accessible from the Control Panel. (See chapter “Constraints palette” en page 146).

❑ Resetting the axes' increment (step size)

The cursor's movements depends on the axes' step size.

You can increase or decrease the step size of the axes with The Tuner: (+/- keys of the keyboard) (see details on page 110).

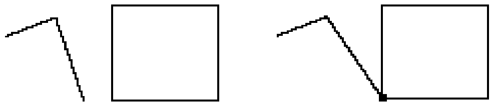




You can set the step size yourself (see chapter “ Preferences / Units” on page 441), but , in this case, the tuners will not have any effect on the graduation precision.

Snapping the cursor on existing points

Press the **Shift key** to position a point at the exact same location as an existing one. If you hold the Shift key down and drag the cursor around, the cursor will be automatically attracted to the nearest point.



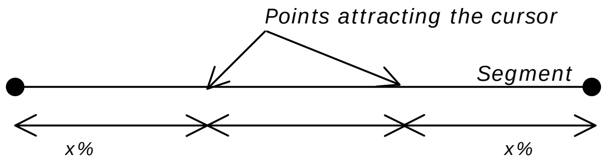
You can inactivate this feature in the Constraint settings menu (See chapter "Preferences / Constraints" on page 445).

Snapping the cursor on a segment

In AMAPI 3D you can position a point on a segment, at its midpoint, and at a third or a quarter of the length of the segment.

First make sure that the "Snap to a segment" feature is activated in the Preferences / Constraints menu.
There, you will also set the interval to which the cursor will be attracted (See chapter "Preferences / Constraints" on page 445).

The shift key not only snaps the cursor onto existing points, **but will also snap the cursor onto user-defined intervals along line segments, relative to the nearest extremity.**



You can inactivate this feature in the constraints settings menu (See chapter "Preferences / Constraints" on page 445).

❑ Positioning the cursor according to lines of constraint

You can position the cursor using what is called a "line of constraint".

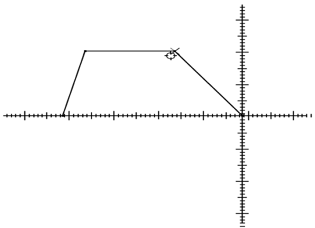
When can you use them?
In any tool displaying the ticked axes and as soon as the axes are displayed.

What are "constraint points"?
They are user-defined points through which the constraints lines will go.
There can be 1, 2 or 3 (maximum) constraint points.

What is a "constraint line"?
- All the lines going through sets of two control points.
- All the vertical and horizontal lines going through each control point.

What can you do with those control lines?
- Position the cursor at the intersection of two control lines.
- Position the cursor along a control line or along a line parallel to it.
- Position the cursor so that a line going through the cursor and one of the control points is perpendicular to a control line.

♦ *Defining control points*



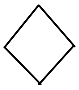
Click on the point you wish to define as a control point, pressing the Shift key and the Control key simultaneously.

The control points defined are highlighted with a small yellow cross.

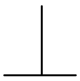
⚠ The axis origin is always defined by AMAPI 3D as the first control point.
You can therefore define two other control points.

♦ *Positioning the cursor*

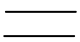
Release the Control key while holding the Shift key down. Drag the cursor around. AMAPI 3D will give you information about the cursor position relative to the different control lines.
One or several icons will be eventually displayed in the "Help" area of the Assistant Palette.



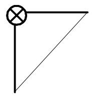
Intersection
AMAPI 3D will display a yellow diamond when the cursor is at the intersection of two constraint lines.



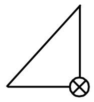
Perpendicular
Indicates that the line going through the cursor and one of the points of constraint is perpendicular to one of the constraint lines.



Parallel
Indicates that the line going through the cursor and one of the points of constraint is parallel to one of the constraint lines.



Horizontal alignment
Indicates that the cursor is on a horizontal constraint line.

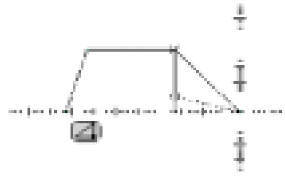


Vertical alignment
Indicates that the cursor is on a vertical constraint line.

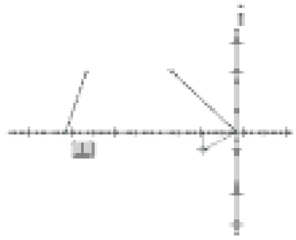
♦ ***How do you deactivate the constraints?***

If you release the Shift key, the cursor is not attracted anymore, and the defined control points disappear.

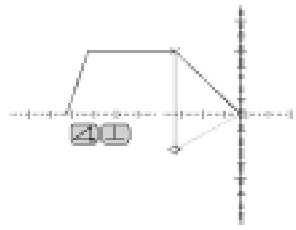
Cursor is on a vertical constraint line.



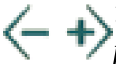
Cursor attracted and constrained to a line perpendicular to a segment.



Perpendicular and vertical attraction combined.

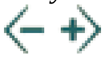


5.1.4 The Tuner "- / +"

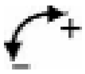


Use the Tuner to increase or decrease a value. You can use it to modify the precision of an action, align or scale an element using axes, and to define the number of points in a curve or a surface. It can also be used to browse through the pages of the Catalog.

It may have two shapes:



The Tuner is shown like this in the Assistant Palette.



The Tuner cursor indicates that AMAPI 3D is expecting you to use the Tuner. (You must use it.)

Usage:

1. **Tuning**
   There are two ways to do this:
   Using the "+" or "-" keys of the numeric keypad.
   Clicking on one of the icons in the Assistant Palette.

2. **Validate or put the tool aside.**
   There are three ways to do this:
   Put the Tuner aside (move the cursor out of the scene through the right hand side of the screen and then back in).
   Press the "Enter" key to validate the action.
   Select another tool (only if you have chosen the "Standard Interface" (see chapter Tool palettes" on page 435).

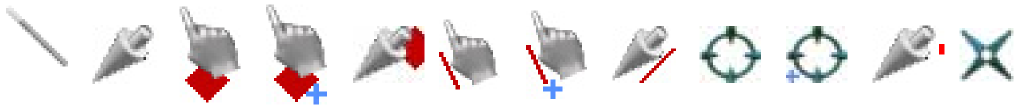
5.1.5 Modes

Some tools can be used in different modes. To enter those modes, click on the corresponding icon in the Mode area of the Assistant Palette or use the hotkeys.

The following tools support different modes:

- VIEW POINT (mode: positioning the eye). See chapter " Point of view (Eye – Target point)" on page 134.
- MOLD (mode: interactive control of the force of attraction). See chapter "The Local deformation modeler" on page 255.
- REPEAT (using the "Multiple copies on the facet of an object" sub-tool: the mode allows you to set a scale factor between the copy and its target facet). See chapter "Duplicate / Multiple copies along a path or on the facets of an object" on page 318.
- STRETCH (mode: "Editing the tangent of a NURBS curve").
- If no tools is selected, the available mode lets the user access the "Animation and Rendering" palette). See chapter " Animation" on page 400.
- 3D Primitives
- Draw

5.2 The selection accessories



5.2.1 What is a selection accessory?

AMAPI 3D provides a set of selection accessories which allow you to select the object(s) you want.
The cursor takes the shape of the accessory you want; with it, you will select the objects.
The icon depicting the selection accessory indicates:

- The kind of objects it selects.
- The way it selects.

It is up to you to select the accessory which is most suitable for the kind of selection you want to do:

- See chapter "The different selection accessories" on page 106 to see the choices.
- See chapter "How to select a selection accessory?" below to find out how to select one.

5.2.2 How to select a selection accessory?

AMAPI 3D lets you access the selection accessories that available in the current tool. You will select the appropriate accessory using one of the following methods:

However, if you prefer, you can use the mouse for quicker access to the selection accessories that are available in the current tool.
Here's how:
PC: Click on the right mouse button.
Mac: Hold down the Option key and click the mouse button.
The cursor switches to the first selection accessory. You can use that tool or repeat the operation to get the next selection accessory. After the last selection tool is reached, clicking again causes the first accessory to be redisplayed. This cyclical process is called "Loop Access".

If you are not currently using a tool, you can get the object selection accessory by putting aside the selection accessory that you don't want anymore.

5.2.3 The different kinds of selectable objects

In AMAPI 3D there are several kinds of objects that can be selected:
- Objects
- Facets
- Edges
- Points

5.2.4 The different ways to select

There are several ways to select things.
You can do a selection by using both methods.

Selection by objects

- ***One by one***

  Click on the object(s) you want.

- ***Several objects***

  This selection method is available in certain tools.
  Press the "Shift" key to indicate that you want to select several objects.
  Then press the "Enter" key to validate.

Selection by groups of objects (the Lasso method)

Lasso selection allows you to specify an area inside of which all the objects will be selected.
There are two ways to use the lasso:

The free form Lasso:
Click several points in view to surround the area you want to select. Then press the "Enter" key to validate.

When you validate, the lasso includes the line segments defined by your mouse clicks. The line segment that is still "in-progress" when you validate, is not included.

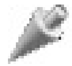
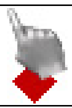
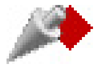
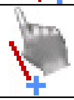
The rectangular Lasso:
PC: Hold down the right mouse button and move the cursor to draw the selection area.
Release the mouse button to validate the selection.
Mac : Press and hold the Option key and click before moving the cursor to surround the selection area.
Release the mouse button to validate the selection.

If you already had points selected in this area, they will be deselected.

5.2.5 The different selection accessories

We have seen that the icon depicting the selection accessory indicates:
- The kind of object it can select.
- The selection method.

The table below shows all the available selection accessories.
See chapter "How to select a selection accessory" on page 104 to find out how to get them.

	Object selection		Group selection
	One by one	Several objects (with the Shift key)	
Objects* *(The Wand)*			
Facets			
Edges			
Points**			
Reference Points ***			

***** The Wand is the default selection accessory: If you have not selected a tool, the cursor is the Wand.
When you select an object with the Wand, it becomes the current object (see "Current object concept" on page 166).
When several objects are overlapping on the screen, it may be difficult to select the one you need: use the Tuner (the "+" and "–" numeric pad keys). You will successively select each of the objects in the scene as the "current object". Stop when you have selected the right one.

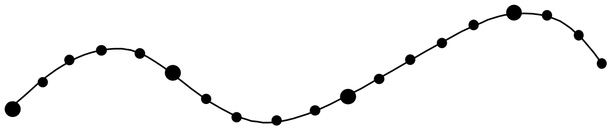
** You may need this accessory either before or while using a tool. This accessory enables Subset selection (see chapter "The offset points selection" on page 107).

*** This accessory is available when using certain tools (i.e: Draw, Rotate, Scale, Symmetry, …). It is useful for selecting a "reference point". This point could be, depending on the case:
An anchor point
A point of symmetry
A connection point
See the User Manual to find out what the reference point is for each tool, what it's used for, and how to use it.

5.2.6 The subset points selection tool

With this tool, you can easily select every Nth point on the current object.

For example: If you set the value of N to 5, AMAPI 3D will automatically select every fifth point on the current object.



Usage:

1. **Selecting the object.**
   Selecting a subset of the points can be done on the current object if you have previously selected the point selection accessory (see chapter "The different selection accessories" on page 106).
   This kind of selection is available when no tool is selected or inside certain tools. In this case, you will see the Data Window which appears on the bottom left of the screen. The message "1 point in N" means you want to select one point for every N points on the current object.
   (A N =0 offset means no selected points).

2. **Specify an offset value.**
   There are several ways to set the offset value:
   - **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - Using the Tab key (see details on page 109).
     - Clicking in the Data Window (see details on page 109).
   - **The Tuner:** (+/- keys of the keyboard) (see details on page 110).

   AMAPI 3D displays the selected points in red.
   ⚠ Subset points selection removes all the previous selections on the current object. However, you can add other selections over a subset points selection.
   Now you can either continue the selection with another selection accessory, or go to the next step.

3. **Validate the selection.**
   When you have selected all the points you want, press the "Enter" key.

5.3 The Data Window

The Data Window provides information regarding the current objects and the current operations.
It displays:

- *The name of the current object;*
- *Dynamic numerical values about the current operation.*

5.3.1 The current object or group name (or group) name

If no tool has been selected, the Data Window displays the name of the current object or group of objects (displayed in cyan). Proceed as follow to assign a name to the object or to change it:

1. Using the object selection accessory, click on the object or group.
2. The current name is displayed.
3. Press the Tab key.
4. Enter the object's name using the keyboard.
5. Press the Return key to validate the entry.

You can also display and edit the name of an object using the Information tool of the Control Panel. (See chapter "Get info" on page 149.)

AMAPI 3D supports a group management tool: the Scene Manager. (See chapter "The Scene Manager" on page 114).

You can use names of any length for objects and groups in AMAPI 3D. However, only nine characters will be displayed.

5.3.2 Numerical data

- Display of numerical data:

The Data Window shows dynamic numerical information about the current operation.
It will give you the following information depending on the type of object being edited:

- Exact 3D coordinates of a point
- Angle
- Distance
- Coefficient
- Range

Modifying a numerical value:

There are different ways to modify the data:

- *Using the mouse*
- *Using the keyboard.*
- *Remote interaction: (The "+/-" Tuner, the"Remote Control", or the "Slider").*

Choose the one best suited to the current operation.

Using the mouse

Mouse positioning

You will use this to position a point in space, as described below:

1. The cursor movement modifies the data interactively.
2. Click on the left mouse button to validate the new value.

Remember that you can apply a constraint to the cursor's movements. (See chapter "Constraints palette" en page 99).

Mouse parameter setting

You can use the mouse to set a parameter, as follows:

1. Move the cursor to modify the data interactively.
2. Click with the left mouse button to validate the data.

Mouse Tuner

You will use this to control the intensity of an action. Please follow the instructions below:

1. Click and hold the left mouse button to start tuning the data.
2. Move the cursor. Moving the cursor modifies the data interactively.
3. Do not release the mouse button until you have the desired results.

Remember that you can apply a constraint to the cursor's movements. (See chapter "Constraints palette" en page 99).

The keyboard

You will use the keyboard to edit one or more data values. Two methods are available for accessing the Data Window (bottom left of the screen):

Using the Tab key 

1. Press the Tab key to access the first data item.
2. Enter a new value using the keyboard.
3. Press the Tab key to access the other data items (if needed).
4. Press the "Enter" key to validate the new entry(ies).

Clicking in the Data Window

1. Click on the window of the value you want to edit.
2. Enter a new value using the keyboard.
3. Press the Tab key to modify the next value and come back to step 2.
   Or
   Press the "Enter" key to validate the new entry(ies).

♦ ***Remote interaction (the Tuner, the Remote Control and the Slider)***

The data palette is used to display data. You can move from one data field to another by pressing the spacebar. The editable date will appear darker. You can modify its value using any of the following methods:

❖ The Tuner

Use the Tuner to increase or decrease a value. There are different ways for you to access the Tuner (see chapter "The Tuner "- / +"" on page 103).
It can have two shapes:

 The Tuner is shown like this in the Assistant Palette

 The Tuner cursor indicates that AMAPI 3D is expecting you to use the Tuner. (You must use it.)

The Tuner modifies the value of the current data.
The current data is displayed darker than the other ones. The spacebar will toggle from one data window to another if (and only if) the data values are editable with the Tuner. The current data value is highlighted.
If there is only one editable data value, the spacebar will have no effect.

There are two ways to use the Tuner:
- ♦ Using the "+" or "-" keys of the numeric keypad.
- ♦ Clicking on one of the icons  in the Assistant Palette.

Validate or put the tool aside:
There are three ways to do this:
- ♦ Put the Tuner aside (move the cursor out of the scene through the right hand side of the screen and then back in).
- ♦ Press the "Enter" key to validate the action.
- ♦ Select another tool (only if you have chosen the "Standard Interface") (see chapter "Tool palettes" on page 435).

❖ The Remote Control

The Remote Control allows precise interactive control of the data. Arrow icons next to the numerical data symbolize the Remote Control. If they are displayed, this means the Remote Control is available.
There are three ways to use them:
- ♦ Click on them to increase or decrease, step by step, the numerical data.
- ♦ Use the following keyboard shortcuts to appreciate the flexibility offered by the Remote control:

Ctrl+Shift+Left arrow	increases the value in X
Ctrl+Shift+Right arrow	decreases the value in X
Ctrl+Shift+Up arrow	increases the value in Y
Ctrl+Shift+Down arrow	decreases the value in Y

The increment value is displayed in the small window. To modify it:
⇒ Click on the window.
⇒ Key in a new value.
⇒ Press the Return key to validate the entry.

❖ The Slider

In the cases where it is available, the Slider is at the bottom of the data palette. You can move the Slider to modify the value of the current data.

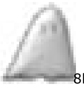
5.4 The Control Panel

The Control Panel is displayed at the bottom of the screen. It provides access to a variety of modeling aids.

1. *Organize the different elements of your scene into groups and sub-groups of objects, layers, or materials with the* ***Scene Manager****. The feature is particularly useful when working on complex scenes.*
2. *The* ***Display Hidden Lines*** *command will help you visualize your objects as they would be seen in the real world.*
3. *You can request a simplified display of your objects. Complex objects will be clearer and the display speed faster.*
4. *You can change the* ***working plane.***
5. *Use the* ***Perspective*** *tool to toggle between perspective and* ***orthogonal*** *viewing.*
6. ***You will be able to define the view*** *with tools such as the* ***Zoom*** *(6e) and the* ***See all*** *(6d) and tools used to* ***navigate*** *around the scene (6a, b, c).*
7. *Change the center of rotation of your scene with the* ***Viewpoint*** *tool which defines define the user point of view.*

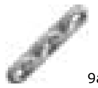
8a

8. *The **Hide** (8a) tool will make selected elements invisible. The **Unhide** (8b) tool will bring them back.*

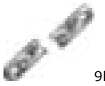


8b

9. *Use the **Group** (9a) tool so that different elements behave as one, until you **Ungroup** (9b) them.*

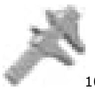


9a



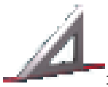
9b

10. *Edit the **Measurements** (dimensions) of your objects. You can edit three types of measures with AMAPI 3D: length, angle, and volume / surface / circumference.*



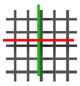
10

11. *This palette allows you **to constrain your cursor movements along a specified axis.***



11

12. ***Magnetization** allows you to choose if you want the cursor to be magnetized or not.*



12

13. *Use the **Material Editor** to assign a color to an object or to a material.*

13

14

14. *Get information about the current object with the **Get Info** command*

5.4.1 General tool usage

❑ How to identify an available tool in the Control Panel

When the mouse cursor passes over a tool's icon, a label displays the name of the tool.
Depending of the current action, some tools may not be available.
Examples:
- If there is no object in the scene, the Scene Manager and the Information tool are not available.
- If there is no hidden object in the scene, the Unhide tool is not available.
- …

If the tool is available, its icon will be highlighted when the mouse cursor passes over. If the tool is not available, the icon will not be highlighted.

❑ How to activate a tool from the Control Panel

To take an available tool, click on the icon depicting the tool. Click on the icon of the Control Panel that depicts the tool you want to activate.
- Some are tools that you take, use and then put aside (e.g., Show / Hide, Group / Ungroup, Measurements).
- Others are toggle options that allow the switching from one mode to another (e.g., Magnetization, Perspective).
- Still others open a window or a dialog box that you must close after use (Scene Manager, Info, Material Editor).

❑ How to end a tool action from the Control Panel

There are two ways to do this:

- ***Validate the action:***

⇒ **In the Assistant Palette**: Click the "Validate" button.
or
⇒ **With the keyboard**: Press the **Return** key.

Validating the action will drop the tool. the object selection accessory  will be available again to select another tool or a different object.

- ***Putting the tool aside:***

⇒ **If you chose the "Workshop"* interface,** you **put the tool aside** by moving the cursor outside of the scene on the right, then moving it back into the scene. Now you are free to select an object or take another tool.
⇒ **If you chose the "Standard"* interface,** select another tool to continue to work.

***** See Chapter " Tools palettes" on page 435.

5.4.2 The Scene Manager

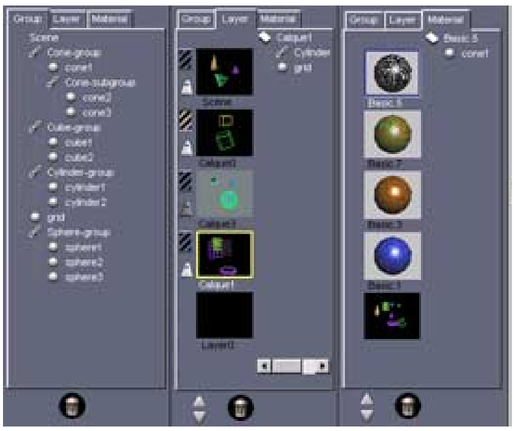
AMAPI 3D provides a system for organizing and managing the hierarchy of the elements of the scene: The Scene Manager. *Hierarchy management is very useful when working on complex scenes. You will able to organize (classify) objects by groups or sub-groups, layers, and materials.*

Closes the Scene Manager　*Minimize the Scene Manager*

The Scene Manager is opened through the Control Panel. It is divided into three sections corresponding to the different types of classification available: Group, Layer, and Material. You switch from one section to another by clicking on the tab at the top of the Scene Manager.

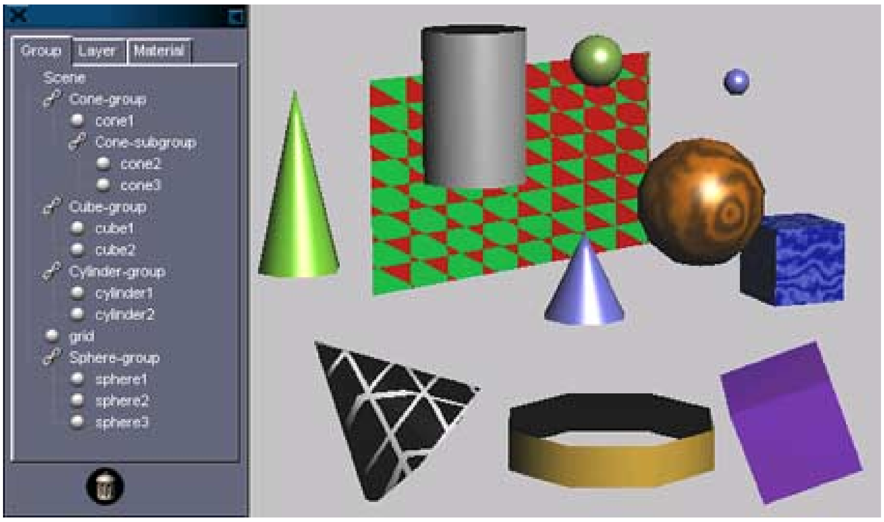
The Scene Manager can be left open while you continue to do modeling work in the main window. You can also minimize the Scene Manager to free up additional workspace.

Classification by Group | **Classification by Layer** | **Classification by Material**



❑ Classifying by groups

The Scene Manager is a tool used to manage objects. It allows you to create groups, to modify them, and also to create a hierarchy.
Of course, the Scene Manager manages the groups you would have created using the Group / Ungroup tool found in the Control Panel. *(See chapter “Group-Ungroup” on page 140.)*



The management of groups allows you to perform the following operations:

♦ ***Consult***

When you open the Scene Manager, AMAPI 3D displays an **organized list of the names of groups and objects present in the scene** (whether they be hidden, or locked, or not).
Groups are indicated by a chain link and objects by spheres .

If the entire list cannot be viewed at once, use the arrows at the bottom of the Scene Manager to scroll the list.

To see the composition of a group: Double click on the Group icon; the list of the elements composing this group will be displayed.

To close the list of objects composing a group: Double click on the Group icon; the list of the elements composing this group will be closed.

i A group can be composed only of sub-groups or only of objects or of both.

i There is no limit on the number of groups and sub-groups that you can create.

i Objects and groups are always listed in alphabetical order.

Empty groups or containing only one object cannot be created.

All the objects belonging to a group must be on the same layer.

- ***Select***

Selecting an element is useful in the following cases:
Designating and identifying and element of the scene. The selected element becomes the current object and is displayed in cyan in the scene.
To select elements, proceed as follows:

❖ **Simple selection (of a single element):**

⇒ Click on the element to be selected.
The object or group name is highlighted.

❖ **Multiple selection, element by element:**

⇒ Click on the first element to be selected, the name of the object or of the group is highlighted.
⇒ Click on the other elements to be selected holding down the Control key.

❖ **Multiple selection by list:**

⇒ Click on the first element to be selected. The object or group name is highlighted.
⇒ Holding down the Shift key, click on the last element to be selected. All the elements located between those two elements in the list are selected.

❖ **Selection by name:**

Once an element is selected, AMAPI 3D allows you to find another element by name.
Enter the first few characters of the desired object's name using the keyboard. The Catalog will select the first available object whose name matches the entered string.

Selecting a group will also select all the sub–groups that are attached to it.

- ***Rename***

There are two ways to rename an object or a group:

1st method, using the popup menu:

⇒ Select the name of the element to rename.
⇒ On PC: Click the right mouse button. On Mac: Hold down the Option key and click.
⇒ Select "Rename" in the list of choices.
⇒ Enter a new name.
⇒ Validate the entry by pressing the Return key or clicking on the mouse button.

2nd method:

⇒ Select the object or the group.
⇒ Click on the name of the element.
⇒ Enter a new name.
⇒ Validate the entry by pressing the Return key or clicking on the mouse button.

⚠ There is no limit on the length of the names you use. However, if a name is longer than nine characters, it will not be displayed entirely in the Data Window.

- ***Delete***

There are different ways to delete an element (object or group):

1st method: Using the popup menu

⇒ Select the element(s) to be deleted.
⇒ On PC: Click the right mouse button. On Mac: Hold down the Option key and click.
⇒ Select "Delete" in the list of choices.

2nd method: the Delete key

⇒ Select the element(s) to be deleted.
⇒ Press the Delete key of the keyboard.

3rd method: the Trash

⇒ Select the element(s) to be deleted.
⇒ Place the cursor on top of the selection.
⇒ Press and hold down the mouse button (a hand indicates that you indeed made the selection).
⇒ Move the cursor on top of the Trash icon at the bottom of the Scene Manager.
⇒ Release the mouse button.

⚠ If you deleted a group, AMAPI 3D will delete all the elements and sub-groups contained in this group.

⚠ If you deleted objects so that there is only one object left in the group, AMAPI 3D will delete this group and the object will depend on the next lower level if there is one.

♦ ***Hide***

The Scene Manager has its own method for hiding objects.
The icon (sphere or chain) of a hidden element is displayed darker.

Using the popup menu:
⇒ Select the name of the element you want to hide (object or group).
⇒ On PC: Click the right mouse button. On Mac: Hold down the Option key and click the mouse button.
⇒ Choose "Hide" in the popup menu.

You cannot hide only a single element of a group. If you ask to hide an element of a group, AMAPI 3D will hide the entire group.

♦ ***Show***

The Scene Manager has its own method for showing hidden objects.
The icon (sphere or chain) of an un-hidden element is displayed lighter.

Using the popup menu:
⇒ Select the name of the hidden element (object or group) you want to show.
⇒ On PC: Click the right mouse button. On Mac: Hold down the Option key and click the mouse button.
⇒ Choose "Show" in the popup menu.

You cannot show only one object belonging to a hidden group. If you ask to show an object belonging to a hidden group, AMAPI 3D will show all the elements belonging to this group.

♦ ***Lock***

You can lock an object or a group. A locked object cannot be edited or moved. Of course, you can always unlock a locked element.

Using the popup menu:
⇒ Select the name of the element (object or group) you want to lock.
⇒ On PC: Click the right mouse button. On Mac: Hold down the Option key and click the mouse button.
⇒ Choose "Lock" in the popup menu. The locked object will be displayed in gray wireframe in the workspace. You will not be able to designate it as the current object.

♦ ***Unlock***

You can unlock a locked element (object or group).
Using the popup menu:
⇒ Select the name of the element (object or group) you want to lock.
⇒ On PC: Click the right mouse button. On Mac: Hold down the Option key and click the mouse button.
⇒ Choose "Unlock" in the popup menu.

♦ *Group*

You can group objects using the Scene Manager.

Creating a new group using the popup menu:
⇒ Select the object or groups to be grouped.
⇒ On PC: Click the right mouse button. On Mac: Hold down the Option key and click the mouse button.
⇒ Choose "Group" in the popup menu.

Inserting new elements in a group:
⇒ Select the element(s) to be inserted.
⇒ Press and hold down the mouse button (a hand indicates that your selection is taken into account).
⇒ Move the cursor on top of the name of the group that you want to insert the selected elements into. Release the mouse button.

Dropping a selection onto an object creates a group including the selection and the object.

A new group will be called by default "(no name)" and listed in alphabetical order in the list.

♦ *Ungroup*

The Scene Manager gives you a different way to ungroup objects.

Ungrouping a whole group:
⇒ Select the group.
⇒ On PC: Click the right mouse button. On Mac: Hold down the Option key and click the mouse button.
⇒ Choose "Ungroup" in the popup menu.

If you ungroup a sub-group, AMAPI 3D will put the elements of this sub-group directly at the root of the scene.

Taking an element out of a group:
⇒ Select the element(s) to be removed.
⇒ Press and hold down the mouse button (a hand indicates that your selection is taken into account).
⇒ Place the cursor over the name of the group to which you want to add the element or over the scene root (the element will not belong to any group).
⇒ Release the mouse button.

Releasing a selection above the name of an object creates a new group that includes this selection and this object.

♦ *Get Info*

There are two ways to get information about an object or a group:

1st method: Using the popup menu

⇒ Select the element about which you want information.
⇒ On PC: Click the right mouse button. On Mac: Hold down the Option key and click the mouse button.
⇒ Choose "Get Info…" in the popup menu.
⇒ Read the information. (You can make modifications following the instructions in the dialog box.)
⇒ Click on the "OK" button to validate any modifications you have made, otherwise click on the "Cancel" button.

2nd method (faster):

⇒ Double click on the icon of the element you want information about.
⇒ Read the information. (You can make modifications following the instructions in the dialog box.)
⇒ Click on the "OK" button to validate any modifications you have made, otherwise click on the "Cancel" button.

⚠ If you select an element that belongs to a group, AMAPI 3D gives you information about the group, not about the element itself.

♦ *Copying a selection into the Catalog*

⇒ Click on the icon of the Catalog  to open it. (See chapter " Catalog" on page 78)
⇒ In the Scene Manager, select the objects / groups to be copied.
⇒ Place the cursor on top of the selection.
⇒ Press and hold down the mouse button.
⇒ Move the cursor. (It takes the shape of a closed hand to indicate that the elements are selected.)
⇒ Position the cursor above an empty cell of the Catalog.
⇒ Release the mouse button.

♦ *Assigning a material to an object or to a group*

⇒ Click on the icon of the Catalog  to open it. (See chapter " Catalog" on page 78)
⇒ Click on the "Materials" tab.
⇒ Place the cursor on top of the material you want to assign.
⇒ Press and hold down the mouse button.
⇒ Move the cursor. (It takes the shape of a closed hand to indicate that the elements are selected.)
⇒ Place the cursor on top of the name of the object / group you want to assign the material to.
⇒ Release the mouse button.

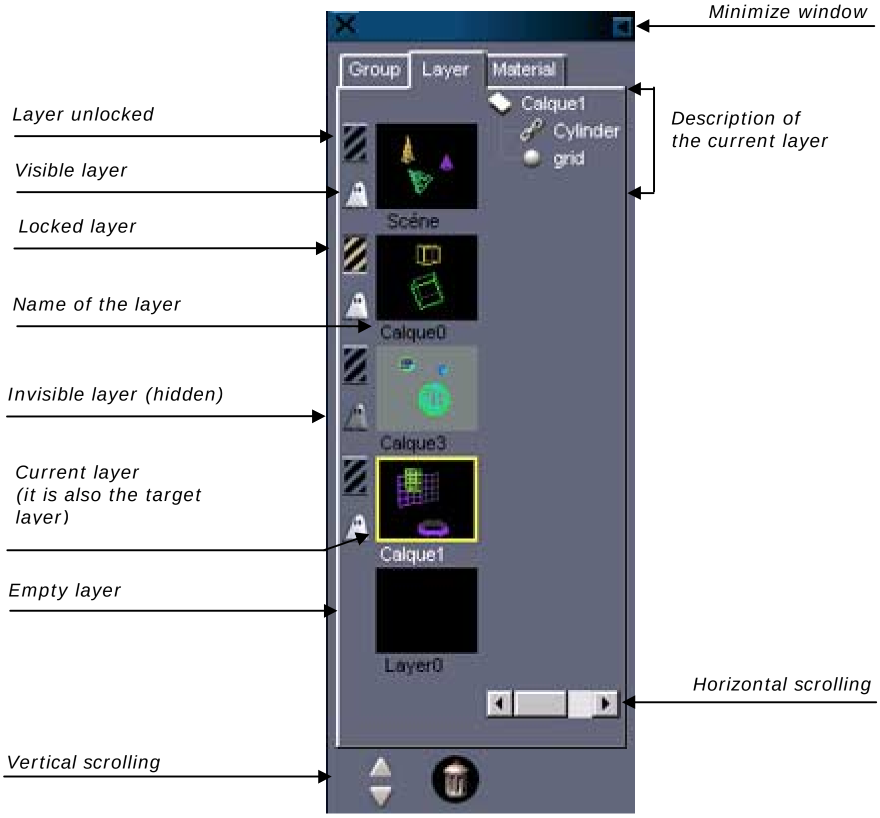
⚠ Even though nothing spectacular happened on-screen, the operation did take place. Open the "Material" tab of the Scene Manager to verify that the material was assigned to the designated elements.

❑ Classification by layer

You can mask one or several layers.
You can also lock selected layers to allow modeling only on active layers.
You can perform the following operations:

♦ ***Consult***

When you open the Scene Manager, AMAPI 3D **displays and names all the existing layers of the scene** plus an **empty layer**.
A layer can be **active (unlocked)** or **inactive (locked).**
It can be **visible (unhidden)** or **invisible (hidden).**
The **current layer** is oulined in yellow. AMAPI 3D lists the hierarchy of the elements of the current layer.
The current layer is also the **target layer**; the objects you will create will be included in this layer.



When opening the Scene Manager for the first time, AMAPI 3D sorts all the elements of the scene in a single layer called "Scene".

AMAPI 3D always organizes and displays layers in alphabetical order.

♦ *Select the current layer (and target layer)*

The current layer is outlined in yellow. AMAPI 3D lists the details of the hierarchy of the elements of the current layer.
To display the contents of a layer:
⇒ Click on the thumbnail of the corresponding layer (it becomes the current layer).

The current layer also becomes the **target layer:** objects that you create subsequently will be included in this layer.

⚠ If you select a layer to check its contents, it becomes the current layer. So, before doing any further modeling, make sure that the current layer is the correct one.

♦ *Editing an element of a layer*

AMAPI 3D lists the contents of the current layer. You can perform various different operations on the elements listed. You can rename them, delete them, hide or show them, lock and unlock, copy them into the Catalog, get information and assign a material to a selection.
The procedure is the same as described previously for classification and management by groups (see the corresponding paragraphs).

♦ *Renaming a layer*

There are two ways to rename a layer:

1st method: Using the popup menu

⇒ Select the layer to rename. (It becomes the current layer and AMAPI 3D lists its contents.)
⇒ Click on the layer's name (the root).
⇒ On PC: Click the right mouse button. On Mac: Hold down the Option key and click the mouse button.
⇒ Choose "Rename" in the popup menu.
⇒ Enter a new name.
⇒ Press the Return key to validate or simply click the mouse button.

2nd method:

⇒ Select the layer to rename. (It becomes the current layer and AMAPI 3D lists its contents.)
⇒ Click on the layer's name (the root).
⇒ Click again on the name of the layer.
⇒ Enter a new name.
⇒ Press the Return key to validate or simply click the mouse button.

♦ *Deleting a layer*

⇒ Select the layer to be deleted. (It becomes the current layer and AMAPI 3D lists its contents.)
⇒ Press the "Delete" key. The layer and its content are deleted.

⚠ AMAPI 3D does not allow empty layers. It deletes them automatically.

- ## ***Hiding a layer***

A visible layer has a white ghost icon at its left and its thumbnail has a black background.
To make all the elements of a layer invisible, you need to hide the layer:

⇒ Click on the icon at the left of the layer. It is grayed and the background of the thumbnail becomes lighter indicating that the layer is hidden (and thus invisible).

It is possible to hide a single element of a layer (see paragraph "Editing an element of a layer" on page 122).

- ## ***Showing" (unhiding) a layer***

A hidden layer has a gray ghost icon at its left and its thumbnail has a clear background.
To make all the elements of a layer visible again, you need to "Show" the layer:

⇒ Click on the icon at the left of the layer. It becomes white and the background of the thumbnail becomes darker to indicate that the layer is now visible.

It is possible to unhide ("show") a single element of a layer (see paragraph "Editing an element of a layer" on page 122).

- ## ***Locking a layer***

The icon at the left of the layer indicates that it is unlocked: the elements in this layer can be edited.
To make all operations impossible on all the elements of a layer, you must to lock the layer:

⇒ Click on the icon at the left of the layer. It changes color, indicating that the layer and its elements are now locked. Locked elements are displayed in brown.

It is possible to lock a single element of a layer (see paragraph "Editing an element of a layer" on page 122).

- ## ***Unlocking a layer***

The icon at the left of the layer indicates that it is locked: elements included in this layer cannot be edited.
To be able to edit those elements once again, you must unlock the layer:

⇒ Click on the icon at the left of the layer. It changes color, indicating that the layer and its elements are now unlocked.

It is possible to unlock a single element of a layer (see paragraph “editing an element of a layer” on page 122).

♦ ***Moving elements from one layer to another***

⇒ Select the layer containing the element(s) to be moved. (It becomes the current layer and AMAPI 3D lists its contents.)
⇒ In the hierarchy, select the element to be moved.
⇒ Place the cursor on the selection.
⇒ Press and hold down the mouse button.
⇒ Move the cursor (a hand indicates that the selection is taken into account).
⇒ Place the cursor on top of the target layer.
⇒ Release the mouse button. The selection is added to the contents of the target layer.

If you drop the selection in the empty layer, AMAPI 3D will automatically create a new empty layer.

AMAPI 3D does not allow empty layers. It deletes them automatically.

It is impossible to move an object belonging to a group to a different layer.

♦ ***Assigning a material to a layer***

⇒ Select the layer. (It becomes the current layer and AMAPI 3D lists its contents.)
⇒ Click on the icon to open the Catalog. (See chapter “ Catalog” on page 78.)
⇒ Click on the Materials tab.
⇒ Place the cursor on top of the material you want to use.
⇒ Press and hold down the mouse button.
⇒ Move the cursor (a closed hand indicates that the selection is taken into account).
⇒ Place the cursor above the root of the of the layer you want to assign the material to.
⇒ Release the mouse button.

Even though nothing spectacular happened on-screen, the operation did take place. Open the “Material” tab of the Scene Manager to verify that the material was assigned to the selected elements.

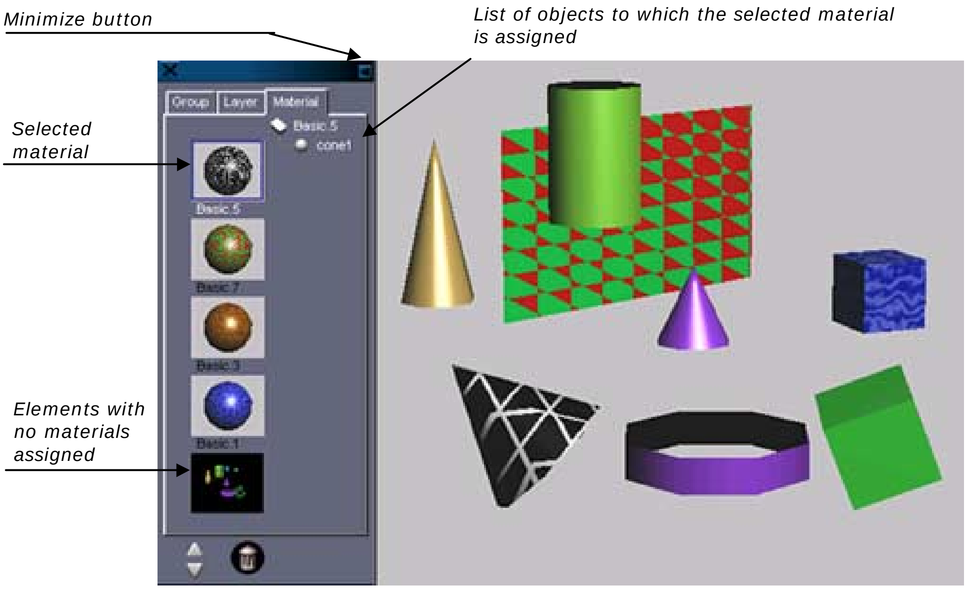
❑ Classification by material

The Material tab of the Scene Manager is a tool for managing materials.

♦ Consult

When you open the Material tab of the Scene Manager, AMAPI 3D displays all the materials used in the scene. Each material is displayed applied to a sphere. When you select a material, AMAPI 3D displays the list of elements to which this material is applied.

⚠ Since a group can contain objects to which different materials are assigned, the classification by layer cannot take into account the notion of groups.



ℹ AMAPI 3D always lists materials in alphabetical order.

You can perform the following operations:

♦ Select a material

To display the names of objects to which a given material is applied:
Click on the thumbnail depicting the material of interest. It becomes the current material.

- ## *Editing elements that use the same material*

AMAPI 3D displays the list of the elements to which the material is assigned. You can perform different operations:
Rename the objects, delete them, hide and unhide them, lock and unlock them, copy them into the Catalog, get information about them, copy a selection into the Catalog or assign a different material to the selection.
The procedure is the same as the one described for classification and management by groups (see the corresponding paragraph).

- ## *Renaming a material*

There are two ways to rename a material:

1st method, using the popup menu:

⇒ Select the material you want to rename. (It becomes the current material and AMAPI 3D displays the list of objects to which this material is assigned.)
⇒ Click on the material name.
⇒ On PC: Click the right mouse button. On Mac: Click the mouse button while pressing and holding down the Option key.
⇒ Select "Rename" in the popup menu.
⇒ Enter a new name.
⇒ Press the Return key to validate or click the mouse.

2nd method:

⇒ Select the material you want to rename. (It becomes the current material and AMAPI 3D displays the list of objects to which this material is assigned.)
⇒ Click on the material name.
⇒ Click on the material name again.
⇒ Enter a new name.
⇒ Press the Return key to validate or click the mouse.

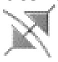
- ## *Delete*

⚠ You cannot delete a material using the Scene Manager.

- ## *Changing the material assigned to an object*

⇒ Select the material currently assigned to the object. (It becomes the current material and AMAPI 3D lists all the objects to which it is assigned.)
⇒ In the list, select the element(s) to move.
⇒ Place the cursor over the selection.
⇒ Press and hold down the mouse button.
⇒ Move the cursor (a closed hand indicates that the selection is taken into account).
⇒ Place the cursor over the target material.
⇒ Release the mouse button.

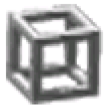
♦ ***Replacing a material with a different one***

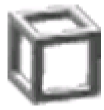
⇒ Select the material to be modified. (It becomes the current material.)
⇒ Click on the  icon to open the Catalog. (See chapter " Catalog" on page 78)
⇒ Click on the Material tab.
⇒ Place the cursor above the new material in the Catalog.
⇒ Press and hold down the mouse button.
⇒ Move the cursor (a closed hand indicates that the selection is taken into account).
⇒ Place the cursor on top of the root of the current material.
⇒ Release the mouse button.

5.4.3 Backface culling

This tool is used to toggle between two types of visualization mode of the scene:

- *Standard Wireframe visualization*
- *Backface Culling visualization: Only facets whose normals are oriented toward the user's eye are visible. You will visualize your model in a more realistic manner.*


Wireframe

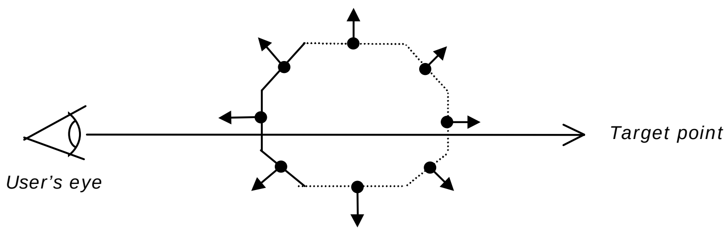

Backface Culling

The icon displayed in the Control Panel indicates the current visualization mode.

There is a third visualization mode: Hidden Lines mode. This mode displays only edges which would be visible (even partially) to the user's eye if the objects' facets were not transparent.
This display mode is much slower than the Backface Culling mode. It can take several minutes to process complex scenes, but it provides a realistic representation of the model.
This visualization mode is accessible as an option in the Printing Parameters. *(See chapter " Preferences / Printing" on page 443.)*

Usage:

1. **Selecting Backface Culling mode**
   Click on the icon depicting the Backface Culling tool in the Control Panel.
   AMAPI 3D displays a wireframe representation of the model where only the front faces are visible – i.e., only faces whose normals are oriented toward the user's eye are visible.

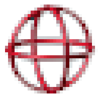


This representation can sometimes be somewhat unrealistic, especially for open or convex objects. However, it provides faster display speed and allows the user to view the model without the backfaces.

You can navigate around the scene with this display mode selected and print the scene.

2. **Ending the tool action**
   Click on the icon depicting the Backface Culling tool in the Control Panel.

5.4.4 Simplified display



You can request a simplified display of your objects. Complex objects will be clearer and the display speed faster.
You can choose between a simplified display for the whole scene (Global) and a simplified display for one or several objects in the scene (Local).

- The different types of simplification

♦ ***By default***

If you have not specified the simplification type of an object, AMAPI 3D will assign it a default simplification type:
- NURBS surfaces will be displayed by their characteristic lines.
- Objects that can be re-edited with the Dynamic Geometry will be displayed by their outline, based on the control curves.
- The other objects will be displayed by their cut profiles: 1 on X, 1 on Y, 1 on Z.

♦ ***Never***

No simplification at all.

♦ ***By 1 cut (intersecting plane)***

1 cut on X, 1 on Y and 1 on Z.

♦ ***By 2 cuts (intersecting planes)***

2 cuts on X, 2 on Y and 2 on Z.

♦ ***By 3 cuts (intersecting planes)***

3 cuts on X, 3 on Y and 3 on Z.

♦ ***By decimation***

- (See chapter « Decimate » on page 306)

- Switch to the simplified display mode

In the ControlPanel, the "Display Simplification" icon allows you to shift between a "simplified" display and an "unsimplified" display.

♦ ***Simplified display mode***

AMAPI 3D displays all the objects using the simplification type assigned to them. If you have not specified a simplification type for the objects, AMAPI 3D will assign the "default" simplification to them.

♦ ***Non-simplified display mode***

- All the objects for which the display type has not been specified will be displayed in "unsimplified" display mode.
- All the objects for which the display type has been specified will remain displayed in "simplified" display mode.

- Specify the object 's simplification type

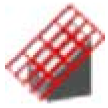
You can simplify the display of a selected object in a scene. This operation can be done through the "Get info" tool in the Control Panel. See chapter "Get info" on page 149.

5.4.5 Working plane

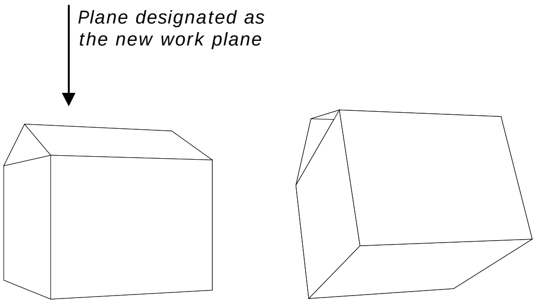
This tool is used to temporarily change the working plane to a plane other than the standard planes.

You will define this new working plane using the Working Plane tool.

Conventional work plane



Customized work plane



Conventional work plane *Customized work plane*

Usage:

1. Select the Working Plane tool  **.**
Click on the icon depicting the Working Plane tool in the Control Panel.

2. Select the new working plane.
You have two choices. Take the selection accessory corresponding to the desired action:

 To select a facet of an object of the scene as the new working plane.

 To select three points of the scene as the new working plane.

See "How to select a selection accessory?" on page 104
Then select the facet or points to specify the new working plane.

AMAPI 3D will rotate the entire geometry so that the new working plane merges with the nearest orthogonal plane. You can then drop the Working Plane tool and use another tool to work in this new working plane.

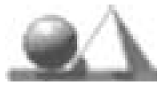
3. Continue to work in this new work plane.

4. Switching back to the conventional work plane. 
Click on the Working Plane icon to switch back to the conventional work plane.
The geometry is rotated to its original position and the working plane returns to the usual one.

Practical Exercises:
- An acoustic baffle / Punch the loudspeaker's hole / Step 1
- An acoustic baffle / The Loudspeaker / Step 3

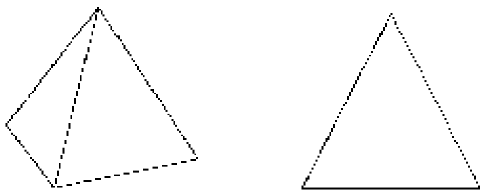
5.4.6 Perspective

This tool is used to toggle between ***perspective*** *and* ***orthographic*** *viewing.*
The icon of the Control Panel indicates the current display mode.
You can work with all of the AMAPI 3D tools no matter which mode is selected.



Orthographic view

Perspective view



Usage:

1. **Selecting the Perspective tool.**
   Click on the icon depicting the Perspective tool in the Control Panel.
   The view is instantly modified to a 2D orthographic view (view perpendicular to the main planes).

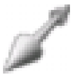
2. **Continue the work with this display mode selected.**
   You can see your scene only from the top, left, right, front or rear views. The arrow keys are inoperative in orthographic view mode.

3. **Click again on the Perspective view tool to return to the normal perspective view.**

5.4.7 The views

AMAPI 3D allows you to work on your models from any point of view and it provides tools to rotate around the scene, zoom in and out, and so forth. (See chapter “View” on page 89.) You can access some of these features through the Control Panel.

- To zoom

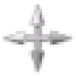


The first icon allows you to zoom in or out from the scene. Click on the icon and hold down the mouse button, moving the cursor upward or downward. You will get the same result as using the “3” and “.” keys of the keyboard. Release the mouse button when the correct view is displayed.

- To rotate the scene

The second icon allows you to **rotate around the scene**. Click on the icon and hold down the mouse button. Move the cursor and the scene will rotate step-by-step around a point which by default is the center of the scene. See chapter “ Point of view (Eye – Target point)” on page 134. Release the mouse button when the correct view is displayed.

- To pan the scene



The third icon allows you to **scroll the scene from side to side.**
Click on the icon and hold down the mouse button. As you might expect, moving the cursor upward scrolls the scene upward, moving the cursor downward scrolls the scene downward and moving sideways scrolls the scene sideways. Release the mouse button when the correct view is displayed.

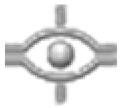
- See all

Either click on the icon in the Control Panel or press the “0” key of the numeric keypad to use this command.
The “See detail” will display the whole scene and all of its objects.

- See detail

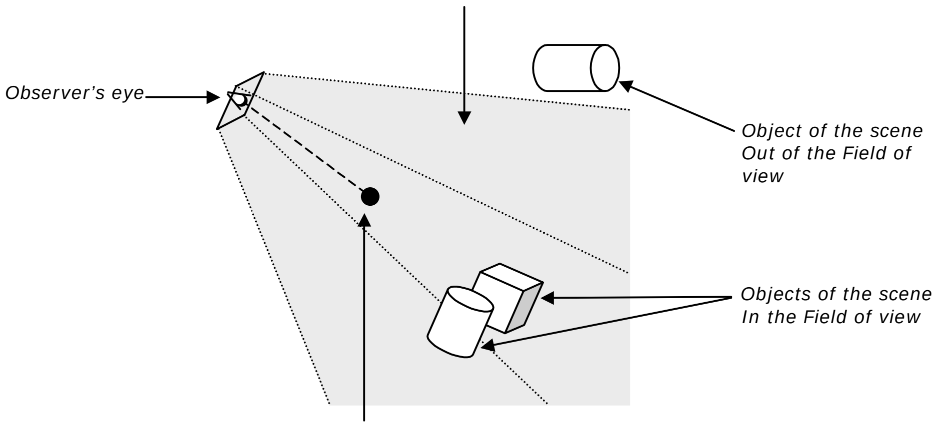
Use “See detail” to define an area of the scene you want to zoom in on.
How do you use it?
Select the “See Detail” tool (the “1” key or the icon in the Control Panel).
A white rectangle with an X at its center is displayed.
Place the cursor at the center of the area you wish to zoom into and click.
Drag the cursor to increase or decrease the size of the window.
Click when the whole area you want to zoom into is inside the boundaries of the white rectangle. The area contained in the white rectangle will replace the previous view on your screen.

5.4.8 Point of view (Eye – Target point)

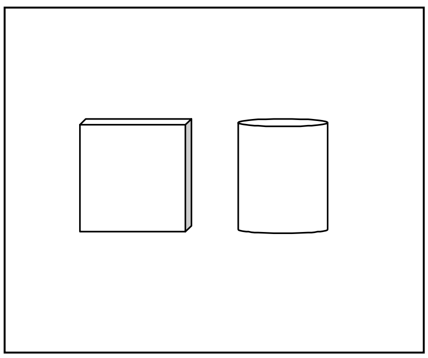


The point of view *is what the user can see. The point of view is defined by the position of the observer's* ***eye****, and a* ***target point*** *defining the eye direction and the field of view.*
You will be able ***to save the current point of view*** *and recall it again later to look at the scene under the same conditions.*

- *See "Position of the Point of View and/or the eye" on page 135.*
- *See "Saving the current point of view" on page 136.*
- *See "Saving the current point of view" on page 136.*
- *See "Deleting a point of view" on page 137.*



Target Point definition



Point of View

Position of the Point of View and/or the eye

THE EYE *is the point from which the scene is viewed. You can modify the Eye position using the navigation icon or the keys described in the paragraph The Views. AMAPI 3D also lets you specify the position of the observer's eye precisely using the Eye tool.*
THE TARGET POINT *is the point toward which the eye looks.*
The Target Point is also the center of rotation of the scene (when you rotate the scene to change point of view).
It is also the center point for zooming the scene in and out.
The Target Point is set using the point selection accessory tool.
If the scene is empty, AMAPI 3D sets the Target Point over the center of the table. However, you can specify a different position for it if you want (see how in the "Usage" paragraph below).
AMAPI 3D specifies the position of the Target Point automatically in the following cases:

- *"See Detail" (see chapter " See Detail" on page 89): The Target Point is at the center of geometry of the detail.*
- *"See All" (see chapter " See All" on page 89): The Target Point is at the center of geometry of the scene.*
- *"Pan the scene" (see chapter "to pan the scene" on page 93): The Target Point is moved laterally with the scene.*

Usage:

1. **Tool Selection.**
   Click on the icon depicting the tool in the Control Panel.
   This tool allows you to modify the Target Point and/or the Observer's Eye position. AMAPI 3D provide a selection accessory for each of them.

2. **Select the appropriate selection accessory.**
   Take the selection accessory corresponding to the action:
   To modify the Target Point position.
   To modify the observer's eye position.
   See "How to select a selection accessory?" on page 104.

3. **Positioning the "Target Point" or the "Observer's Eye".**
   The Data Window on the bottom left of the screen displays the current coordinates of the point you are moving. Several ways are available:
   - **Mouse positioning**: Move the cursor, then click (see details on page 109).
   - **The keyboard** (see chapter "The keyboard" on page 109).
     Two methods are available:
     - Using the Tab key .
     - Clicking in the Data Window.

   You can repeat this step as many times as you need to set the scene the way you want.
   Go back to step 2 to take another selection accessory, or go to the next step to end the action of this tool.

4. **Ending the tool action.**
   End the action by putting the tool aside or validate. See chapter "How do you end a tool action?" on page 158.

Saving the current point of view

If you think to use frequently a point of view, you may save it to allow you to recall it at any time.

Using the « Point of View » tool :
1. You will tune the current AMAPI 3D view like you will want to save it (use the navigation icons, the arrow keys or the eye and the target point position, like described above).
2. When you will be satisfied of the point of view, place the mouse cursor on the « Point of View » icon in the Control panel.
3. PC : Click on the mouse right hand button. Mac : Press and hold the Option key, then click. The point of view and cameras list will be displayed.
4. Click on: « new » to save the current point of view. AMAPI 3D saves the point of views with the name « view » followed by a creation number.

Using the keyboard shortcut :
1. You will tune the current AMAPI 3D view like you will want to save it (use the navigation icons, the arrow keys or the eye and the target point position, like described above
2. When you will be satisfied of the point of view, PC : press on Ctrl+« Enter ». Mac : press on Ctrl+« Enter ». The current point of view will be saved. AMAPI 3D saves the point of views with the name « view » followed by a creation number.

The point of views are saved as hidden cameras in a reserved layer (" Classification by layer" on page 121). You may make them visible or not.

Recalling a point of view

You can recall a point of view using either the "Point of View" tool or using a keyboard shortcut:

Using the Point of View tool:
1. Drag the cursor on top of the Point of View icon button in the Control Panel.
   On PC: Click the right mouse button.
   On Mac: Press the Option key and simultaneously click the mouse button.
   The list of the different points of view and cameras appear.
2. Drag the cursor on top of the point of view or camera name you want to recall and click the mouse button. AMAPI 3D automatically display the scene seen from the selected point of view.

Using the keyboard shortcut:
Use the following key combinations:
- Ctrl+0 to watch the scene from the first point of view of the list.
- Ctrl+1 to watch the scene from the first point of view of the list.
- Etc.

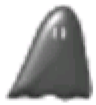
The cameras are the tools used to set the Point of View. (See chapter "The Cameras" on page 396) As you may need to view the scene from one of them, they are also listed in the point of view list.

- Deleting a point of view

Proceed as follows to delete a saved point of view:

1. The point of view you want to delete must be the current point of view. (See above paragraph Recalling a point of view).
2. Drag the cursor on top of the Point of View icon button in the Control Panel.
3. On PC: Click the right mouse button. On Mac: Press the Option key and simultaneously click the mouse button.
4. Click on "Delete" to delete the point of view from the list.

5.4.9 Hide-Unhide



Use the Hide tool to make elements of the scene invisible, use the Unhide tool to have them reappear again.
You can Hide or Unhide elements in AMAPI 3D according to specific criteria using the Scene Manager (by object, group, layer or material). (See chapter "The Scene Manager" on page 114).
Those commands can be useful for temporarily hiding elements that are obstructing your view of other elements of the scene. They are also used to store (invisibly) construction curves used to create objects (extrusion curves, for instance).

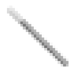
The Workbench and the Grid can also be hidden if necessary. (They can be permanently hidden: see chapter "Preferences / Interface / Work space" on page 439).

- Hide (PC: Ctrl+H; Mac: Command+H)

Usage:

1. **Select the Hide tool.** 
Click on the icon depicting the Hide tool in the Control Panel.
The cursor is displayed as a small gray "ghost".

2. **Selecting the elements to hide.**
Take the appropriate selection accessory corresponding to the action. If necessary, see chapter "How to select a selection accessory?" on page 104. Then select the objects following the directions for use of the accessory you are selecting.

Available selection accessories		Usage
	The Wand (default accessory) is the selection accessory for selecting one object at a time.	Click on the object.
	The group-of-objects selection accessory	Surround by successive clicks the objects you want to select, then validate by pressing the "Enter" key.

Each selected element turns white.

3. **Ending the tool action.**
Validate or put the tool aside to end the action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

4. **The selected elements disappear from the scene.**

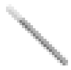
Press return after selecting the tool to have the whole scene disappear. This operation can be reversed (see paragraph Use of the Unhide tool).

- Unhide (PC: Ctrl+Y; Mac: Command+Y)

Usage:

1. Select the Unhide tool. 
Click on the icon depicting the Unhide tool in the Control Panel.
The cursor is displayed as a small white "ghost".
The scene displays only the previously hidden objects.

2. Select the elements to unhide.
Take the appropriate selection accessory corresponding to the action. If necessary, see chapter "How to select a selection accessory?" on page 104. Then select the objects following the directions for use of the accessory you are selecting.

Available selection accessories		Usage
	The Wand (default accessory) is the selection accessory for one object at a time.	Click on the object.
	The group-of-objects selection accessory.	Surround by successive clicks the objects you want to select, then validate by pressing the "Enter" key.

Each selected element turns white.

3. Ending the tool action.
Validate or put the tool aside to end the action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

4. The main scene reappears.
The unhidden elements are at the exact same location they occupied before being hidden

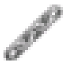
Press return after selecting the tool to have all the hidden elements reappear.

5.4.10 Group-Ungroup

Use the Group tool to make one or more objects behave as a single object. Unlike the Weld tool, this association can be reversed.
By grouping objects or groups of objects together, you can organize your scene hierarchically. AMAPI 3D provides a tool specifically dedicated to group and sub-group management: the Scene Manager (see chapter “The Scene Manager” on page 114).
The Ungroup tool will ungroup the objects in a group.

- Grouping (PC: Ctrl+G; Mac: Command+G)

Usage:

1. **Selecting the Group tool.** 
   Click on the icon depicting the Group tool in the Control Panel.
   The object selection accessory  cursor appears.

2. **Selecting the objects to group.**
   Take the appropriate selection accessory corresponding to the action. If necessary, see chapter “How to select a selection accessory?” on page 104. Then select the objects following the directions for use of the accessory you are selecting.

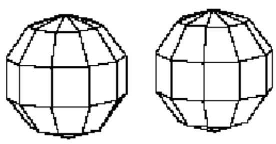
Available selection accessories	Usage
 The Wand (default accessory) is the selection accessory for selecting one object at a time.	Click on the object.
 The group-of-objects selection accessory.	Surround by successive clicks the objects you want to select, then validate by pressing the “Enter” key.

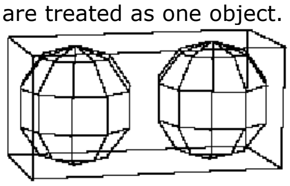
   The selected elements are grouped and are displayed in cyan.

3. **To create another group, repeat step 2.**

4. **Ending the tool action.**
   Validate the action to end it or put the tool aside. See chapter “How do you end a tool action?” on page 167.

After this operation the objects are grouped. They are treated as one object.





This operation can be reversed. See the Ungroup tool below.

You can also group the objects of a scene without selecting the tool.

⇒ Using the object selection accessory , select the first element of the group.
⇒ Press the Shift key and do not release it.
⇒ Click on the other objects you want to group.
⇒ Release the Shift key.

Practical exercises:

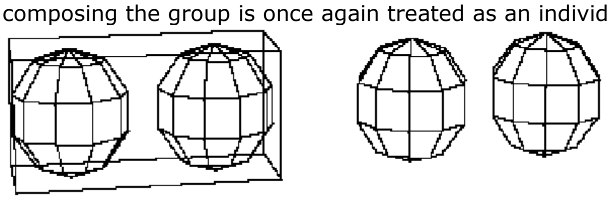
- A tiled floor / Create geometric shapes / Step 8

❑ Ungroup (PC: Ctrl+U; Mac: Command+U)

Usage:

1. Select the Ungroup tool.
Click on the icon depicting the Ungroup tool in the Control Panel.
Existing groups will be displayed surrounded by a white cube in the scene.
the object selection accessory appears.

2. Selecting the groups to be ungrouped.
Select with the object selection accessory , clicking on the left mouse button each group to be ungrouped.
Each object composing the group is once again treated as an individual object.



If you ungroup a group made up of sub-groups, those sub-groups will be displayed surrounded by a white cube when you destroy the master group. You will then be able to ungroup those sub-groups.

3. the action.
Validate the action to end it or put the tool aside (depending on the interface). See chapter "How do you end a tool action?" on page 158.

You can also use the following keyboard shortcut to ungroup a group:

⇒ Using the object selection accessory , select the group.
⇒ Press the Shift key and simultaneously click on the element you want to ungroup.
Release the Shift key.

Entering and leaving a group

If you want to momentarily work on an element that is part of a group but without having to ungroup and then re-group it, you can use the "Enter and leave a group" mode.

To enter a group:

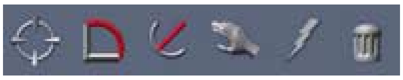
1. With no tool selected, place the cursor above the group.
2. Place the cursor above the group tool icon or above the Ungroup tool icon in the Control Panel.
3. Then, on PC: Click the right mouse button.
4. On Mac: Holding down the Option key, click the mouse button.
5. In the popup menu, select: "Go in group" and release the mouse button. The group will be momentarily ungrouped allowing you to work separately on the elements that are part of the group. (The other elements of the scene will be hidden during the operation.)

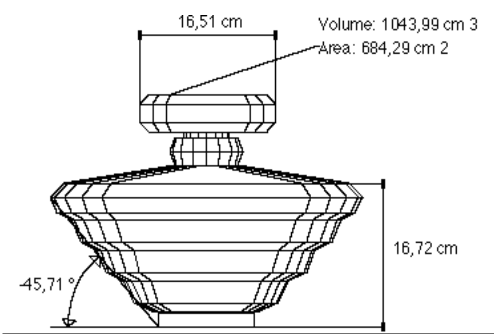
Leaving a group:

1. With no tool selected, place the cursor above the Group tool icon in the Control Panel. Then, on PC: Click the right mouse button. On Mac: Holding down the Option key, click the mouse button.
2. In the popup menu, select: "Go out of the group". The group will be re-created once again and the whole scene will reappear.

5.4.11 Measurements

Use the Measurements tool to display an object's dimensions. You can display three types of dimensions with AMAPI 3D: ***length, angle, and volume / surface / circumference.***
You can also move the dimensions around or delete them.
Those features are available in a sub-palette of the Measurements tool.





Dimensions are kept as long as the topology of the object is not modified. If the topology is modified, a message will warn you that the dimensions will be discarded.

Dimensions are saved along with the file and can be accessed during another session.

The measurement of the distance between two points is done using the Bullseye.
The distance measured will be the absolute distance between two points, or the distance between their projections on a vertical axis, or the distance between their projections on a horizontal axis.

Usage

1. **Select the Measurements tool** 
   Click on the icon depicting the tool in the Control Panel.

2. **Select a Measurement accessory.**
   You must select the accessory corresponding to the measurement you want to perform (the icon of the desired accessory must follow the movement of the mouse cursor). If this is not the case, there are two ways to get the right accessory:
   - Select it in the measurement tool palette.
   - Or faster. On PC: By clicking the right mouse button. On Mac: Press and hold the Option key, and click on the mouse.

For more information about the selection accessories, see chapter "How to select a selection accessory?" on page 104.

Accessories list	
Measure distance	Go to step 3.1
Measure angle	Go to step 3.2
Measure circumference / volume / area	Go to step 3.3
Position a measurement	Go to step 3.4
Delete a measurement	Go to step 3.5
Delete all measurements	Go to step 3.6

3. Measurement.

3.1 Distance measurement

Selecting the two points you want to measure the distance between.

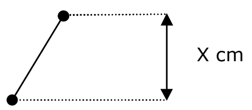
⇒ Click as close as possible to the point you want to select because the Bullseye tool automatically selects the nearest point.

The first distance displayed is the larger of two possible distances:

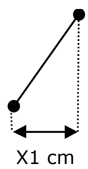
- Distance between the points' projections on the vertical axis (in green).
- Distance between the points' projections on the horizontal axis (in red).

⇒ Press the spacebar to display the shortest distance.

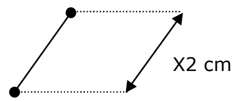
⇒ Press the spacebar again to display the absolute distance (in white).



Distance between the points' projections on the vertical axis



Distance between the points' projections on the horizontal axis



Absolute distance between the two points

Then go to step 4.

3.2 Measuring angles

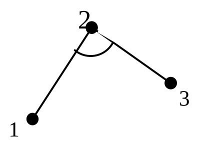
Selecting the angle.

⇒ Click on the end of a segment of the angle.

⇒ Click on the vertex of the angle.

⇒ Click on the end of the other segment of the angle.

The angular dimension is displayed near the vertex of the angle.



Then go to step 4.

3.3 Measuring circumference / volume / area

An object made from NURBS curves is not closed, It's not possible to get the volume mesurement. However, you can convert the object to Polygonal mode to get it.

If the object is…		AMAPI 3D displays…
A closed volume	⇒	A volume
	⇒	An area
An open volume	⇒	Circumference (The sum of the openings' perimeters)
	⇒	An area
A 3D surface	⇒	Circumference (The perimeter)
	⇒	An area
An open or closed curve	⇒	Circumference (A length)

Then go to step 4.

3.4 Positioning the dimension.

Drag the cursor to the desired location and click the mouse button.
Then go to step 4.

3.5 Deleting a dimension

Click on the dimension to be deleted.
The dimension disappears and is no longer attached to the scene.
You can go back to step 2, or go to step 5 to end the action of the tool.

3.6 Deleting all the dimensions

All the dimensions disappear and are deleted from the current scene. You can go back to step 2, or go to step 5. to end the action of the tool.

4. Positioning the dimension.

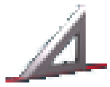
Move the cursor to correctly position the dimension, then release the mouse button.
You can go back to step 2 , or go to step 5 to end the action of the tool.

5. Ending the tool action.

Validate to end the action or put the tool aside. See chapter "How do you end a tool action?" on page 158.

Practical exercises:
- A tiled floor / Create geometric shapes / Step 7

5.4.12 Constraints palette



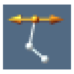
With this palette, you can constrain your cursor to move only along a specified axis. Here are the possible axes:

- *horizontal, passing through the last point drawn.*
- *vertical, passing through the last point drawn.*
- *passing through the last point drawn and a specified point.*
- *passing through the last point drawn and parallel to a specified edge.*
- *passing through the last point drawn and perpendicular to a specified edge.*
- *horizontal, passing through a specified point.*
- *vertical, passing through a specified point.*

Usage:

1. Display the Constraints palette.
⇒ Click on the icon depicting the Constraint tool in the Control Panel.

2. Apply the constraint.
⇒ Click on the icon depicting the constraint you want to apply to your cursor movement.
⇒ Depending on the constraint type that you select, you many need to specify a point or an edge, as follows:

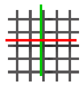
Icon	Constraint type	Click on
	Free moving: Disable the constraint effect by clicking on the "free moving" icon.	
	Moving along a horizontal axis passing through a point "P" to be specified.	The point "P"
	Moving along a vertical axis passing through a point "P" to be specified.	The point "P"
	Moving along an axis passing through the last point drawn and a point "P" to be specified.	The point "P"
	Moving along an axis passing through the last point drawn and parallel to an edge "S" to be specified. The default is the last drawn edge.	The edge "S"
	Moving along an axis passing through the last point drawn and perpendicular to an edge "S" to be specified. The default is the last drawn edge.	The edge "S"

The specified constraint is immediately applied to the cursor. You can repeat step 2.

3. Action.
Click when the cursor is at the desired position.
The constraint is disabled and the cursor can move freely again. If you need to apply a constraint again, return to step 2.

5.4.13 Magnetization

This icon (toggle) allows you to choose whether you want the cursor to be magnetized or not. Magnetization is sometimes referred to as "grid snap" or "snap to" in other graphics programs.



- A non-magnetized cursor will move freely in the scene.
- A magnetized cursor will be snapped to the gridpoints of a virtual grid which is defined by the tick marks along the scene axes.

You can specify the grid interval (step size). See " Preferences / Units" on page 441.

5.4.14 Editing Materials (PC: Ctrl+L; Mac: Command+L)

Click on this icon to open the Material Editor. See chapter "Material Editor" on page 353.
A MATERIAL *determines the appearance of the surface of an object. It is described by one or several layers:* ***the uniform level zero layer*** *and* ***a superposition of upper level layers*** *(textures or mapping). The upper level layers can interact with the characteristics of the zero level layer.*

5.4.15 Get Info (PC: Ctrl+I; Mac: Command+I)

Use the Get Info command to obtain information (about the current object, lught and cameras) and edit it. Double clicking on the current object will also open the Information window.

- Object

Usage:

1. **Selecting the object.**
   Using the object selection accessory , click on the object of interest. The selected object becomes the current object.

2. **Selecting the Get Info tool.**
   Click on the icon depicting the Get Info tool in the Control Panel.
   A window displaying the following information is opened:
   - **Type**: Volume (closed surface), surface, open or closed curve, group of elements. It is specified if your model is a NURBS model, but not if it is a polyhedral one. (See chapter "Polygonal and NURBS drawing modes" on page 153).
   - **Name:** Click on the name and enter a new one if you want to. Press the Return key to validate.
   - **Number of points, edges, and faces**.
   - **Dimensions** along X, Y, and Z.
   - **Remove smoothing:** With this button, you can remove the smoothing (if not generated) of the object. (See chapter "Smooth" on page 276.)
   - **Remove animation information**
   - **Triangulate curved faces**: Click on this button to convert curved faces into a series of (planar) triangular faces.
   - **Triangulate N-sided faces** (with more than 4 points) *****: Click on this button to convert N-sided faces into a series of (planar) triangular faces.
   - **Triangulation algorithm**: This dialog box will allow you to select a triangulation algorithm which will be used for the rendering computation and in the above triangulations.
     AMAPI 3D provides the following choices:
     1st algorithm: fast
     2nd algorithm: better quality, but slower than above
     3rd algorithm: trivial
   - **Remove coplanar faces *:** Click on this button to remove coplanar faces.
   - **Remove confused points *:** Click on this button to remove the confused (degenerate) points.
   - **Convert to Polyhedral:** Click on this button to transform a NURBS model to a Polygonal one (See chapter "Polygonal and NURBS drawing modes" on page 153).
   - **Convert to mesh:** Click on this button to remove the construction curves (Dynamic Geometry).
   - **Simplification:** You can request a simplified display of the objects. A complex object will seem less complicated and the display time will be shorter.
     Select the simplification type you prefer:
     - By default
     - Never
     - By 1 cut (1 cut on X, 1 on Y and 1 on Z)
     - By 2 cuts (2 cuts on X, 2 on Y and 2 on Z)

- By 3 cuts (3 cuts on X, 3 on Y and 3 on Z)
- By decimation (See chapter « Decimate » on page 306)

For more information about this subject, see chapter "Simplified display" on page 129.

- **Modify the normals** Click to "orient the normals" to display or modify the facet normal vectors. See chapter "Orienting the normals" on page 348.

3. Ending the tool action

Click on the "OK" button when satisfied with the modifications made, or click on the "Cancel" button to go back to the original settings.
The dialog box will be closed and you can continue your work.

* This action deletes the Dynamic Geometry of the object. You will no longer be able to edit this object using the features of Dynamic Geometry.
For more information see chapter "Dynamic Geometry" on page 155.

Lights

See chapter " Setting the lights / Using the information box" on page 393.

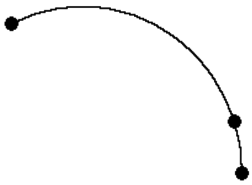
Cameras

See chapter " Setup of the cameras" on page 397.

6 Objects

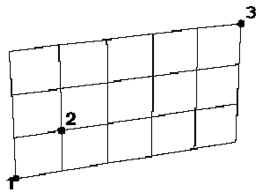
6.1 The basic shapes

AMAPI 3D distinguishes three types of shapes:



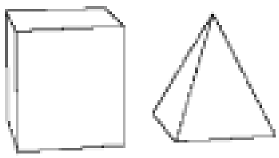
CURVES

Curves are made up of a set of points. They can be 2D or 3D. Arcs, rectangles, polylines, and NURBS curves are examples of curves.



SURFACES

Surfaces are made up of facets. They can be can be 2D or 3D. For example, tubes and plane surfaces are surfaces.

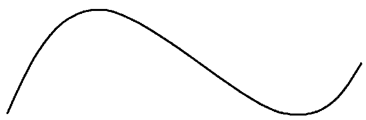


VOLUMES

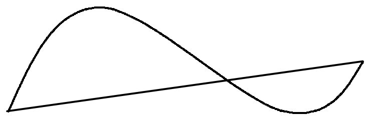
Volumes are defined as closed surfaces. For instance, spheres, cubes, and pyramids are volumes.

6.2 Open shapes / Closed shapes

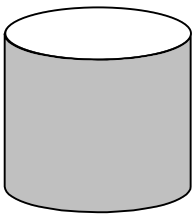
Here is the difference between open shapes and closed shapes:



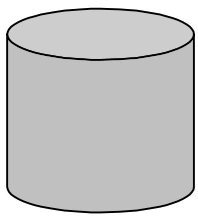
Open curve



Closed curve



Open volume
An open volume may have one or more openings



Closed volume

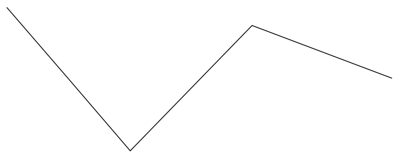
6.3 Polygonal and NURBS drawing modes

6.3.1 Definition

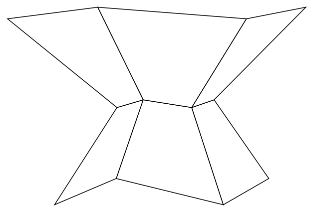
AMAPI 3D supports two drawing modes:

- **Polygonal mode**: The points defining the element are connected by line segments. The facets are defined by the points' coordinates.

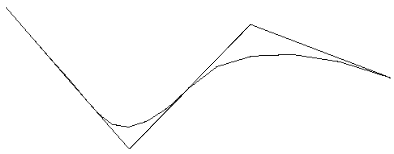
- **NURBS mode** (Non-Uniform Rational B-Spline): A NURBS curve or surface is a mathematical function. A NURBS curve or surface is defined at any point of its length or surface. As AMAPI 3D cannot display all of the points at once, it displays only some of them. The drawback of the NURBS mode is the increased computing time compared to the polygonal mode. Furthermore, some tools do not operate on NURBS objects. (See the Modeling Palette" on page 243".)



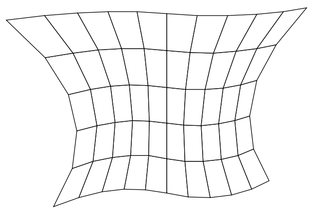
Polygonal curve



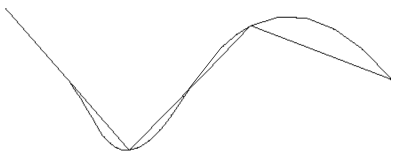
Polygonal surface



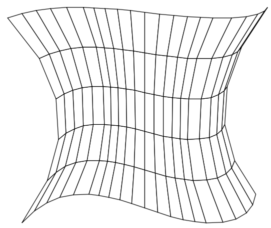
NURBS curve



NURBS Surface



Interpolated NURBS curve



Interpolated NURBS surface

6.3.2 Select the creation mode: Polygonal or NURBS

You must specify the creation mode (Polygonal or NURBS) before creating 3D primitives or drawing curves. (see chapters “3D Primitives” on page 169 and “Drawing” on page 185).

Polygonal

If the Assistant Palette is enabled: AMAPI 3D displays a toggle button in the “Mode” area (included in the Assistant Palette) which allows you to switch between Polygonal mode and NURBS mode. Make sure the correct mode is enabled. If not, click on it or use the keyboard shortcut (PC: Ctrl+B, Mac: Command+B).

NURBS

If the Assistant Palette is disabled: AMAPI 3D displays the current mode at the top left of the screen (on the right hand side of the current tool icon). Make sure the correct mode is enabled. If not, click on it, or use the keyboard shortcut (PC: Ctrl+B, Mac: Command+B).

6.4 Dynamic Geometry

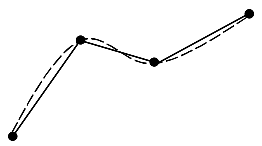
6.4.1 The principle

The tools that generate surfaces from curves (Extrusion, Sweep, ...) can now "retain" the initial curves and also remember how the wireframe was generated.
This allows the editing of a surface not only from the surface wireframe but from the construction curves which become the control curves of the surface. The surface is automatically regenerated when editing the curves (like NURBS control polygons).

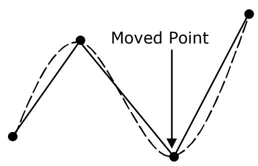
Surface smoothing is now dynamic, as it is regenerated each time the "initial" surface or curve is modified.

Interpolated or smoothed polyline curves also retain the initial curve.

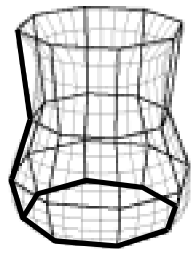
Dynamic Geometry properties are stackable and create control levels. You can choose to work on one of the object finishing levels.



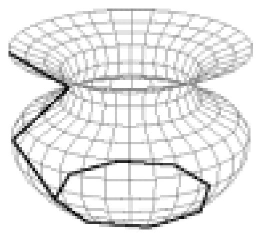
Original object:
The original object is a smoothed polyline.



Transformed object:
We transform the object by moving a point of the construction polyline.
The smoothed polyline is affected by this transformation.



Original object:
The original object was generated by the extrusion of a circle (polyhedral) along a path (polyline).
The result has been smoothed.



Transformed object:
We transform the object by moving some points of the construction polyline.
The rough object (not smoothed) and the smoothed object are both affected by this transformation.

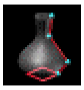
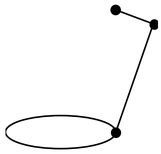
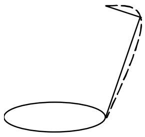
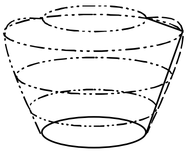
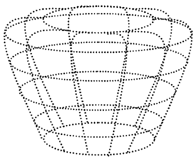
Other examples illustrate the Dynamic Geometry principle in the paragraph "How to edit an object in D.G.".

6.4.2 The tools and Dynamic Geometry

Each tool reacts differently to the Dynamic Geometry.
We can see:

- Tools which create or add a finishing level to an object

An object may have one to four finishing levels, depending how it was built.
The table below shows how each construction step corresponds to each finishing level.

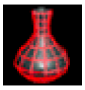
Finishing level and illustration		Description
1 	Rough Structure 	Circle, Polyline…
2 	Smoothed Structure 	Smoothing, interpolation, approximated structure. The interpolated Curve tool creates smoothed structures directly.
3 	Rough Object 	Object made from a smoothed structure or not. The construction can be made from one of the following tools: ♦ 3D Primitives ♦ Text ♦ Extrusion ♦ Sweep ♦ Double Sweep ♦ Surfaces
4 	Smoothed Object 	Smoothed rough object

You can choose to work on any finishing level of an object. The higher levels will be affected by modifications to the lower ones.

In the object's "Information" dialog, a button allows you to delete the Dynamic Geometry of the current object: "Convert to Mesh" (see chapter "Get info" on page 149).

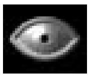
❑ Tools which edit the D. G. properties of the object

The tools editing these properties will allow you to choose which finishing level you want to work with. The upper levels will follow the transformations you make on the lower levels.
To see which tools edit Dynamic Geometry properties, see "Summary of the effects of each tool on D.G." on page 163.
When opening one of these tools, AMAPI 3D will display a new palette with up to four icons corresponding to the four finishing levels (maximum) allowed for one object.
Only the icons corresponding to the editable finishing levels of the current object will be displayed.
If only one level is editable, AMAPI 3D will not display any icon.
Click on the icon corresponding to the finishing level you want to work on.

Finishing level	Icon
4 – Smoothed object	
3 – Rough object	
2 – Smoothed structure	
1 – Rough structure	

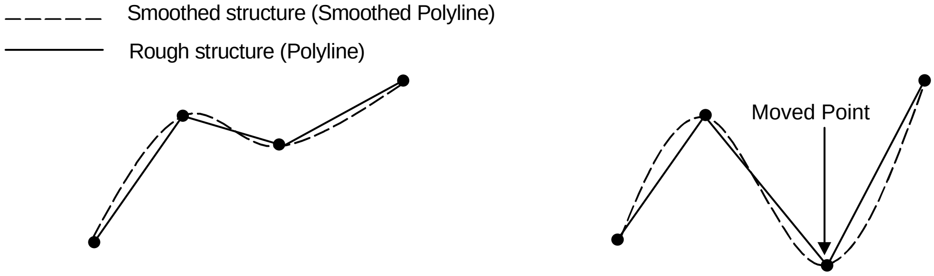
If you transform an object at a level "n" with any of the tools listed above, the higher levels (if there are any) will be affected by this transformation.

 If you decide to work at a level "n", you will no longer be able to work on any of the lower levels. The icons of the unavailable levels will disappear. See the following examples.

 AMAPI 3D displays the effect of the current deformation on all the finishing levels in real time. As you would expect, the more complex an object, the longer the display time. In some cases, it is better for you to disable the real-time display. To do this, click on the icon just above the Dynamic Geometry palette.

 Some tools use the D.G. properties of the object but delete finishing levels of the object (see chapter "Tools which edit the D. G. properties of the object " above).
See chapter "Summary of the effects of each tool on D.G." on page 163 to see which tools behave this way.

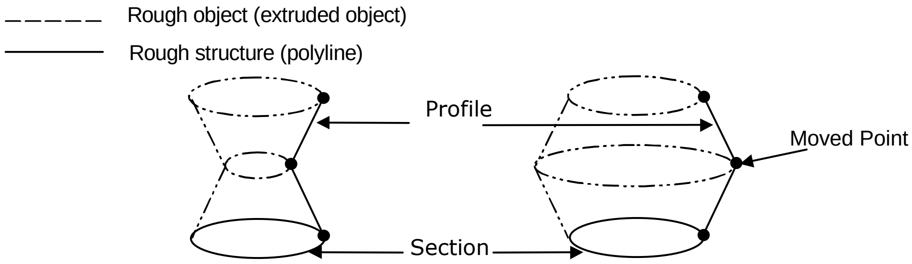
Example 1:



Original object: *Transformed object:*

- ♦ The original object is a smoothed structure, it was made by smoothing a polyline.
- ♦ We transform the object by moving a point of its structure (polyline).
- ♦ The smoothed structure (smoothed polyline) is affected by this deformation.

Example 2:

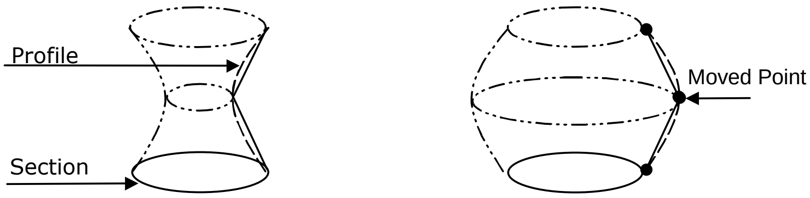


Original object: *Transformed object:*

- ♦ The original object is a rough structure. It has been generated by the extrusion of a circle (polyhedral) along a path (polyline).
- ♦ We transform the object by moving a point of its structure (polyline).
- ♦ The rough object is affected by this deformation.
- ♦ All of the finishing levels are still editable.

Example 3:

Rough object (Extruded Structure)
Smoothed Structure (Smoothed Polyline)
Rough Structure (Polyline)



Original object: *Transformed object:*

- The original object is a rough structure. It has been generated by the extrusion of a circle (polyhedral) along a path (smoothed polyline).
- We transform the object by moving a point of its structure (polyline).
- The smoothed structure (smoothed polyline) and the rough object (extruded structure) are affected by this deformation.
- All of the finishing levels are still editable.

Example 4:

Rough object (Extruded Structure)
Smoothed Structure (Smoothed Polyline)
Rough Structure (Polyline)

Original object: *Transformed object:*

- The original object is a rough structure. It has been generated by the extrusion of a circle (polyhedral) along a path (smoothed polyline).
- We transform the object by modeling its smoothed structure (smoothed polyline).
- The rough object is affected by of this deformation.
- The rough structure (polyline) is no longer editable and the icon corresponding to this finishing level has disappeared.

Example 5:

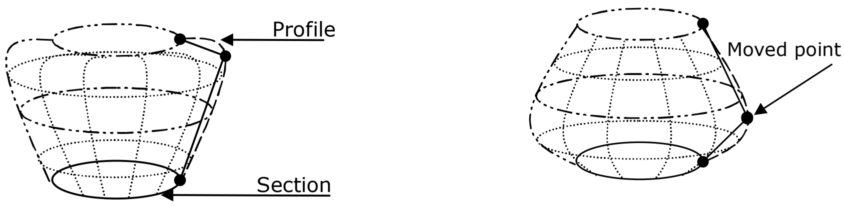
Rough object (Extruded Structure)
Smoothed Structure (Smoothed Polyline)
Rough Structure (Polyline)

Original object: *Transformed object:*

- The original object is a rough structure. It has been generated by the extrusion of a circle (polyhedral) along a path (smoothed polyline).
- We transform the object by modeling the rough object (extruded structure).
- The smoothed structure (smoothed polyline) and the rough structure (polyline) are no longer editable and the icons corresponding to these finishing levels have disappeared.

Example 6:

Smoothed object (Smoothed rough object)
Rough object (Extruded Structure)
Smoothed Structure (Smoothed Polyline)
Rough Structure (Polyline)

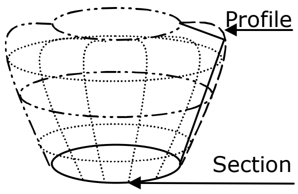


Original object: *Transformed object:*

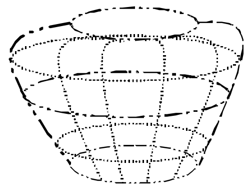
- The original object is a smoothed object. It was made by smoothing a rough object. This object was generated by the extrusion of a circle (polyhedral) along a path (smoothed polyline).
- We transform the object by moving a point of its structure (polyline).
- The smoothed structure (smoothed polyline), the rough object (extruded structure), and the smoothed object are affected by this deformation.
- All of the finishing levels are still editable.

Example 7:

Smoothed object (Smoothed rough object)
Rough object (Extruded Structure)
Smoothed Structure (Smoothed Polyline)
Rough Structure (Polyline)



Original object:

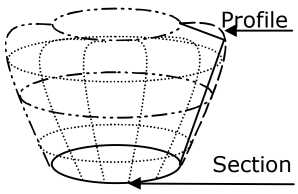


Transformed object:

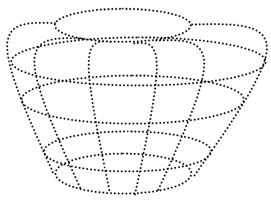
- The original object is a smoothed object. It was made by smoothing a rough object. This object was generated by the extrusion of a circle (polyhedral) along a path (smoothed polyline).
- We transform the object by modeling the rough object (extruded structure).
- The smoothed structure (smoothed polyline) is affected by this deformation.
- The smoothed structure (smoothed polyline) and the rough structure (polyline) are no longer editable and the icons corresponding to these finishing levels have disappeared. However, the smoothed object and the rough object still have Dynamic Geometry.

Example 8:

Smoothed object (Smoothed rough object)
Rough object (Extruded Structure)
Smoothed Structure (Smoothed Polyline)
Rough Structure (Polyline)



Original object:



Transformed object:

- The original object is a smoothed object. It was made by smoothing a rough object. This object was generated by the extrusion of a circle (polyhedral) along a path (smoothed polyline).
- We transform the object by modeling the smoothed object (smoothed rough object).
- The rough object, the smoothed structure (smoothed polyline) and the rough structure (polyline) are no longer editable and the icons corresponding to these finishing levels have disappeared. However, the smoothed object still has Dynamic Geometry.

Practical exercises:
- A little Ant / Create the nostrils
- A little Ant / Puff out the cheeks
- Spotlights / Deform a spotlight using Dynamic Geometry / Methods 1,2 and 3

Tools which don't use the D.G. properties of the object …

♦ … and delete the D.G. properties of the object

Some tools cannot use the D.G. properties of the object, and will delete its D.G. properties. (AMAPI 3D will no longer display the finishing levels palette for this object.)
See chapter "Summary of the effects of each tool on D.G." on page 163 to see which tools behave this way.
If you want to retain the D.G. properties of an object, don't use these tools on the object.

If you have used one of these tools by mistake, type on the PC: Ctrl+Z, Mac: Command+Z, or choose Cancel in the Edit menu: The object will get back its D.G. properties.

The "Information" dialog box (in the Control Panel) allows you to delete the D.G. properties of the current object by using the "Convert to mesh" button (see chapter "Get Info (PC: Ctrl+I; Mac: Command+I)" on page 149).

♦ … but pass them on

Some tools like LayOn and Move don't use the D.G. properties but allow them to continue to be editable with other tools.
Some tools ("Duplicate - Repeate" for example) hold the D.G. properties and pass them on to the generated object.
Some tools ("Unfold" for example) hold the D.G. properties but don't pass them on to the generated object.
See chapter "Summary of the effects of each tool on D.G." on page 163 to see which tools behave this way.

6.4.3 Summary of the effects of each tool on D.G.

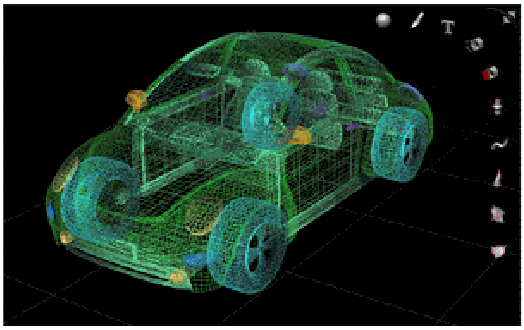
	Their effect on D.G. / **Name of the tools in their palette**	**Generate** One or more finishing levels		**Uses** D.G. properties		**Doesn't use** D.G. properties …			
							… Holds them and …		
		Creates finishing levels number…	**Add** finishing levels number…		…but **Deletes** finishing levels number…	… and **Deletes them**		…pass them on	…doesn't pass them on
Construction	**3D Primitives**	3							
	Draw								
	- Interpolated curve	1 and 2							
	- Symmetry						x		
	- Other tools	1							
	Text	3							
	Extract curve								x
	Facets Extraction								x
	Extrusion								
	- of curve		3						
	- of facet, edge, vertex				1 and 2				
	Sweep								
	- of curve		3						
	- of facet, edge, vertex				1 and 2				
	Surfaces		3						
Modeling	**Deformer**			x					
	Bend			x					
	Wrap			x					
	Stretch			x					
	Delete			x					
	Smooth								
	- on a level 1		2						
	- on a level 3		4						
	Chamfer					x			
	Thickness					x			
	Cut					x			
	Decimation					x			
	Tessellate			x					
	Relief			x					
Assembly	**Duplicate**							x	
	Mirror							x	
	Rotate			x					
	Move						x		
	Scale			x					
	Snap								
	- an object						x		
	- a point			x					
	Lay on						x		
	Weld					x			
	Unfold								x

Their effect on D.G. / **Name of he tools n their palette**		**Generate** One or more finishing levels		**Uses** D.G. properties		**Doesn't use** D.G. properties			
							… Holds them and …		
		Creates finishing levels number…	**Add** finishing levels number…		…but **Deletes** finishing levels number…	… and **Deletes them**		…pass them on	…doesn't pass them on
Control Panel	**Information**								
	- Suppress (delete) coplanar faces					x			
	- Suppress (delete) the confused (degenerate) points					x			
	- Triangulate curved faces or with more than four points					x			

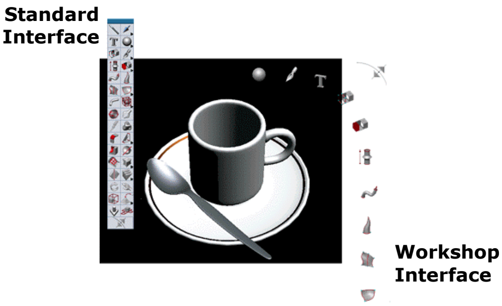
7 Modeling tools

*T**hree tool palettes** are available for the user:*

- ***Construction** (see details on page 168)*
- ***Modeling** (see details on page 243)*
- ***Assembly** (see details on page 313)*



In AMAPI 3D you can choose between two user-interfaces:



- *The first one follows the **"Workshop"** metaphor. Specially adapted to work in 3D space, it attempts to mimic, as closely as possible, the natural movement of a designer at the drawing table, or the movement of a sculptor in his workshop.*
- *The second interface has the advantage that it is more familiar to the average computer user, it is the **"Standard"** interface.*

For more information about the choice of interface, see the chapter "Preferences / Interface / Tool palettes" on page 435.

7.1 Generic use of a tool

7.1.1 Current object concept

Before selecting a tool, you should be sure that the current object is really the one on which you want to work.

The object selection accessory **is the default** selection accessory (see chapter "The selection accessories" on page 104). In fact, when no tool is selected, the cursor is the object selection accessory .
Selecting an object designates it as the **current object**; it will be **displayed in a blue color** to distinguish it from the other objects in the scene. **Its geometrical center is displayed with a little white sphere.**
There is always a current object in a scene. **The next action will be applied on this object**. Most tools work only on the current selection; so before using a tool, make sure the current object is the right one.

However, with some tools like Move, Stretch, Rotate, Scale, Snap you can change the current object. To do this while using the tool:

⇒ Press the Shift+ESC key to display the object selection accessory .
⇒ Click on an object in the scene to make it the current object (move the cursor toward the right hand side of the screen to cancel).

7.1.2 How do you select a tool?

1. First make sure that the current object is the one you want to work on before selecting a tool (see chapter "Current object concept" above).

   It is possible to change the current object while using the following tools:
   Move, Stretch, Rotate, Scale, Snap.
   Proceed as follows: within the tool

   ⇒ Press Shift+Esc. the object selection accessory appears.
   ⇒ Click on another object to make it the current object (put the tool aside to cancel).
   ⇒ You can continue to use the tool on the new current object.

2. Click on the icon depicting the tool.

7.1.3 How do you change tool palette?

⇒ If you have chosen the "Workshop" interface, move the cursor outside of the scene through the right hand side of the screen and then back in to change tool palette.

⇒ If you have chosen the "Standard" interface, you do not have to change tool palettes as all the tools are grouped into a single tool palette.

7.1.4 How do you end a tool action?

There are two ways to do this:

- Validating the action:
  - ⇒ **Through the Assistant Palette**: Click on the "OK" button.

  or
  - ⇒ **Through the keyboard**: Press the Return key.

  Validating the action will drop the tool. The object selection accessory  selection accessory will be available again to select another tool or a different object.

- Putting the tool aside:
  - ⇒ **If you have chosen the "Workshop" interface:** Move the cursor outside of the scene through the right hand side of the screen and then back in to put the tool aside. You will then be able to select another object or tool.
  - ⇒ If you have chosen the "Standard" interface (dropping the tool is automatic):
    - ⇒ Select another tool to continue to work on the current object.

    Or
    - ⇒ Select a construction tool to build a new object.

7.2 Construction

This tools palette contains the tools used to draw the shapes that will be the modeling basis.

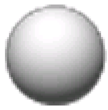
Icon	Tool name	Description	See
	3D Primitives	Sphere Cube Grid Cylinder Cone Platonic solids Height Fields	en page 169
	Drawings	Circle, Arc, Rectangle, Polyline, Curve, Interpolated Curve, Sketch, Helicoid, Symmetry.	on page 185
	Text Editor	The Text Editor allows you to insert 2D or 3D text, with the font you have selected, in a scene.	on page 203
	Extract curves	The Extract curves tool creates a new curve from points you select from existing objects.	on page 204
	Facet extraction	Create a facet, that is, generate a surface from several points	on page 206
	Extrusion	Curve extrusion Facet, edge, or vertex extrusion	on page 209
	Sweeping	Sweeping of a section Facet, edge or vertex sweeping	on page 220
	Double sweeping	Generates a surface from a section and two profiles.	on page 234
	Ruled Surface	Between curves Between surfaces	on page 234
	Surfaces	Coons Gordon Hull	en page 236

7.2.1 3D Primitives

Dragging the cursor on top of this tool icon opens a sub-palette containing tools used for quickly creating specific 3D shapes. These shapes (sphere, cube, grid, cone, cylinder…) are called ***primitives*** *as they will often be used as the building blocks for the construction of your models.*

❑ Sphere

The Sphere tool is used to create spheres anywhere in the work space.
You will need to specify the drawing mode before you create the sphere. A polygonal sphere is represented using flat facets.



A NURBS sphere is represented using curved facets and is in fact made up of two NURBS hemispheres. A NURBS sphere looks smoother than a polygonal one.

Usage:

1. **Selecting the Sphere tool.**

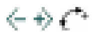
   Click on the icon  depicting the Sphere tool in the Construction palette.

2. **Specifying the origin and the graduation of the reference axes.**

<table>
<tr><td colspan="4">If…</td><td>…Then go to step…</td></tr>
<tr><td rowspan="3">The scene is empty</td><td>Yes</td><td colspan="2"></td><td>2.1</td></tr>
<tr><td rowspan="2">No</td><td rowspan="2">You selected “Automatic positioning of rulers” in the “Preferences / Units” menu (see chapter “Preferences / Units” on page 441).</td><td>Yes</td><td>2.1</td></tr>
<tr><td>No</td><td>2.2</td></tr>
</table>

2.1 Automatic positioning
AMAPI 3D automatically positions the origin of the reference axes. In this case go to step 2.3.

2.2 Manual positioning
AMAPI 3D will ask you to position the origin of the reference axes manually. Click to set the origin, then go to step 2.3.

2.3 Defining the graduation step (optional).
You can increase or decrease the graduation step size using The Tuner:  (+/- keys of the keyboard) (see details on page 110).

3. **Specifying the mode: NURBS or polygonal.**

Polygonal

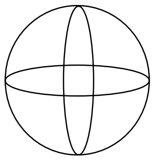
NURBS

See chapter “Polygonal and NURBS drawing modes” on page 153
See chapter “Select the creation mode: Polygonal or NURBS” on page 154.

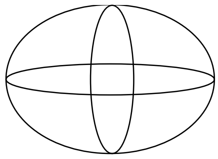
4. Specifying the construction reference point.
The reference point will be either the top or bottom point of the sphere.
There are several ways to specify this:

- **Mouse positioning**: Move the cursor, then click (see details on page 109).
- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).

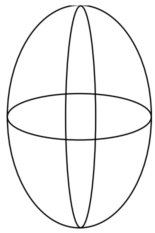
5. Sphere / Ellipsoid toggle (optional)
By pressing the spacebar, you can switch between the cursor motion constraints (default = free, then horizontal, then vertical…).



Cursor moves freely



Cursor constrained to move horizontally

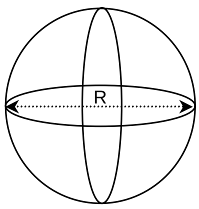


Cursor constrained to move vertically

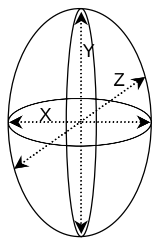
You can use the keyboard arrow keys to change the point of view and then control the ellipsoid depth radius (See chapter " Point of view (Eye – Target point)" on page 134).

6. Setting the radius of the sphere.
For a sphere you must set the radius.
For an ellipsoid you must set three radii (x, y, and z).
There are several ways to do this:

- **Mouse parameter setting**: Move the cursor, then click (see details on page 109).
- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).

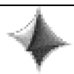


Sphere
(Set the radius R)



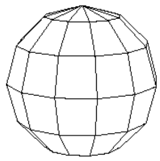
Ellipsoid
(Set the radii X, Y, and Z)

7. Toggling between the different kinds of spheres (optional)
The Tuner appears; AMAPI 3D displays several kinds of spheres to chose from. Click on the one corresponding to your choice:

		Go to step…
	Tapered sphere (default)	7.1
	♦ Geodesic spheres: ♦ Based on a cube ♦ Based on an icosahedron ♦ Based on an octahedron	7.2
	Super-ellipsoid	7.3

7.1 Tapered sphere

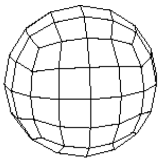
The Tapered sphere is the AMAPI 3D default sphere.
If it fits your needs, you can go to the next step (8).



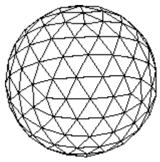
Tapered sphere

7.2 Geodesic spheres

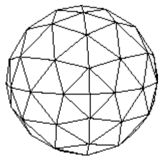
At this point, each time you press the spacebar, you will switch between the geodesic spheres below:



Geodesic sphere
Based on a cube



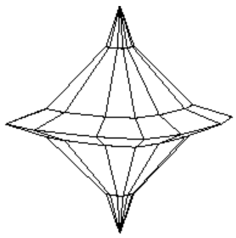
Geodesic sphere
Based on anicosahedron

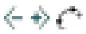


Geodesic sphere
Based on an octahedron

7.3 Super-ellipsoid

The super-ellipsoid tuning is done with two coefficients (Coeff1 and Coeff2).
Their values are displayed in the Data Window. There are several ways to set these values:



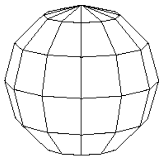
The Tuner:  You can toggle from one data value to another by pressing the spacebar. You can tune the current data value with the +/- keys of the keyboard (see details on page 110).
The keyboard: Access the Data Window, then enter the values through the keyboard. Two methods are available:
- ♦ Using the Tab key  (see details on page 109).
- ♦ Clicking in the Data Window (see details on page 109).

Note that you can set the number of points in step 8.

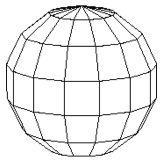
8. Defining the number of points.

You have just drawn a shape (sphere, ellipsoid, geodesic sphere, or super-ellipsoid). The Tuner indicates that you may make it more or less smoothed by setting the "No pts" (number of points) parameter.

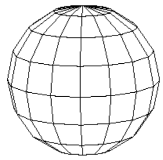
Example: Number of points on a sphere:



Number of pts=7



Number of pts=8



Number of pts=9

There are several ways to do this:

- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).
- **The Tuner:** (+/- keys of the keyboard) (see details on page 110).

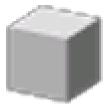
9. Ending the tool action.

Validate to end the action or put the tool aside. See how in chapter "How do you end a tool action?" on page 167.

Practical exercises:

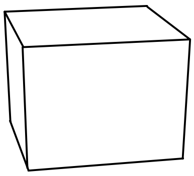
- A Champagne cap / The cap's head / Step 1
- A broken egg / Constructing the egg / Sphere creation

❑ Cube

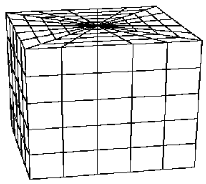


The Cube tool is used to create cubes anywhere in the work space.
The icon of the Cube tool is displayed at the top left corner of the screen while it is selected.

The cube tool can create any rectangular 3D shape defined by its numerical dimensions along the X, Y and Z axes.
A NURBS cube is displayed with grid lines to differentiate it from a polygonal cube.
You will need to specify the drawing mode before creating the cube.



Polygonal cube



NURBS cube

Usage:

1. Selecting the Cube tool.

Position the cursor over the “Sphere” icon, and the icons depicting the “3D primitives” will be displayed.

Click on the icon depicting the “Cube”.

2. Specifying the origin and the graduation of the reference axes.

If…				…Then go to step…
The scene is empty	Yes			2.1
	No	You selected “Automatic positioning of rulers” in the “Preferences / Units” menu (see chapter “Preferences / Units” on page 441).	Yes	2.1
			No	2.2

2.1 Automatic positioning
AMAPI 3D automatically positions the origin of the reference axes. In this case go to step 2.3.

2.2 Manual positioning
AMAPI 3D will ask you to position the origin of the reference axes manually. Click to set the origin, then go to step 2.3.

2.3 Defining the graduation step (optional).
You can increase or decrease the graduation step size using The Tuner: (+/- keys of the keyboard) (see details on page 110).

3. Specifying the mode: NURBS or polygonal.

Polygonal

NURBS

See chapter "Polygonal and NURBS drawing modes" on page 153.
See chapter "Select the creation mode: Polygonal or NURBS" on page 154.

4. Positioning the center of the base of the cube.

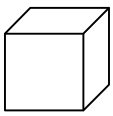
There are several ways to set this coordinate:

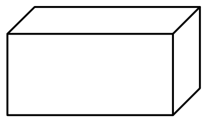
- **Mouse positioning**: Move the cursor, then click (see details on page 109).
- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).

5. Creating the cube (or a parallelepiped).

You now must specify the dimensions of the (x, y, and z) cube or parallelepiped. There are two ways to do this:

- **Mouse parameter setting**: Move the cursor, then click (see details on page 109).
- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).


Cube


Parallelepiped

6. Ending the tool action.

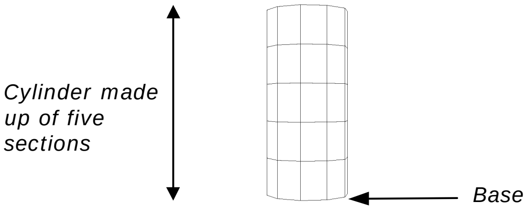
The tool is automatically put aside and the object selection accessory reappears.

Practical exercises:

- A little house / The little house's body
- A cone on a sloping plane / The sloping plane / Step 1
- An acoustic baffle / Draw the box / Step 1
- A playing card, a die and a token / Basic construction

❑ Cylinder

The Cylinder tool is used to create a cylindrical 3D object quickly.



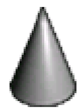
The procedure followed to create a cylinder is exactly the same one as for creating a cone (see the "Cone" paragraph, following).

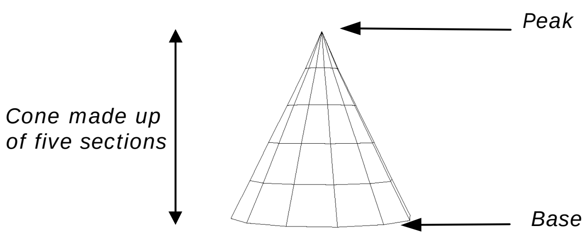
Practical exercises:

- A playing card, a die and a token / Basic construction

❑ Cone

The Cone tool is used to create a cone quickly.





Usage:

1. Selecting the Cone tool.

Position the cursor over the “Sphere” icon , and the icons depicting the “3D primitives” will be displayed.

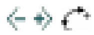
Click on the icon  depicting the “Cone” tool.

2. Specifying the origin and the graduation of the reference axes.

<table>
<tr><th colspan="4">If…</th><th>…Then go to step…</th></tr>
<tr><td rowspan="3">The scene is empty</td><td>Yes</td><td colspan="2"></td><td>2.1</td></tr>
<tr><td rowspan="2">No</td><td rowspan="2">You selected “Automatic positioning of rulers” in the “Preferences / Units” menu (see chapter “Preferences / Units” on page 441).</td><td>Yes</td><td>2.1</td></tr>
<tr><td>No</td><td>2.2</td></tr>
</table>

2.1 Automatic positioning
AMAPI 3D automatically positions the origin of the reference axes. In this case go to step 2.3.

2.2 Manual positioning
AMAPI 3D will ask you to position the origin of the reference axes manually. Click to set the origin, then go to step 2.3.

2.3 Specifying the step size (optional).
You can increase or decrease the step size by using The Tuner:  (+/- keys of the keyboard) (see details on page 110).

3. Specifying the mode: NURBS or polygonal.

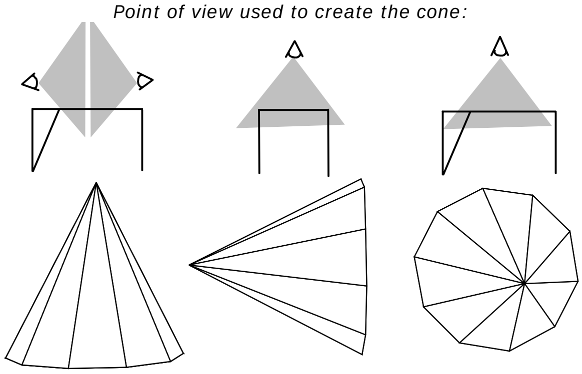
Polygonal

NURBS

See chapter “Polygonal and NURBS drawing modes” on page 153
See chapter “Select the creation mode: Polygonal or NURBS” on page 154.

4. Specifying the cone orientation.
The orientation of the cone depends on the viewpoint selected at this stage. (See chapters " The Views" on page 133 and "View" on page 89)

Point of view used to create the cone:



Face view of the cone.

5. Specifying the center of the base.
There are several ways to set this coordinate:

- **Mouse positioning**: Move the cursor, then click (see details on page 109).
- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).

6. Specifying the radius of the base.
There are several ways to set the radius:

- **Mouse parameter setting**: Move the cursor, then click (see details on page 109).
- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).

7. Specifying the height and the number of sections.
By default, the cone is defined by five sections. However, you can specify a different number of sections.
There are two cases:

7.1 You only want to set the height.
There are several ways to do this:
Mouse parameter setting: Move the cursor, then click (see details on page 109).
The keyboard: Access the Data Window, then enter the values through the keyboard. Two methods are available:

- Using the Tab key (see details on page 109).
- Clicking in the Data Window (see details on page 109).

7.1 You want to set the height and the number of slices.
To set both parameters (height and the number of slices) you must use the keyboard. Access the Data Window, then enter the values through the keyboard. Two methods are available:

- Using the Tab key (see details on page 109).
- Clicking in the Data Window (see details on page 109).

8. Specifying the number of points defining the base.
Once the cone is created, the Tuner is displayed. Use it to set the number of points defining the base.
There are several ways to do this:

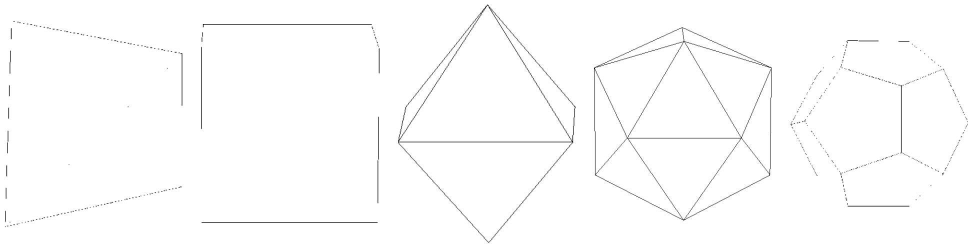
- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).
- **The Tuner:** (+/- keys of the keyboard) (see details on page 110).

9. Capping the base (optional).
By default, the base of the cone is open (it is highlighted in red) (see chapter "Open shapes / Closed shapes" on page 152).
Go to the next step if you want to leave it open.
Click on it if you want to cap it.

10. Ending the tool action.
Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 156.

Platonic solids

This tool allows to create the following volumes:



Tetrahedron	*Cube*	*Octahedron*	*Icosahedron*	*Dodecahedron*

This tool creates polyhedral volumes only.It is not possible to create a Platonic solid in NURBS mode.

Usage:

1. Select the Platonic solids tool.

Position the cursor over the “Sphere” icon , and the icons depicting the “3D primitives” will be displayed.

Click on the icon  depicting the “Platonic solids” tool.

2. Specifying the origin and the graduation of the reference axes.

<table>
<tr><td colspan="4">If…</td><td>…Then go to step…</td></tr>
<tr><td rowspan="3">The scene is empty</td><td>Yes</td><td colspan="2"></td><td>2.1</td></tr>
<tr><td rowspan="2">No</td><td rowspan="2">You selected “Automatic positioning of rulers” in the “Preferences / Units” menu (see chapter “Preferences / Units” on page 441).</td><td>Yes</td><td>2.1</td></tr>
<tr><td>No</td><td>2.2</td></tr>
</table>

2.1 Automatic positioning
AMAPI 3D automatically positions the origin of the reference axes. In this case go to step 2.3.

2.2 Manual positioning
AMAPI 3D will ask you to position the origin of the reference axes manually. Click to set the origin, then go to step 2.3.

2.3 Defining the graduation step (optional).
You can increase or decrease the graduation step size using The Tuner: (+/- keys of the keyboard) (see details on page 110).

3. Positioning the central point of the base of the volume.

There are several ways to set this coordinate:

- **Mouse positioning**: Move the cursor, then click (see details on page 109).
- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).

Move the cursor slightly to see the first available Platonic solid (Tetrahedron).

4. Select the kind of volume.

By pressing the spacebar, you will from one shape to the next.

- The Tetrahedron
- The Cube
- The Octahedron
- The Icosahedron
- The Dodecahedron

5. Sizing the volume.

There are several ways to set the X, Y, and Z measurements of the object:

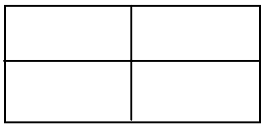
- **Mouse parameter setting**: Move the cursor, then click (see details on page 109).
- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).

6. Ending the tool action.

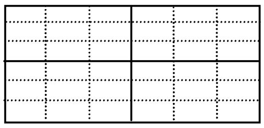
The tool is automatically put aside and the object selection accessory reappears.

❑ Grid

Use the Grid tool to create a flat mesh. Then modify it using the modeling tools.
A grid can be created either in polygonal mode or in NURBS mode. A NURBS grid looks different than a polygonal grid. A NURBS grid shows additional and smaller facets.
You must specify the drawing mode before creating the grid.



2 X 2 polygonal grid



2 X 2 NURBS grid

Usage:

1. Selecting the Grid tool.

Position the cursor over the "Sphere" icon , and the icons depicting the "3D primitives" will be displayed.

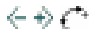
Click on the icon  depicting the "Grid" tool.

2. Specifying the origin and the graduation of the reference axes.

<table>
<tr><th colspan="4">If…</th><th>…Then go to step…</th></tr>
<tr><td rowspan="3">The scene is empty</td><td>Yes</td><td colspan="2"></td><td>2.1</td></tr>
<tr><td rowspan="2">No</td><td rowspan="2">You selected "Automatic positioning of rulers" in the "Preferences / Units" menu (see chapter "Preferences / Units" on page 441).</td><td>Yes</td><td>2.1</td></tr>
<tr><td>No</td><td>2.2</td></tr>
</table>

2.1 Automatic positioning
AMAPI 3D automatically positions the origin of the reference axes. In this case go to step 2.3.

2.2 Manual positioning
AMAPI 3D will ask you to position the origin of the reference axes manually. Click to set the origin, then go to step 2.3.

2.3 Defining the graduation step (optional).
You can increase or decrease the graduation step size using The Tuner:  (+/- keys of the keyboard) (see details on page 110).

3. Specifying the mode: NURBS or polygonal.

Polygonal

NURBS

See chapter "Polygonal and NURBS drawing modes" on page 153
See chapter "Select the creation mode: Polygonal or NURBS" on page 154.

4. Specifying a corner of the grid.
There are several ways to set this coordinate:

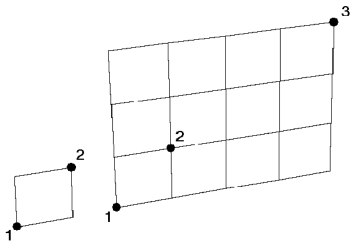
- **Mouse positioning**: Move the cursor, then click (see details on page 109).
- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).

5. Setting the size of the facets of the mesh.
There are several ways to set the length and width of a cell:

- **Mouse parameter setting**: Move the cursor, then click (see details on page 109).
- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).

6. Setting the length and height of the grid.
There are several ways to set the width and height of the entire grid:

- **Mouse parameter setting**: Move the cursor, then click (see details on page 109).
- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).



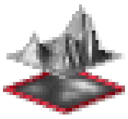
You will always have an integer number of facets. For instance, if each facet measures 10x10, the length and height of the grid must each be a multiple of 10. For example, 180x50, not 182x47.

7. Ending the tool action.
The tool is automatically put aside and the object selection accessory cursor reappears.

Practical exercises:

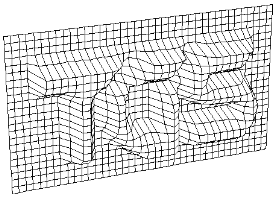
- A house / The tiles / Step 4
- A tiled floor / Generating the tile floor / Step 1

❑ Height Fields

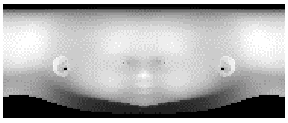


This tool allows you to convert a 2D image to a 3D object.
How it works:
Select an image and a shape.
AMAPI 3D maps the picture onto the shape and then moves the points of the shape to give it relief. This displacement is done according to the color of the area: the lighter the color, the greater the altitude. The darker points will remain at zero altitude.

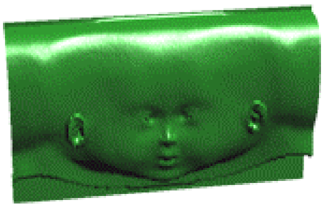
A= 2D gray scale picture



Picture A converted into a 3D object



B = 2D gray scale picture



B'= Picture B converted into a 3D object and rendered

B' object wrapped on a cylinder (See chapter "Wrap" on page 265)

Usage:

1. **Selecting an object to work with.**
   It is best to start with an empty scene. If there are no objects in the scene, AMAPI 3D will automatically create a grid.
   However, you can select an object by clicking on it with the object selection accessory .

2. **Selecting the tool.**
   Position the cursor over the "Sphere" icon , and the icons depicting the "3D primitives" will be displayed.
   Click on the icon  depicting the "Height Fields" tool.

3. **Selecting the picture.**
   A dialog box asks you to select the picture you want.
   The conversion is done immediately.

4. **Setting the altitude.**
   - The altitude is set via the keyboard. Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - Using the Tab key  (see details on page 109).
     - Clicking in the Data Window (see details on page 109).

5. **Ending the tool action.**
   Put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

7.2.2 Drawing

The Drawing tool is used to create 2D or 3D curves.

This tool opens a line drawing tool palette:

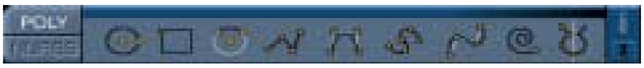
- *Circle*
- *Rectangle*
- *Arc*
- *Polyline*
- *Curve*
- *Interpolated curve*
- *Sketch*
- *Helicoid*
- *Symmetry*

General use of the Drawing tool palette

Usage:

1. **Selecting the Drawing tool palette.**
   Click on the icon depicting the Drawing tool in the Tools Palette.

2. **Displaying and positioning the drawing palette.**
   When you enter the tool, AMAPI 3D displays the following palette. This palette contains all of the Drawing tools:



1 2 3 4 5 6 7 8 9

1. Circle
2. Rectangle
3. Arc
4. Polyline
5. Curve
6. Interpolated curve
7. Sketch
8. Helicoid
9. Symmetry

You may, if you like, display this palette vertically. To do so, click on the toggle-icon "Reverse".

You can also decide to keep this palette displayed all the time. To do so, click on the toggle-icon "Lock".

If you use the drawing palette out of the Drawing tool (you had "locked" the palette), you will not be able to:

- Connect the curves between them
- Use the Symmetry tool (if you need to do a mirror image of a drawing out of the Drawing tool, use the "Symmetry" tool included in the Assembly palette.

3. Specifying the origin of the reference axes.

<table>
<tr><th colspan="5">If…</th><th>…Then go to step…</th></tr>
<tr><td rowspan="4">The scene is empty</td><td>Yes</td><td colspan="3"></td><td>3.1</td></tr>
<tr><td rowspan="3">No</td><td rowspan="2">You have just opened the Draw tool</td><td rowspan="2">You selected “Automatic positioning of rulers” in the “Preferences / Units” menu (see chapter “Preferences / Units”on page 441).</td><td>Yes</td><td>3.1</td></tr>
<tr><td>No</td><td>3.2</td></tr>
<tr><td>You already have used a drawing subtool and you want to use another one</td><td colspan="2"></td><td>3.3</td></tr>
</table>

3.1 Automatic positioning
AMAPI 3D automatically positions the origin of the reference axes. In this case go to step 4.

3.2 Manual positioning
AMAPI 3D will ask you to position the origin of the reference axes manually. Click to set the origin, then go to step 4.

3.3 Set a new position manually (optional).
You can set manually a new position for the axes:
- ♦ If you want to do this: move the cursor, then click to set the axes origin before going to step 4.
- ♦ If not, go to step 4.

4 Specifying the graduation step (optional).
You can increase or decrease the graduation step size using The Tuner: (+/- keys of the keyboard) (see details on page 110).

5. Specifying the mode: NURBS or polygonal.
Other types of curves can only be created in polygonal mode (polylines, sketch, helicoid). AMAPI 3D will always draw them in polygonal mode no matter what mode is selected.
See chapter “Polygonal and NURBS drawing modes” on page 153
See chapter “Select the creation mode: Polygonal or NURBS” on page 154.

6. Selecting a drawing tool.
Select a Drawing tool from the palette:

Subtool	Method	Access
Circle		Click on corresponding icon
Rectangle		Click on corresponding icon
Arc	Center-Radius-Angle method	Click on corresponding icon
	3 points method	Put the mouse cursor over the Arc icon, press and hold the left mouse button. Move the cursor onto the icon depicting the method you want, and release the mouse button.
Polyline		Click on corresponding icon
Curve		Click on corresponding icon
Interpolated curve		Click on corresponding icon
Sketch		Click on corresponding icon
Helicoid		Click on corresponding icon
Symmetry		Click on corresponding icon

7. Drawing a curve.
See the paragraph below corresponding to the drawing tool selected:
- ♦ Circle
- ♦ Rectangle
- ♦ Arc
- ♦ Polyline
- ♦ Curve
- ♦ Interpolated curve
- ♦ Sketch
- ♦ Helicoid
- ♦ Symmetry

Unless you specify otherwise, the cursor can move freely in any direction. AMAPI 3D allows you to apply a constraint to the cursor movement and positioning:
- ♦ Movement constraint along one axis
- ♦ Resetting the axes' increment (step size)
- ♦ Snapping the cursor on existing points
- ♦ Snapping the cursor on a segment
- ♦ Positioning the cursor according to lines of constraint

For more information see chapter "Cursor movement and positioning constraints" on page 98.

The drawing will be done on one of the three orthogonal planes defined by the axes. It is important to note that AMAPI 3D automatically selects the plane that is closest to the plane of the current view. You can continue your drawing on another plane by changing the point of view (See chapters "View" on page 89, "The views" on page 133 or chapter " Point of view (Eye – Target point)" on page 134).

8. The curve is drawn. There are two possibilities:

8.1 Ending the current drawing and leaving the "Draw" tool

In this case, go to the next step.

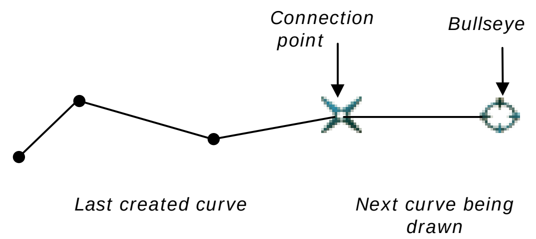
8.2 Using another Drawing subtool.

⇒ If the **curve** which has been validated **is closed**, go back to step 3.

⇒ If the **curve** which has been validated **is open**, the last entered point is marked as a **connection point**. It indicates you may either continue the drawing of this curve with another drawing subtool, or end the drawing:

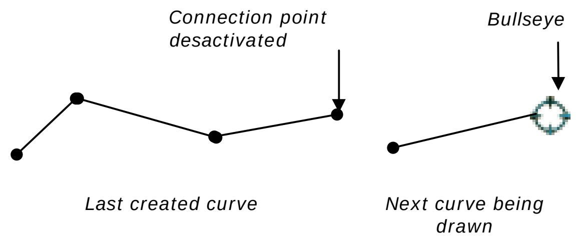
⇒ Continue the drawing of the current curve with another subtool: go back to step 3.

Connected curves:



⇒ End the current drawing and begin the drawing of another curve: To do this, you must first disable the connection point by pressing the spacebar (this toggles the connection point on/off) before going back to step 3 to draw the next curve.

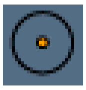
Curves not connected:



9. Ending the tool action.

Put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

Circle



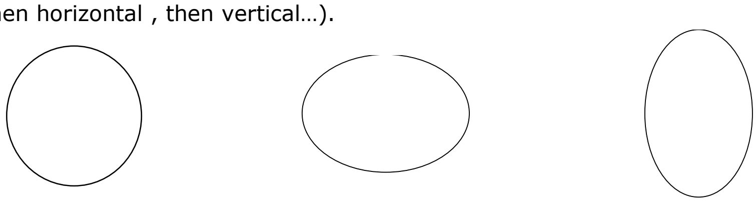
Use the Circle tool to create a circle. A circle can be created either in polygonal mode or in NURBS mode. A NURBS circle looks similar to a polygonal circle, but is composed of two half-circles. When editing a NURBS circle, you will pull the control points of the NURBS envelope instead of pulling the points of the circle directly. Only one half-circle will be modified. You will need to specify the drawing mode before creating the circle.

Usage:

This chapter describes the usage of a "Draw" subtool. See chapter "General use of the Drawing tool palette" on page 185, to find out how it is accessed and how it is integrated in the "Draw" tool.

1. **Setting the center of the circle.**
   There are several ways to set the center of the circle:
   - **Mouse positioning**: Move the cursor, then click (see details on page 109).
   - **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - Using the Tab key (see details on page 109).
     - Clicking in the Data Window (see details on page 109).

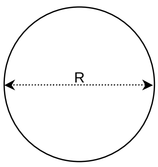
2. **Toggle Circle / Ellipse** (optional)
   By pressing the spacebar, you can switch between the motion constraints (default= free, then horizontal , then vertical…).



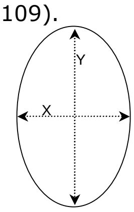
Cursor free moving | *Cursor horizontal motion constraint* | *Cursor vertical motion constraint*

3. **Dimensioning the radius.**
   - For a circle, you will set the radius.
   - For an ellipse, you will set two radii (x and y).

   There are several ways to set these values.
   - **Mouse parameter setting**: Move the cursor, then click (see details on page 109).
   - **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - Using the Tab key (see details on page 109).
     - Clicking in the Data Window (see details on page 109).



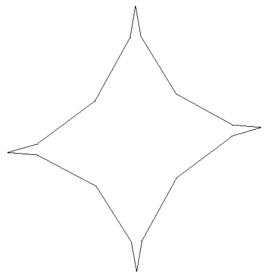
Circle (set the radius R)



Ellipse (set the radii x and y)

4. Toggle Super-ellipse (optional)

The Tuner appears. You can choose to transform the current shape (circle or ellipse) to a super-ellipse. The toggle is done by pressing the spacebar.
A super-ellipse is set with a coefficient (Coeff). This data is displayed in the Data Window.



There are several ways to set this:

- ♦ **The Tuner:** You can toggle from one data value to another by pressing the spacebar. You can tune the current data value with the +/- keys of the keyboard (see details on page 110)..
- ♦ **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - ♦ Using the Tab key (see details on page 109).
  - ♦ Clicking in the Data Window (see details on page 109).

  For the super-ellipse, you can set the number of points in step 5.

It is not possible to transform a NURBS circle to a super-ellipse.

5. Specifying the number of points of the circle.

You have just drawn a shape (sphere, ellipsoid, geodesic sphere, or super-ellipsoid). The Tuner indicates that you can make it more or less smoothed by setting the "No pts" (number of points) parameter.
There are several ways to do this:

- ♦ **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - ♦ Using the Tab key (see details on page 109).
  - ♦ Clicking in the Data Window (see details on page 109).
- ♦ **The Tuner:** (+/- keys of the keyboard) (see details on page 110).

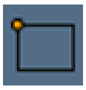
6. Ending the action of the sub-tool.

Put the tool aside or validate to end the action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

Practical exercises:

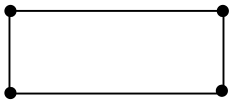
- A glass / Drawing the construction curves / Step 1
- A tiled floor / Create geometric shapes / Step 2
- A chair / The foot / Step 1
- Intersecting pipes / Draw the base (circle)
- An acoustic baffle / Punch the loudspeaker's hole / Step 2

❑ Rectangle

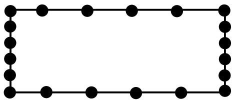


Use the Rectangle tool to create a rectangle.
A rectangle can be created in polygonal or in NURBS mode.

A polygonal rectangle is defined by its four corner points.



A NURBS rectangle displays additional points on each segment They are used to transform the straight lines into a curve.



.

The NURBS rectangle is not a closed curve. AMAPI 3D does not handle periodic NURBS and true closed curves cannot be created in NURBS mode

Usage:

This chapter describes the usage of a "Draw" subtool. See chapter "General use of the Drawing tool palette" to find out how it is accessed and how it is integrated in the "Draw" tool.

1. Specifying the first corner of the rectangle.
There are several ways to set the coordinates of this point:
- **Mouse positioning**: Move the cursor, then click (see details on page 109).
- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).

2. Specifying the opposite corner.
Do the same to specify the second point.

Practical exercises:
- A house / The walls / Step 2
- A house / The peaks / Step 1
- A house / The main beam / Step 1
- A house / The rafters / Step 2
- A tiled floor / Create geometric shapes / Step 1
- A chair / The seat / Step 1

❑ Arc

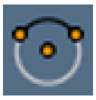
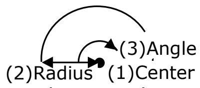
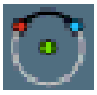
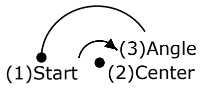
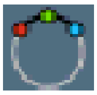
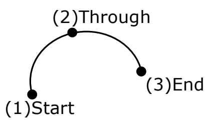
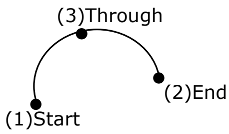
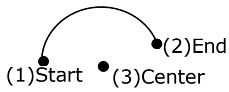
An arc can be created in polygonal or NURBS mode: a NURBS arc looks like a polygonal one, but consists of two NURBS arcs joined together. When editing a NURBS arc, you will be pulling the control points of the NURBS envelope instead of pulling directly on a point of the arc. Only one of the two half-arcs will be modified.
You must specify the drawing mode before creating the arc.

Usage:

⚠ *This chapter describes the usage of a "Draw" subtool. See chapter "General use of the Drawing tool palette" on page 185, to find out how it is accessed and how it is integrated in the "Draw" tool.*

1. Select one of the available methods.

⇒ Put the cursor on the "Arc" icon while holding down the left mouse button. A sub-palette appears and offers you methods for drawing an arc. The drawing order for the points is indicated by the color code below:
- ♦ 1st point to enter: Red
- ♦ 2nd point to enter: Green
- ♦ 3rd point to enter: Blue

Icon	Setting points or values order	
	1. Center 2. Radius 3. Angle	
	1. Start 2. Center 3. Angle	
	1. Start 2. Through 3. End	
	1. Start 2. End 3. Through	
	1. Start 2. End 3. Center	

Put the cursor over the icon depicting the method you want, then release the mouse button.

2. Specifying the points ou values that define the arc.

2.1 Specifying the points that define the arc.

There are several ways to set the coordinates of these three points:

- **Mouse positioning**: Move the cursor, then click (see details on page 109).
- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).

If the arc is connected to a curve, you only have to set two points.

If necessary, you can use a different mode for each point.

2.2 Specifying the points that define the arc.

There are several ways to set the angle value:

- **Mouse parameter setting**: Move the cursor, then click (see details on page 109).
- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).

3. Specifying the number of points of the curve.

Once the arc is created, the Tuner appears. It allows you to specify the number of points used to define the arc.

There are several ways to set this:

- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).
- **The Tuner:** (+/- keys of the keyboard) (see details on page 110).

4. Ending the tool action.

- End the action by validating or putting the tool aside. See chapter "How do you end a tool action?" on page 158.

Or

- Select another tool in the 2D palette, and continue to draw other shapes.

Practical exercises:

- A house / The tiles / Step 1

Polyline

Use the Polyline tool to draw a set of connected straight line segments. A polyline cannot be created in NURBS mode.

Usage:

This chapter describes the usage of a “Draw” subtool. See chapter “General use of the Drawing tool palette” on page 185, to find out how it is accessed and how it is integrated in the “Draw” tool.

1. **Specifying the first point of the curve.**
   There are several ways to set the coordinates of this point:
   - **Mouse positioning**: Move the cursor, then click (see details on page 109).
   - **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - Using the Tab key (see details on page 109).
     - Clicking in the Data Window (see details on page 109).

2. **Drawing the curve.**
   A polyline is defined by a succession of points (that define line segments).
   There are several ways to set the coordinates of these points:
   - **Mouse positioning**: Move the cursor, then click (see details on page 109).
   - **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - Using the Tab key (see details on page 109).
     - Clicking in the Data Window (see details on page 109).

3. **Validating the drawing of the polyline.**
   Press the Return key to validate the entry.
   When you validate, the polyline includes the line segments defined by your mouse clicks. The line segment that is still in-progress at the time of validation is not included in the polyline. .

Defining a constraint on an axis
Click on the appropriate constraint icon in the Assistant Palette to draw a straight vertical or horizontal line (or press the spacebar to toggle the axis). If only one axis is available you will have to draw along this axis.

Using polar coordinates
You can work in either Cartesian coordinates (X, Y, Z) or polar coordinates (distance relative to the previous point and angle relative to the previous edge).
To switch from one mode to another:
⇒ On PC: Click the right mouse button.
Or
⇒ On Mac: Press the Option key and simultaneously click the mouse button.

Creating a closed polyline
Click on the first point of a polyline to snap the last point to it and close the polyline.

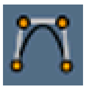
Creating a 3D polyline

Use the arrow keys of the numeric keypad to change the view and working plane as you are drawing the line. This will enable you to create points on the other perpendicular planes and create a polyline in 3D.

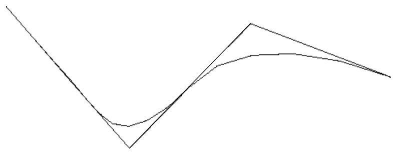
Practical exercises:

- Pipes / Draw the path
- A house / The rafters / Step 1
- A glass / Drawing the construction curves / Step 2
- An acoustic baffle / Draw the box / Step 2
- A little ant / Constructing half of the head / Step 1

❑ Curve



The Curves tool generates a curve that is controlled by the points entered. AMAPI 3D will use these points as polygons of control. This tool can generate either NURBS curves or polygonal curves.



Usage:

This chapter describes the usage of a "Draw" subtool. See chapter "General use of the Drawing tool palette" on page 185, to find out how it is accessed and how it is integrated in the "Draw" tool.

1. **Drawing the curve.**
   A curve is defined by a succession of control points.
   There are several ways to set the coordinates of each of these points:
   - ♦ **Mouse positioning**: Move the cursor, then click (see details on page 109).
   - ♦ **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - ♦ Using the Tab key (see details on page 109).
     - ♦ Clicking in the Data Window (see details on page 109).

2. **Defining the range.**
   The range corresponds to the number of segments generated between two control points. To change its value :
   - ♦ **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - ♦ Using the Tab key (see details on page 109).
     - ♦ Clicking in the Data Window (see details on page 109).
   - ♦ **The Tuner:** (+/- keys of the keyboard) (see details on page 110).

3. **Validating the drawing.**
   Press the Return key to validate the drawing.

4. **Ending the sub-tool action.**
   ⇒ Validate or put the tool aside to end the sub-tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.
   Or
   ⇒ Select another Drawing tool to create another 2D curve.

To add a point to an existing curve, press the Shift key and simultaneously click the mouse button.

Closed curve
Snapping the last point to the first one will close the curve.

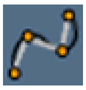
As AMAPI 3D does not handle periodic NURBS, it is technically impossible to generate a closed NURBS curve.

Creating a NURBS curve in 3D
Use the arrow keys of the numeric keypad to change the view and working plane while you are drawing the curve. This will allow you to create points on the nearest perpendicular plane and create a NURBS curve in 3D.

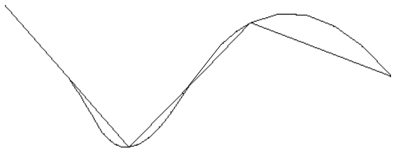
NURBS curves are always created as NURBS even if the NURBS mode of the Tools menu is not selected.

Practical exercises:
- A windshield for a motorbike / (1st method: Coons) / Step 1
- A windshield for a motorbike / (2nd method: ruled surface) / Step 1
- Hull for a boat (example 1) / (1st method: hull) / Step 1

Interpolated curve



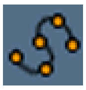
The Interpolated curves tool creates a curve that is controlled by the controls points created when the curve was drawn initially. The curve goes through those points. To use this tool, proceed as for the Curves tool (see the corresponding paragraph).



Practical exercises:

- Hello! (3D text) / Modeling the text / Step 1
- Potato chips / Step 1

Sketch



This tool allows the user to draw a curve "freehand" as if using a pencil. The curve generated by AMAPI 3D will follow the path drawn by the cursor movements. The curve will always be generated in polygonal mode.

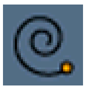
Usage:

This chapter describes the usage of a "Draw" subtool. See chapter "General use of the Drawing tool palette" on page 185, to find out how it is accessed and how it is integrated in the "Draw" tool.

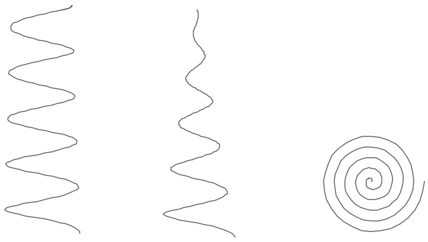
1. **Specifying the step size.**
   The step size is the distance between the points defining the curve. To change this value:
   - **Mouse parameter setting**: Move the cursor, then click (see details on page 109).
   - **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - Using the Tab key (see details on page 109).
     - Clicking in the Data Window (see details on page 109).

2. **Drawing the curve.**
   ⇒ Position the cursor at the exact location where you want to start the drawing.
   ⇒ Press the mouse button and do not release it.
   ⇒ Move the mouse: a curve is generated following the path of the cursor.
   ⇒ Release the mouse button to end the drawing.

Helicoid



This tool is used to create helicoids and spirals.



Usage:

This chapter describes the usage of a "Draw" subtool. See chapter "General use of the Drawing tool palette" on page 185, to find out how it is accessed and how it is integrated in the "Draw" tool.

1. **Setting the center of the base of the helicoid.**
   There are several ways to set the coordinates of this point:
   - **Mouse positioning**: Move the cursor, then click (see details on page 109).
   - **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - Using the Tab key (see details on page 109).
     - Clicking in the Data Window (see details on page 109).

2. **Setting the radius.**
   There are several ways to set the coordinates of this value:
   - **Mouse parameter setting**: Move the cursor, then click (see details on page 109).
   - **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - Using the Tab key (see details on page 109).
     - Clicking in the Data Window (see details on page 109).

3. **Specifying the number of spirals and the height of the helicïd.**
   There are several ways to set the number of spitals (by default, AMAPI 3D creates a helicoid with one turn) and the height:
   - **Mouse positioning** (height): Move the cursor, then click (see details on page 109).
   - **The keyboard** (number of spirals and height): Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - Using the Tab key (see details on page 109).
     - Clicking in the Data Window (see details on page 109).

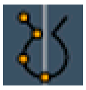
   A helicoid with a height of 0 is a spiral.

4. Validating.
Press the Return key to validate.

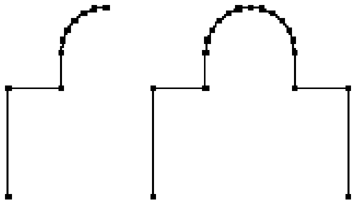
5. Specifying the number of points.
The cursor  indicates that you can increase or decrease the number of points of the curve with The Tuner:  (+/- keys of the keyboard) (see details on page 110).

6. Ending the tool action.
Validate or put the tool aside to end the sub-tool action (depending on the interface). See chapter “How do you end a tool action?” on page 158.
Or
Select another Drawing tool to create another 2D curve.

❑ Symmetry



Use the Symmetry tool to create the mirror image of a curve.
Use the polyline, arc, Bezier curve, or NURBS curve drawing tool to create an open curve. Make sure that the connection point marked by the icon is visible (see the beginning of the chapter "Construction / Drawing" on page 185).



The mirror image of a NURBS curve is another NURBS curve.

Usage:

This chapter describes the usage of a "Draw" subtool. See chapter "General use of the Drawing tool palette" on page 185, to find out how it is accessed and how it is integrated in the "Draw" tool.

Do not use the arrow keys to change the point of view while using the 2D Symmetry tool.
Make sure that you are working in the right plane before selecting the 2D Symmetry tool.
If you intend, while drawing a curve, to make a mirror image of the curve you are drawing, do not leave the Drawing tool. You can not make a mirror image of a curve once you leave the tool used to draw it.

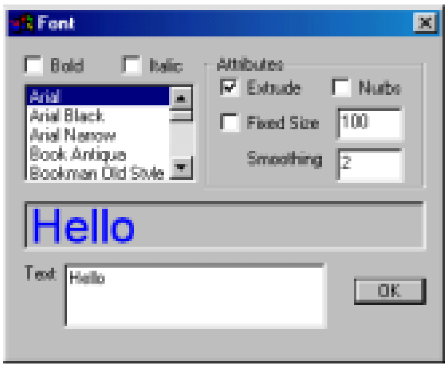
1. **Changing the axis of symmetry (horizontal or vertical).**
   A straight line is displayed as you move the cursor. It represents the axis of symmetry.
   To change its orientation, you can either:
   ⇒ Click on the icon depicting the correct orientation in the Assistant Palette.
   ⇒ Press the spacebar to select different orientations, cyclically.

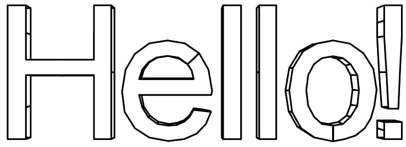
2. **Positioning the axis of symmetry.**
   There are several ways to set this:
   - **Mouse positioning**: Move the cursor, then click (see details on page 109).
   - **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - Using the Tab key (see details on page 109).
     - Clicking in the Data Window (see details on page 109).

   A symmetric reflection of the curve is displayed. It is connected to the original curve, both curves being one single drawing.

7.2.3 Text Editor

The Text tool allows you to add 2D or 3D text to your scene with user-specified fonts.





Usage:

1. Selecting the tool.
Click on the icon depicting the Text tool in the Tools Palette.

2. Typing in the text writing and setting the parameters.
Select the parameters by filling or checking the boxes in the Dialog Box:

Text: Enter the text in the text box.
Font: Choose a font from the list of choices.
Bold: Check this box to generate bold text.

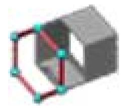
Italic: Check this box to generate italic text.
Extrusion: Check this box to generate 3D text.
NURBS: Check this box if needed.
Fixed size: Check this box to set the size of the characters in points. Then set the size.
Smoothing: You will use smoothing to smooth the characters of your text. It will subdivide each "thickness facet" depending the range you set (default = 2).

Take care to set the range BEFORE entering the text

3. Ending the tool action.
Click on the "OK" command button to validate or click on the "Undo" command button to cancel the action.

Practical exercises:
- Hello! (3D text) / Composing the text

7.2.4 Extract Curve



The Extract Curve tool creates a curve from points selected on an existing object. The resulting curve is then used to create a new element using the Sweep tool, the Extrusion tool, or any other surface-generating tool.

There are two possibilities:

- ***Manual line extraction**. This method allows you to draw a new curve by selecting points on the objects in the scene.*
- ***Automatic contour lines extraction**. This method will extract the contour lines of the openings of the object, e.g. the top adn bottom edges of a cylinder (see chapter “Open shapes / Closed shapes” on page 152).*

On a NURBS surface, the group-of-points selection (selection accessory) will extract a NURBS curve. The point selection accessory) will only generate a polyline curve.

This tool lets the current object keep its Dynamic Geometry properties but does not pass these properties on to the newly generated object.
For more information, see the chapter “Dynamic Geometry” on page 145.

Usage:

1. **Selecting the current object.**
   Click on the object you want to work on (see chapter “Current object concept” on page 166).

2. **Selecting the Extract Curve tool.**
   Click on the corresponding icon in the tool palette.
   To do an automatic extraction, go to step 3.
   To do a manual extraction, go to step 4.

3. **Automatic extraction of openings.**
   This method will create new curves on all the openings of the object. It will not work if the object is closed (sphere or cube). (see chapter “Open shapes / Closed shapes” on page 152).
   Press “Enter”. One or several curves will be generated on all the open edges of the current object.

4. **3D line manual extraction.**
   This method allows to draw a curve by selecting points on the objects of the scene.
   AMAPI 3D provides two selection accessories.

   Choose the appropriate selection accessory. See Chapter “ How to select a selection accessory?” on page 104.
   Then select the points using the selection accessory you have chosen.

Selection accessory	Usage
The group-of-points selection accessory (default) allows you to select points on the current object only *.	Surround the desired points by successive clicks, then validate by pressing the "Enter" key *.
The point selection accessory allows you to select points on any object of the scene.	Click on each point, then validate by pressing the "Enter" key.

* With the group-of-points selection accessory , be careful to select a collection of points from which it will be possible to extract only one curve.

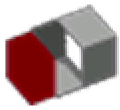
You can repeat this step as many times as necessary.

5. Ending the tool action.
Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

Practical exercises:

- A Champagne cap / The cap's bodyStep 1
- An acoustic baffle / The loudspeaker / Step 1
- A little ant / Constructing half of the head / / Step 4

7.2.5 Facet extraction



Creating a facet is the generation of a surface using several points (three or more). This is what the Facet Extract tool does.

You can use it several ways:

Extraction:

- ***Manual extraction**: The user manually selects the points of the current object which will become the facet(s) to be generated.*
- ***Automatic extraction**: This method will automatically create all facets necessary to close the openings of the current object (for example, this will close the top and bottom faces of an open cylinder).*

***Freehand drawing:** With this, you will draw a freehand facet in the scene.*

This tool lets the current object keep its Dynamic Geometry properties but does not pass these properties on to the newly generated object.
For more information see chapter “Dynamic Geometry” on page 155.

Facets created with this tool will be considered a distinct object. If you want them integrated with the current object, you will need to group the facets with the object.

The Facet Extraction tool used on a NURBS object will generate polygonal facets.

❑ Extraction

Usage

1. Selecting the current object.
Click on the object you want to work on (see chapter "Current object concept" on page 166).

2. Selecting the Facet extraction tool.
Click on the corresponding icon in the tool palette.

- To do an automatic extraction, go to step 3.1.
- To do a manual extraction, go to step 3.2.

3. Facet extraction.

3.1 Automatic facet extraction for the current object.
This method automatically creates the facets needed to cap an object. It works on open objects only (see chapter "Open shapes / Closed shapes" on page 152). For example, it will not work with a cube or a sphere.
Press "Enter".
One or several facets will be generated, capping all the openings of the current object.
You can either:

- Perform a manual facet extraction, by going to step 3.2.
- End the tool action, by going to step 4.

3.2 Manual facet extraction on the objects of the scene.
AMAPI 3D provides two selection accessories.
Choose the selection accessory you need. See chapter "How to select a selection accessory?" on page 104.
Then select the points using the selection accessory you have chosen.

Selection accessory	Usage
The point selection accessory (default) allows you to select points on any object of the scene.	Click on each point, then validate by pressing the "Enter" key.
The group-of-points selection accessory allows you to select points on the current object only.	Surround the desired points by successive clicks, then validate by pressing the "Enter" key.

Then, you will either:

- Perform a new manual facet extraction, by doing to this step again.
- End the tool action, by going to step 4.

4. Ending the tool action.
Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

Freehand drawing

Usage:

1. Selecting the current object.
Click on the object you want to work on (see chapter "Current object concept" on page 166).

2. Select the "Freehand Facet" tool.
⇒ Place the cursor on the icon of the "Facet Extraction" tool. You will see it unfold.
⇒ Click on the icon depicting the "Freehand Facet" tool.

3. Freehand facet drawing.

3.1 Drawing a facet.
AMAPI 3D displays the point selection accessory ; You will draw the facet with it. There are several ways to set the coordinates.

- **Mouse positioning**: Move the cursor, then click (see details on page 109). AMAPI 3D allows you to apply a constraint to the cursor movement and positioning (see chapter "Cursor movement and positioning constraints" on page 98).
- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).

You can repeat this step as many times as necessary before going to the next step.

3.2 End the facet drawing.
Press the "Enter" key to end the facet drawing.
You can either:

- Draw another facet using the "Free drawing" mode by going back to step 3.1.
- End the tool action, by going to step 4.

4. Ending the tool action.
Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

Practical exercises:

- A cone on a sloping plane / The sloping plane / Step 3
- A house / The peaks / Step 3A cone on a sloping plane / The sloping plane / Step 3
- A tiled floor / Create geometric shapes / Step 6
- A little ant / Constructing half of the head / Step 2

7.2.6 Extrusion

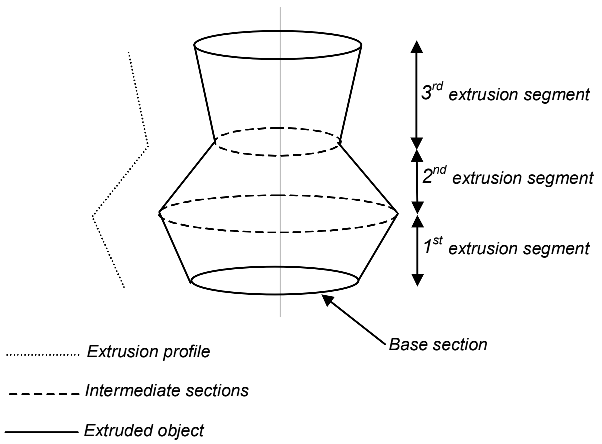
The Extrusion tool is used to create a surface or a volume from a basic curve (original section).

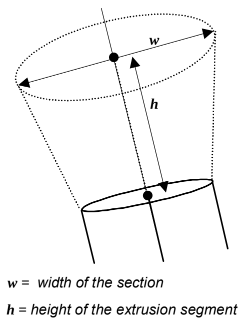
***Curve extrusion** (seeon page 210):*

- *Curve extrusion following a profile to be drawn in the tool.*
- *Sweep a curve following a profile already drawn.*

***Surface Extrusion** (seeon page 216):*

- *Facet extrusion*
- *Edge extrusion*
- *Vertex extrusion*



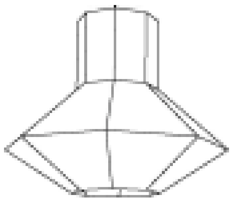


Segment while extrusion

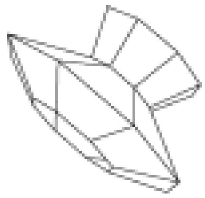
- Curve extrusion

The extrusion orientation is done following the normal of the base section.
You can modify the size of each intermediate section. Two methods are available:

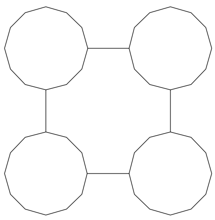
- *Curve extrusion*
- *Extrude a curve following an already drawn.*



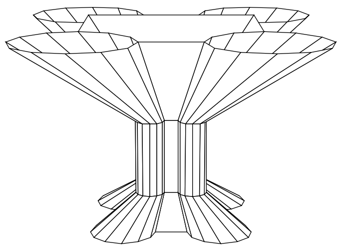
Curve extrusion



Curve extrusion
on any plane



(top view of the sections)



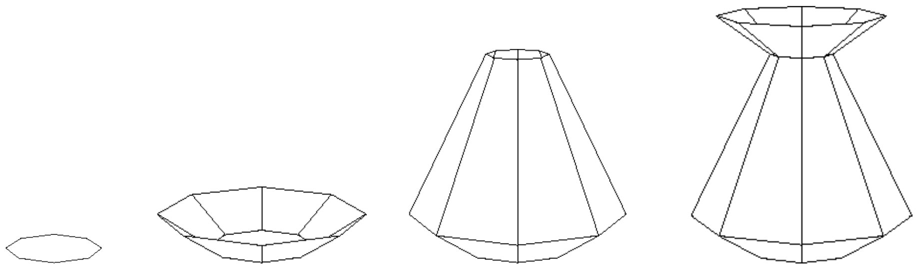
Extrusion of a group of curves

In NURBS mode, the Extrusion tool creates a model that is quite different from a model created in Polygonal mode. In NURBS mode, AMAPI 3D makes you work with the control box surrounding the object. The working mode is the same as in Polygonal mode, but the result is different: The junction between two sections is rounder whereas it is sharp when extruding a polygonal curve. A NURBS curve must have at least three control points to be extruded.

This tool adds a finishing level to the object which is editable by the tools using the Dynamic Geometry properties. It becomes a rough object.
For more information see chapter “Dynamic Geometry” on page 155.

♦ ***Curve extrusion following a profile to be drawn in the tool***

This mode allows you to create an extrusion directly from a basic section (2D or 3D open/closed curve) with multiple segments of varying section size.



Usage:

1. **Selecting the section.**
   Click on the curve or the group of curves you want to extrude.
   The section becomes the current object.

2. **Selecting the Extrusion tool.**
   Click on the icon depicting the tool in the Tools palette.

3. **Selecting the basic section.**
   Click on the section to be extruded.
   Use the arrow keys of the keyboard to display a somewhat perpendicular view of the current object. (see chapter “Navigation” on page 91).

4. **Extrude.**
   Drag the mouse to extrude the curve.

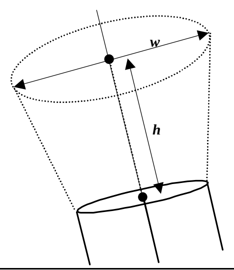
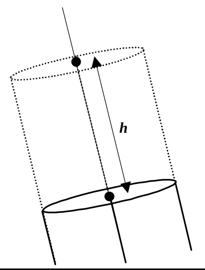
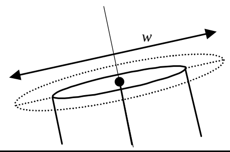
5. **Extrusion drawing**
   For each segment of extrusion you can tune the following parameters:
   - The **width** of the intermediate section (*l*).
   - The **height** of the segment of extrusion (***h***).

   i The extrusion axis always follows the normal of the section.

Two drawing methods are available:

♦ **"Freehand" extrusion (direct):**

1. In some cases, you can **constrain the cursor moving**. The spacebar allows you to switch from one constraint to another.

	Default No action on the spacebar	**1st press** on the spacebar	**2nd press** on the spacebar
Cursor motion	Free moving.	The cursor moves along the extrusion axis only.	The cursor moves along the last drawn section axis only.
Effect on the drawing	The cursor motion simultaneously controls: **The section scaling** (width w). **The height** (*h*) of the extrusion.	**The "Nth" currently drawn section** retains the scale of the "n-1" section. The cursor motion controls controls the **height** (*h*) extrusion only.	**The height** (*h*) of the currently extruded segment is null (*h=0*) The cursor motion controls control the **section scaling** (width w) only.
Illustration			

2. Move the cursor to draw (or stop drawing) a segment of the profile, then click to validate the extrusion.

♦ **Drawing with data settings:**

Press on the "Tab" key to access the Data Window.
You will always use this key to switch from one data value to another one.
Enter the desired values for each data (**Width** and/or **Height**), then validate by pressing the "Enter" key.

Repeat this step as many times as necessary.

6. Extrusion validation
Press the "Enter" key to validate the extrusion.

When you validate, the extrusion includes the segments defined by your mouse clicks. The segment that is still "in-progress" when you validate, is not included.

7. Capping the openings.
If the original section was a closed curve, the resulting extruded object will have openings that you may want to cap. see chapter "Open shapes / Closed shapes" on page 152).
The edges of the openings will be displayed in red.

⇒ Click with the object selection accessory on the opening you wish to close.
⇒ Or go to the next step if you want to leave the object open.

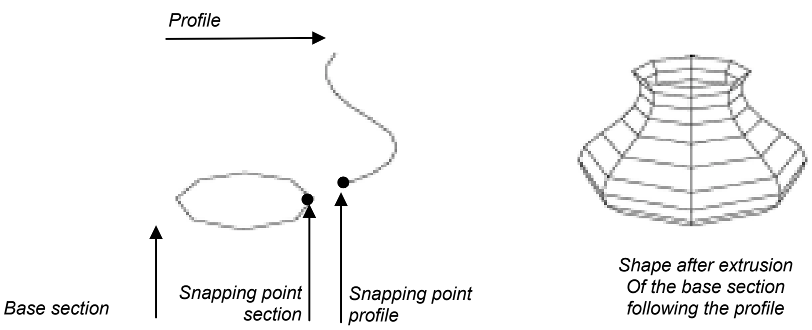
8. Ending the tool action.
Put the tool aside to end the action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

Practical exercises:

- A cone on a sloping plane / The cone / Step 2
- A Champagne cap / The cap's body / Step 2
- A house / The rafters / Step 3
- A mouse on a piece of cheese / The cheese / Step 1
- A chair / The foot / Step 2
- Intersecting pipes / Make a cylinder
- An acoustic baffle / The loudspeaker / Step 2
- A little ant / Constructing half of the head / Steps 3 and 4

♦ *Extrude a curve following an already drawn profile*

This method is used to create an extrusion from a section (2D or 3D curve, open or closed) and a path (open 2D or 3D curve).
The path does not have to share a common point with the section; AMAPI 3D will automatically move the section to the path before extruding. Each segment of the path will correspond to a section of the extrusion. The distance from the center of the section to the corresponding line segment will define the size of each intermediate section.



Usage:

1. **Creating two curves.**
   One of the curves will be the "Section" that will be extruded along the "Profile" or "path", the second curve. These curves can be drawn with the "Draw" tools.

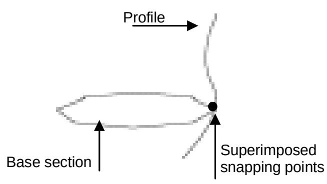
2. **Designating the section.**
   Using the object selection accessory , designate the section. It becomes the current object.

3. **Selecting the Extrusion tool.**
   Click on the icon depicting the Extrusion tool in the Tools Palette.

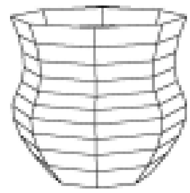
4. **Selecting snap-to points** (optional).
   There is a snap-to point for the section and for the profile.
   When Amapi does the extrusion, the profile is moved so that the snap-to points are superimposed. AMAPI 3D gives a default position to the snap-to points, but in certain cases, you can set these points.

4.1 Default snap-to points

If the curves share a common point, AMAPI 3D considers this point the snap-to point.

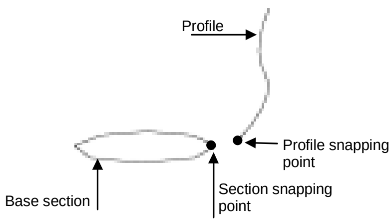


Default snap-to points
Before extrusion

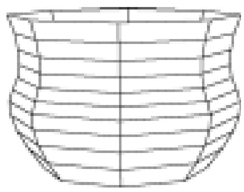


Result
After extrusion

If the curves do not share a common point, the snap-to points are the closest points of the curves.

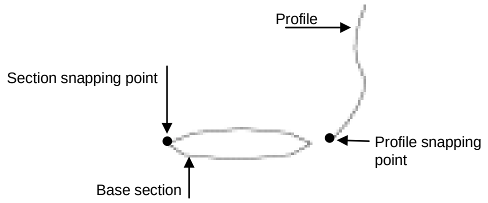


Default snap-to points
Before extrusion

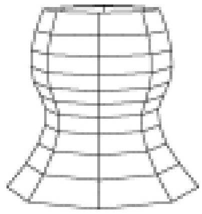


Result
After extrusion

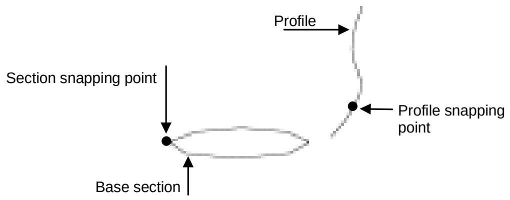
4.2 Move a snap-to point
To move a snap-to point, you must use the reference point selection accessory  (See "How to select a selection accessory?" on page 104).
Place it on a curve and click to set a new snap-to point on this curve.



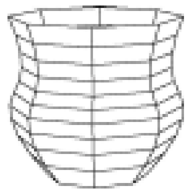
Positioning of the Section snap-to point
Before extrusion



Result
After extrusion



Positioning of the Profile snap-to point
Before extrusion



Result
After extrusion

4. **Designating the prrofile**
   Click on the profile curve.
   AMAPI 3D joins the profile to the base section.
   The extrusion appears.
   If the section was a closed curve, the resulting extruded shape will have two openings, highlighted in red. (see chapter "Open shapes / Closed shapes" on page 152).

5. **Capping the openings (optional).**
   Using the object selection accessory, click on the opening(s) you wish to cap.
   Or go to the next step if you want to leave them open(see chapter "Open shapes / Closed shapes" on page 152).

6. **Ending the tool action.**
   Put the tool aside to end the action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

The two original curves are sent to the hidden scene once the extrusion is created. Use the Unhide tool if you want to bring them back into the main scene.

It is advised to connect together the Section and the Profile, though it is not required; but this ensures the most predictable results.

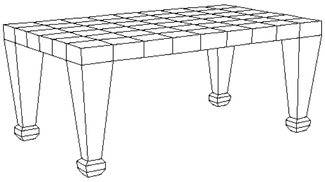
Practical exercises:

- A glass / Extruding the glass (2 methods) / Step 1a

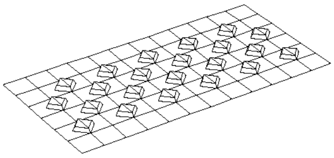
- Facet, edge, or vertex extrusion

If the current object is a surface or a volume, as soon as you take the "Extrusion" tool, you will be doing a surface extrusion.
*In this case **the base section** can be:*

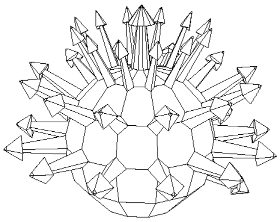
- *a **facet***
- *an **edge***
- *a **vertex***



Facet extrusion



Edge extrusion



Vertex extrusion

*You can **generate simultaneously several extrusions of the same kind on the current object.***

***The drawing of the profile is done while using the tool** itself.*

*It is possible to control **the scale of each section** and **the height of each section** while extruding.*

Extrusion on a surface or a volume deletes levels 1 (structure) and 2 (smoothed structure) of the object's Dynamic Geometry. For more information see chapter "Dynamic Geometry" on page 155.

It is not possible to extrude a NURBS volume.

Usage:

1. Object selection.

With the object selection accessory , click on an object to make it the current object.

2. Selecting the Extrusion tool.

Click on the icon depicting the Extrusion tool.
The tool subpalette appears at the top of the screen.

3. Selecting the kind of section to be extruded.

The subpalette at the top of the screen allows you to select the kind of section you want to extrude. You can choose between:

 **Facet** (default)

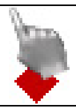
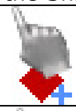
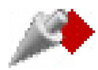
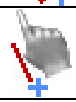
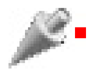
 **Edge**

 **Vertex**

Click on the icon corresponding to the kind of section you chose.

4. Selecting one or several base sections (facet, edge, or vertex).

Take the selection accessory appropriate for this action:

	Object selection		Group selection
	One by one	Several objects (with the Shift key)	
Facets			
Edges			
Vertex			

Refer to chapters: "How to select a selection accessory?" on page 104. Then select the element(s) (facet, edge, or vertex) following the directions for use of the selection accessory you chose (see chapter "The different ways to select" on page 105).

 You can use the arrow keys of the keyboard to select a facet, an edge, or a vertex on a hidden face of the object (see chapter Navigation" on page 91).

5. Display simplification (optional).

Move the cursor; you will see the first extruded segment(s).
When extruding several base sections at the same time, AMAPI 3D will select one as the reference section. From this one you will draw the path which will be the reference for the other extrusions. AMAPI 3D displays interactively all the extrusions while drawing. To avoid overloading the screen, you can display only the reference

path. Just press the button or press simultaneously the Control key and the spacebar.

6. Extrusion drawing

For each of the extrusion segments, you will control the following parameters:

- The **width** of the intermediate section (w).
- The **height** of the extrusion segment (***h***).

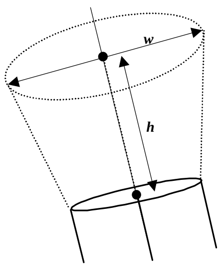
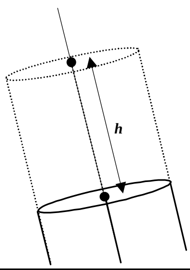
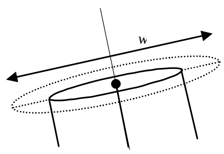
The extrusion axis always follows the normal to the section.

Two methods are available:

- **"Freehand" extrusion (direct):**

1. In some cases you will need **to constrain the cursor movement**. The spacebar will allow you to toggle from one constraint to another.

The sequence of movement constraints will be different depending if you are extruding a single section or multiple sections.

Sequence	Single section	1st constraint	2nd constraint	3rd constraint
	Multiple sections	3rd constraint	1st constraint	2nd constraint
Cursor movement		Free movement	Movement on the extrusion axis	Movement on the plane of the last drawn section
Effects on the drawing		The cursor movement simultaneously controls: **The scaling of the section** (the width *w*). **The height** (*h*) of the extruded segment.	**Section "n"** being drawn retains the proportions of section "n-1". The cursor movement controls only the **height** (*h*) of the extruded segment.	**The height** (*h*) of the extruded segment **is null** (*h=0*). The cursor movement controls only the **scaling of the section** (the width *w*).
Illustration				

2. Move the cursor to draw (or stop drawing) a segment of the profile, then click to validate the extrusion.

♦ **Drawing with data settings:**

Press the "Tab" key to access the Data Window.
Use this key to switch between data items.
Enter the desired values for each data (**Width** and/or **Height**), then validate by pressing the "Enter" key.

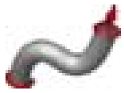
Repeat this step as many times as necessary.

7. Extrusion validation.
Press the "Enter" key to validate the extrusion.
⚠ When you validate, the extrusion includes the segments defined by your mouse clicks. The segment that is still in-progress when you validate, is not included.

8. Draw a new extrusion on the same volume.
- ♦ If you want to do a new extrusion:
  - ♦ With the same kind of section, go back to step 4.
  - ♦ With a new kind of section, go back to step 3.
- ♦ If you want to leave the tool, go to the next step

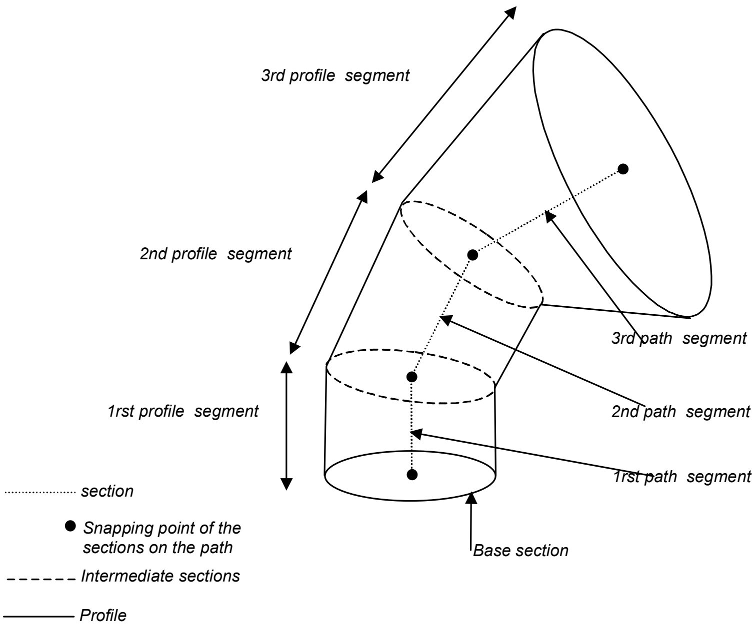
9. Ending the tool action.
Put the tool aside to end the action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

7.2.7 Sweeping



This tool allows you to create a profile from a base section and a path.
A profiled segment will correspond to each segment of the path.
With the Sweep tool, you can control both the orientation and the scale of each section.

- *If you take this tool with* ***a curve as the current object****, see the "Sweep a section" chapter (see "Sweep a section" on page 221).*
- *If you take this tool with* ***a volume as the current object****, see the "Sweep a facet, an edge, or a vertex" chapter (see "Sweep a facet, an edge, or a vertex" on page 227).*



This tool adds a finishing level to the object which is editable by the tools using the Dynamic Geometry properties. It becomes a rough object.
For more information see chapter "Dynamic Geometry" on page 155.

❑ Sweep a section

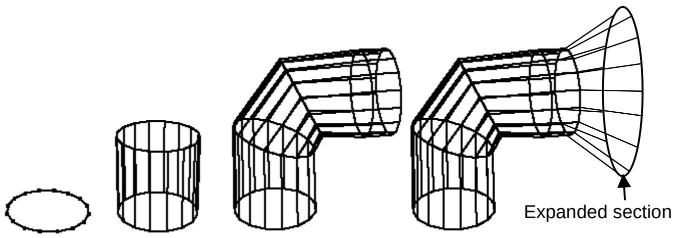
If you take this tool with a curve as the current object, this curve will automatically be considered the base section.
The profile can be either:

- *already been drawn before taking the tool*
- *directly drawn in the Sweep tool*

This tool adds a finishing level to the object which is editable by the tools using the Dynamic Geometry properties. It becomes a rough object.
For more information see chapter "Dynamic Geometry" on page 155.

♦ ***Sweeping a base section following a profile drawn in the tool***

With this method:
- The profile drawing is done while using the tool itself.
- It is possible to control the scaling of each section while drawing.
- After the profile drawing validation, it will be possible to control the position, the orientation and the scaling of all the intermediate sections (see chapter "Orientation and scaling of the swept sections" on page 232).



Example of profile drawing

Usage:

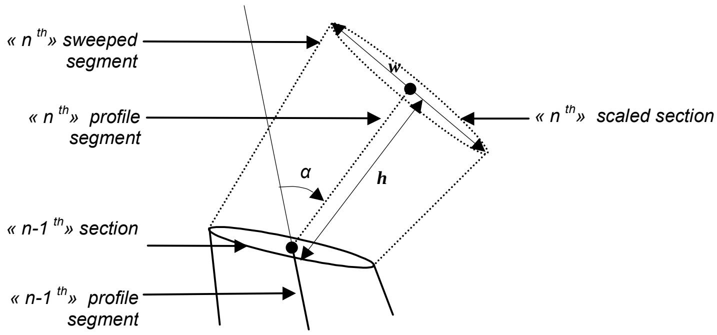
1. **Selecting the base section.**
   The section can be a 2D or 3D curve, open or closed (see chapter "Open shapes / Closed shapes"on page 152). Click on the curve to make it the current object (see chapter "Current object concept" on page 166.

2. **Selecting the Sweep tool.**
   Click on the icon depicting the tool in the Tools palette.

3. **Adjust the point of view.**
   Use the arrow keys of the keyboard to display a somewhat perpendicular view of the current object.

4. **Starting drawing.**
   Click again on the base section to start the drawing.
   Move the cursor: you will see that the first point of the profile is the geometrical center of the base section.
   The sections' snap-to point on the profile will be their geometrical center.

5. **Drawing the profile segment by segment.**
For each segment of the profile, you can control the following parameters:
The **orientation** of the segment being drawn "n" relative the "n-1" segment (angle **α**).
The **height** (*h*) of the profile segment.
The **width** (w) of the intermediate section. By default, each intermediate section will retain the measurements of the base section.



AMAPI 3D orients each sectionsuch that its plane follows the bisecting line of the angle made by two successive profile segments (see chapter "Orientation and scaling of the swept sections" on page 232).

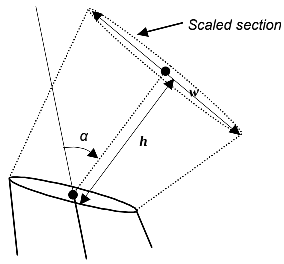
Two drawing methods are available:

5.1 "Freehand" sweeping (direct):

1. To control the **scaling of the section** while drawing, you can choose between two methods:

1st method: Press and hold the Ctrl key before moving the cursor; release it when you have the desired scaling.

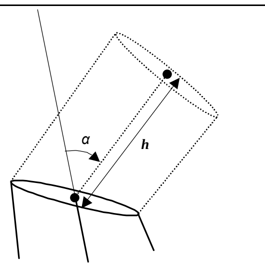
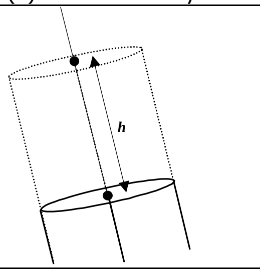
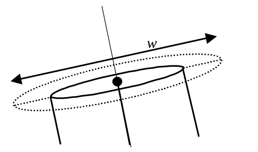
2nd method:
PC: Click on the right mouse button before moving the cursor.
After you have the desired scaling, click again on the right mouse button.
Mac : Press and hold the Option key and click before moving the cursor. When the section size will be tuned, click one more time.



The profile segment is not finished; the cursor movement still controls:
- The orientation (α) of the profile segment.
- The height (*h*) of the profile segment.

In the both cases, a mouse click with the left mouse button will validate the whole swept segment (size, orientation, height). Then, you will begin drawing the next segment (go back to step 5).

2. In some cases, it may be useful to **apply a motion constraint to the cursor**. The spacebar allows you to switch from one motion constraint to another.

	Default No action on the spacebar	**1st press** on the spacebar	**2nd press** on the spacebar
Cursor movement	Free movement.	The cursor will move along the axis of the previously drawn profile. *	The cursor moves on the last drawn section plane only.
Effect on the drawing	Cursor movement simultaneously controls: The **orientation** (α) of the profile segment **The height** (*h*) of the extrusion.	The profile segment in drawing is oriented along the axis of the previously drawn profile segment (a=0).* Cursor movement controls the **height** (*h*) extrusion only.	**The height** (*h*) of the currently extruded segment is null (*h=0*) Cursor movement controls the **section scaling** (width w) only.
Illustration			

* In the special case of the base section, the cursor will move along its normal axis.

3. Move the cursor to draw (or stop drawing) a segment of the profile, then click to validate the sweep.

5.2 Drawing with data settings:

Press the "Tab" key to access the Data Window.
Use this key to switch between data items.
Enter the desired values for each data item (**Height, Angle** and/or **Width**), then validate by pressing the "Enter" key.

In both cases, the sweep is displayed following the defined path.
Repeat this step as many times as necessary.

6. Sweep validation.
Press the "Enter" key to validate the sweep.
⚠ When you validate, the sweep includes the segments defined by your mouse clicks. The segment that is still in-progress when you validate, is not included.

7. **Orientation and scaling of the swept sections (optional).**
   It is still possible to control the orientation and the scaling of the swept sections (see chapter "Orientation and scaling of the swept sections" on page 232).

8. **Capping the openings (optional).**
   If the original section was a closed curve, the edges of the openings will be displayed in red (see chapter "Open shapes / Closed shapes" on page 152).
   If you want to leave them open, go to the next step.
   If you want to close them, click on the openings to be closed.

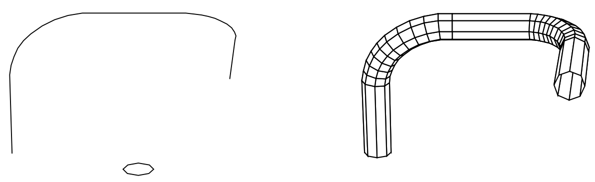
9. **Ending the tool action.**
   Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

Practical exercises:

- A house / The walls / Step 3
- A house / The main beam / Step 4
- A house / The tiles / Step 2

♦ *Sweep a curve along an already drawn path*

This method allows you to sweep a 2D or 3D, open or closed curve along an already drawn path (which can be nonplanar).
The base section can be a 2D or 3D, open or closed curve (see chapter "**Open shapes** / Closed shapes" on page 152).
The profile is an open 2D or 3D curve.
Each segment of the path will define a segment of the swept object.
With this method it will not be possible to control the scale of each section (to do this use the method "Sweeping a base section following a profile drawn in the tool" décrite on page 221); but it will still be possible to control the orientation and the scaling of the swept sections.

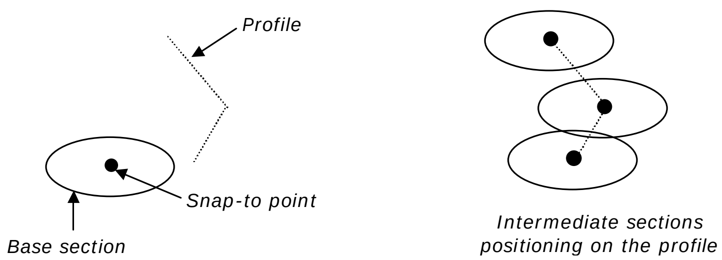


Sweeping a section along a profile (path)

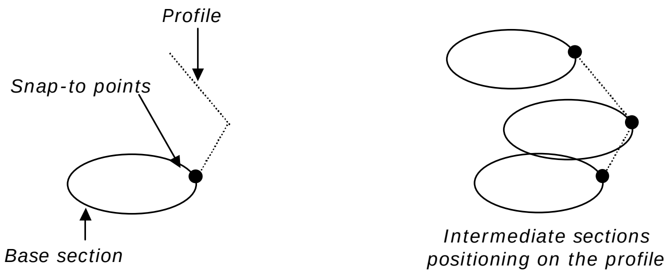
Usage:

1. **Snap-to point positioning (if needed).**
During the sweep operation, the "Sweep" tool will position the snap-to point of each intermediate section to each point of the path.
The two snap modes are described below; it's up to you to position the profile depending on the result you want to get. You may have to get the "Snap" tool (see on page 336).

Snap mode 1: No point in common between the section and the profile:
The snap-to point is the center of the section. In this case, this is the section which moves to the profile during the sweep.



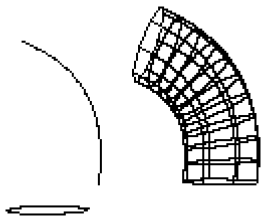
Snap mode 2: There is a point in common between the section and the profile: The snap-to point is the point of intersection of the base section and the profile.



2. Selecting the base section.
The base section may be a 2D or 3D, open or closed curve (see chapter "Open shapes / Closed shapes" on page 152). Click on a curve to designate it as the section (see chapter "Current object concept" on page 166).

3. Select the Sweep tool
Click on the icon depicting the Sweep tool in the palette.

4. Selecting the profile.
Click on the already drawn profile (path) to generate the sweep.
AMAPI 3D orients each section such that its plane follows the bisecting line of the angle made by two successive profile segments (see "Orientation and scaling of the swept sections" on page 232).



Each intermediate section retains the size of the base section.

5. Orientation and scaling of the swept sections (optional).
It is still possible to control the orientation and the scaling of the swept sections (see "Orientation and scaling of the swept sections" on page 232).

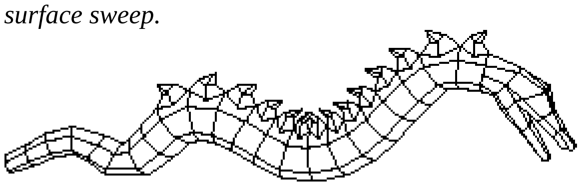
6. Capping the openings (optional).
If the original section was a closed curve, the edges of the openings will be displayed in red (see chapter "Open shapes / Closed shapes" on page 152).
If you want to leave them open, go to the next step.
If you want to close them, click on the openings to be closed.

7. Ending the tool action.
Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

Practical exercises:
- A glass / Extruding the glass (2 methods) / Step 1b

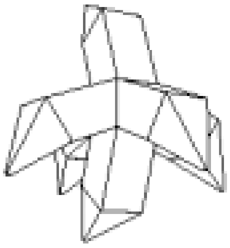
❑ Sweep a facet, an edge, or a vertex

If the current object is a surface or a volume, as soon as you take the “Sweep” tool, you will be doing a surface sweep.

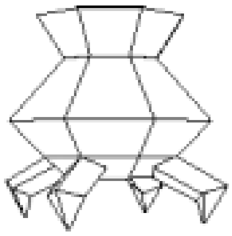


In this case ***the base section*** *could be:*

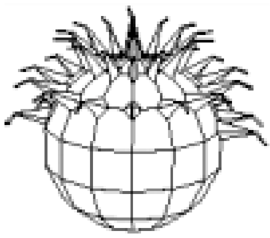
- *a facet*
- *an edge*
- *a vertex*



Cube with swept facets



Sweeping of multiple edges



Sweeping of multiple points

You can generate several profiles of the same kind, at the same time.

The profile drawing is done while using the tool itself.

You can control the scaling of each section when drawing.

After validating the profile drawing, you still may able to control the orientation and the scaling of the whole swept intermediates sections (see chapter “Orientation and scaling of the swept sections" on page 232).

⚠ *Sweeping on a surface or a volume deletes levels 1 (structure) and 2 (smoothed structure) of the object’s Dynamic Geometry. For more information see chapter “Dynamic Geometry” on page 155.*

Usage:

1. Object selection.

With the object selection accessory , click on an object to make it the current object.

2. Selecting the Sweep tool

Click on the icon depicting the Sweep tool.
The tool subpalette appears on the top of the screen.

3. Selecting the kind of section to be extruded (facet, edge, or vertex)

The subpalette at the the top of the screen allows you to select the kind of section you want to sweep. You have the choice of:

 **Facet** (default)

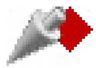
 **Edge**

 **Vertex**

Click on the icon corresponding to the kind of section you want.

4. Selecting one or several base sections (facet, edge, or vertex).

Take the selection accessory appropriate for this action:

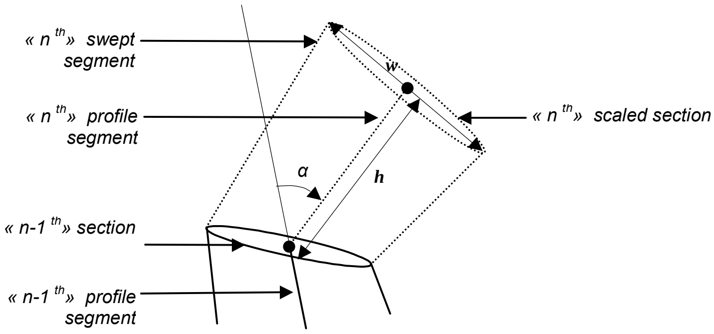
	Object selection		Group selection
	One by one	Several objects (with the Shift key)	
Facets			
Edges			
Vertex			

Refer to chapters: "How to select a selection accessory?" on page 104. Then select the element(s) (facet, edge, or vertex) following the directions for use of the selection accessory you chose (see chapter "The different ways to select" on page 105).

i You can use the arrow keys of the keyboard to select a facet, an edge, or a vertex on a hidden face of the object (see chapter Navigation" on page 91).

5. Display simplification (optional).
Move the cursor; you will see the first segment of the profile.
You can see that the first point of the profile is on the geometrical center of the base section. The sections' snap-to point on the profile will be their geometrical center.
When sweeping several base sections at the same time, AMAPI 3D will select one as the reference section. From this one you will draw the path which will be the reference for the other extrusions. AMAPI 3D displays interactively all the profiles while drawing. To avoid overloading the screen, you can display only the reference path. Just press the button or press simultaneously the Control key and the spacebar.

6. Profile drawing, segment by segment.
For each of the extrusion segments, you will control the following parameter:
- The **orientation** of the profile segment "n" being drawn, relative to the "n-1" segment (angle **α**).
- The **height** of the extrusion segment (***h***).
- The **width** of the intermediate section (w). By default, each intermediate section retains the measurements of the base section.



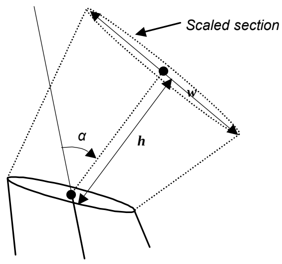
AMAPI 3D orients each section such that its plane follows the bisecting line of the angle made by two successive profile segments (see chapter "Orientation and scaling of the swept sections" on page 232).

In the case where you had selected several base sections on step 4, AMAPI 3D will draw a swept segment for each section that is like the segment of the reference section.

Two methods are available:

6.1 "Freehand" sweeping (direct):
1. To control the **scaling of the section** while drawing, you can choose between two methods:

1st method: Press and hold the Ctrl key before moving the cursor; release it when you have the desired scaling.
2nd method:
PC: Click on the right mouse button before moving the cursor.



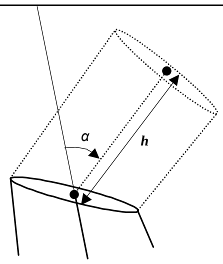
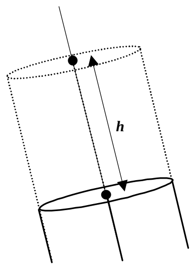
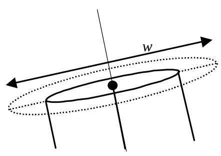
After you have the desired scaling, click again on the right mouse button.
Mac : Press and hold the Option key and click before moving the cursor. When the section size will be tuned, click one more time.

The profile segment is not finished; the cursor movement still controls:
- The orientation (α) of the profile segment.
- The height (*h*) of the profile segment.

In both cases, a mouse click with the left mouse button will validate the whole swept segment (size, orientation, height). Then, you will begin drawing the next segment (go back to step 6).

2. In some cases, it may be useful to **apply a movement constraint to the cursor**. The spacebar allows you to switch from one motion constraint to another.

The sequence of motion constraints will be different depending on if you are extruding a single section or multiple sections.

Sequence	Unique section	1st constraint	2nd constraint	3rd constraint
	Multiple sections	3rd constraint	1st constraint	2nd constraint
Cursor movement		**Cursor moves freely.**	**Cursor moves along the axis of the previous profile segment. ***	**Cursor moves on the plane of the last drawn section.**
Effects on the drawing		The cursor movement simultaneously controls: The **orientation** (α) of the profile segment **The height** (*h*) of the extruded segment.	The profile segment being drawn is oriented along the axis of the previously drawn profile segment (a=0).* The cursor movement controls the **height** (*h*) extrusion only.	**The height** (*h*) of the currently extruded segment is null (*h=0*) The cursor movement controls the **section scaling** (width w) only.
Illustration				

* In the special case of the base section, the cursor will move along its normal axis.

3. Move the cursor to draw (or stop drawing) a segment of the profile, then click to validate the sweep.

6.2 Drawing with data settings:

Press the "Tab" key to access the Data Window.
Use this key to switch between data items.
Enter the desired values for each data item (**Height**, **Angle** and/or **Width**), then validate by pressing the "Enter" key.

In the both cases, the sweep is displayed following the defined path.
Repeat this step as many times as necessary.

7. Sweep validation.
Press the "Enter" key to validate the sweep.

⚠ When you validate, the sweep includes the segments defined by your mouse clicks. The segment that is still in-progress when you validate, is not included.

8. Scaling of the swept sections (optional).
It is still possible to control the scaling (only) of the swept sections (see chapter "Orientation and scaling of the swept sections" on page 232).

9. Draw a new sweeping on the same volume.

- If you want to do a new sweeping:
    - With the same kind of section, go back to step 4.
    - With a new kind of section, go back to step 3.
- If you want to leave the tool, go to the next step

10. Ending the tool action.
Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

Orientation and scaling of the swept sections

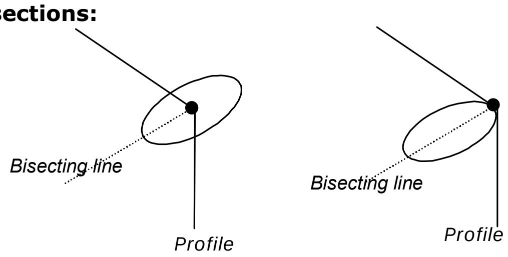
The Sweep tool creates an intermediate section for each profile segment. AMAPI 3D provides a default positioning, orientation, and size for the swept sections. You can control the orientation and the scaling of the swept sections.

♦ ***Section orientation***

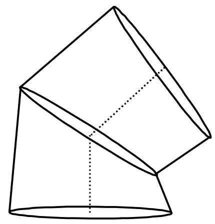
This optional step is only available on the "Sweep a curve along an already drawn path" on page 225" ; this step is performed after the object is drawn but before the openings are (optionally) capped.

1. **Default orientation of the sections:**

By default, AMAPI 3D orients each section such that its plane follows the bisecting line of the angle made by two successive profile segments.



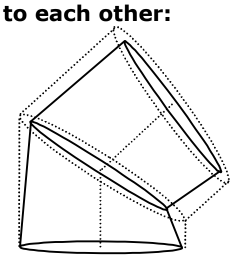
The first and last intermediate sections of the swept object are perpendicular to, respectively, the first and the last segments of the path.
The size of the intermediate sections is the same as the original section. In this case, the edges of the segments of the swept object may not be parallel to one another.



2. **Set the segments of the swept object parallel to each other:**

Press the spacebar once.

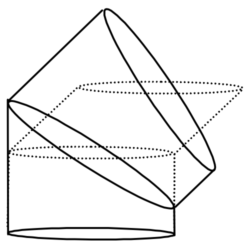
The size of each segment will be modified to ensure that the edges will be parallel to each other.



3. **Set the sections of the swept object parallel to each other:**

Press the spacebar twice.

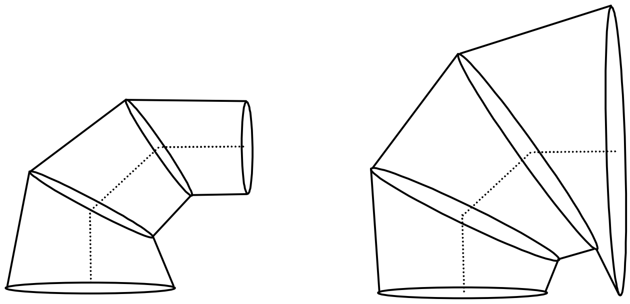
Pressing the spacebar a third time brings you back to the default position.



♦ ***Progressive scale***

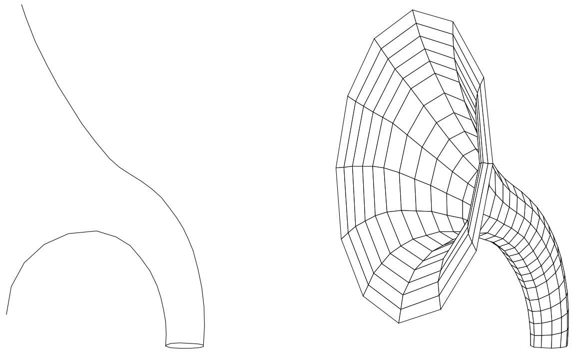
This optional step applies a progressive scale to the sections of the swept object.

The setting is made with The Tuner: (+/- keys of the keyboard) (see details on page 110).



7.2.8 Double Sweeping

The Double-Sweep tool is used to generate a surface from a section (2D or 3D curve, open or closed) and two profiles (open 2D or 3D curve).
The profile with the higher number of points will determine the number of sections of the final object. You can thus create in a single operation, asymmetrical objects, such as horns, tubes with variable diameter, helicoid surfaces, and more.
This tool works also in NURBS mode and will generate NURBS surfaces if the section is a NURBS curve.



This tool adds a finishing level to the object, editable by the tools using the Dynamic Geometry properties. It becomes a rough object.
For more information see chapter "Dynamic Geometry" on page 155.

Usage:

1. **Creating the section and the two profiles.**
   Create a section and two profiles. Each profile must share a common point with the section and preferably be perpendicular to the section.
   - Both profiles must be either **closed or open**.
   - Each profile must share a common point with the section.
   - The two profiles must not share the same common point with the section.

2. **Selecting the current object.**
   Using the object selection accessory , click on the curve you want to designate as the section.

3. **Selecting the Double-Sweep tool.**
   Click on the icon depicting the Double-Sweep tool in the Construction Palette.

4. **Selecting the two profiles.**
   Select each profile one after another: the surface is generated.

5. **Changing the section orientation (optional).**
   You can change the sections' position, as previously (See chapter "Orientation and scaling of the swept sections" on page 232).

6. **Capping the openings (optional).**
   If the original Section was a closed curve, the resulting object will have two openings, highlighted in red. Using the object selection accessory , click on the opening you wish to cap. Go to the next step if you want to leave them open (see chapter "Open shapes / Closed shapes" on page 152).

7. **Ending the tool action.**
   Put the tool aside to end the action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

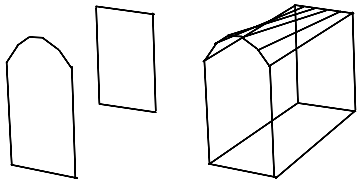
Practical exercises:

- A mouse on a piece of cheese / The mouse / Steps 1, 2 and 4

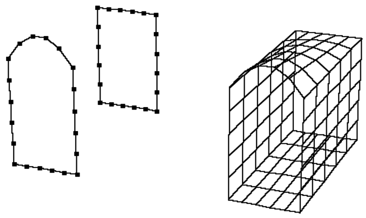
7.2.9 Ruled Surface

The Ruled Surface tool is used to create a surface between two or more 2D or 3D curves. An example of a ruled surface would be the wing of an airplane: the structural members of the wing represent the curves and the wing's surface is the mesh linking those curves together.
A Ruled Surface can be built either in NURBS mode or in polygonal mode.

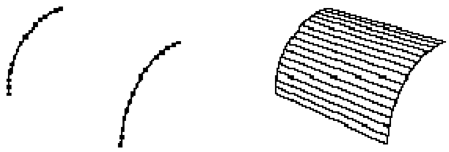
The curves may be opened or closed curves, or opened volumes (see chapter "Open shapes / Closed shapes" on page 152).



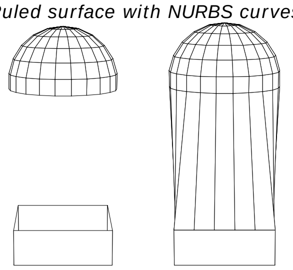
Ruled surface with polygonal curves



Ruled surface with NURBS curves



Ruled surface with open curves



Ruled surfaces with open shapes (volume)

In case of closed curves or open shapes (volume), the choice of the points selected is important; the two points define the starting point of the action.

This tool adds a finishing level to the object, editable by the tools using the Dynamic Geometry properties. It becomes a rough object.
For more information see chapter "Dynamic Geometry" on page 155.

Usage:

1. **Creating the curves.**
   The curves can have different profiles and a different number of points. AMAPI 3D will automatically interpolate the missing points.
   The only constraint is that the curves must all either be open or closed. You can not create a ruled surface between an open curve and a closed curve.

2. **Select the Ruled Surface tool.**
   Click on the icon depicting the Ruled Surface tool in the Tools Palette.

3. **Selecting a point on each curve.**
   AMAPI 3D draws a segment between the two curves selected and uses it to create the surface. Therefore, choose the points carefully. Results will vary depending on the points you select.
   ⇒ Click on a point of the 1st curve.
   ⇒ Click on a point of the 2nd curve.
   ⇒ Do the same for all the other curves. A flat surface, or "skin" is created between each curve.
   ⇒ Press the Return key to end the selection process.

4. **Capping the openings.**
   If the curves used were closed curves, a closed surface with two openings (highlighted in red) is created. Using the object selection accessory , click on the opening you wish to close. Or go to the next step if you want to leave them open. (see chapter "Open shapes / Closed shapes" on page 152).

5. **Ending the tool action.**
   Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

The construction curves used are sent in the hidden scene. Use the Unhide tool to bring them back in the main scene if necessary.

Practical exercises:
- A windshield for a motorbike / (2nd method: ruled surface) / Step 2
- Hull for a boat (Example 1) / (3rd method: ruled surface) / Step 1
- Hull for a boat (Example 2) / (3rd method: ruled surface) / Step 1

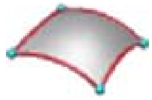
7.2.10 Surfaces

Moving the cursor on top of the icon of this tool opens a sub-palette displaying tools used to create complex surfaces.

This sub-palette supports three tools:

- ***Coons Surfaces:*** *This tool generates a surface from connected curves defining a closed perimeter. You can use 1 to "n" 2D or 3D curves. See on page 239.*
- ***Gordon Surfaces:*** *This tool generates a surface along a network of 3D curves (no limit to the number of curves used). The generated surface is stretched simultaneously along the longitudinal curves and along the latitudinal curves. Se en page 240.*
- ***Hull tool:*** *This tool generates a surface from three connected curves, each one belonging to one main plane (top, front, profile). The section is repeated along the length of the profile and of the contour. See on page 242.*

❑ Coons surfaces



This tool generates a surface from connected curves (snapped by the end points with the adjacent ones) drawing a closed perimeter. You can use 1 to "n" 2D or 3D curves.

This tool adds a finishing level to the object, editable by the tools using the Dynamic Geometry properties. It becomes a rough object.

For more information see chapter "Dynamic Geometry" on page 155.

Usage:

1. Creating the connected curves.
The last point of a curve must be connected to the first point of the next one. The minimum number of curves is 4. They must draw a closed perimeter.

2. Selecting the Coons Surface tool.
⇒ Drag the cursor on top of the Surfaces tool icon. The icon opens into a series of surface-related tools.
⇒ Click on the icon depicting the Coons Surfaces tool icon.

3. Generating the surface.
Click on each curve in no particular order. The surface is created.
You can cancel the last operation (PC: Ctrl+Z; Mac: Command+Z) if you make a mistake.

4. Ending the tool action.
Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

You can change the current object using The Tuner: (+/- keys of the keyboard) (see details on page 110).

Practical exercises:

- Potato chips / Step 2
- A windshield for a motorbike / (1st method: Coons) / Step 2
- Hull for a boat (Example 1) / (2nd method: Coons) / Step 1
- Hull for a boat (Example 2) / (2nd method: Coons) / Step 1
- A chair / The seat / Step 4

❑ Gordon surfaces

This tool is used to create surfaces using networks of 3D curves. The surface is generated along the horizontal curves and vertical curves.

This tool adds a finishing level to the object, editable by the tools using the Dynamic Geometry properties. It becomes a rough object.
For more information see chapter "Dynamic Geometry" on page 155.

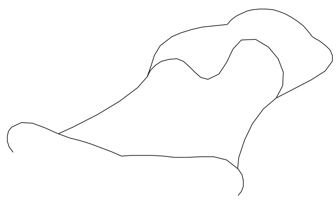
- *All the curves must be connected between so as to create a net.*
- *All the curves going in the same direction (horizontal or vertical) must either be closed or open.*
- *Even if NURBS curves are used, the resulting surface will be polygonal. You will be able to manipulate as if they were NURBS objects (using a control bounding box, using the Deformer tool.*

Usage:

1. **Create a net of connected curves defining the internal and external curves of the surface.**

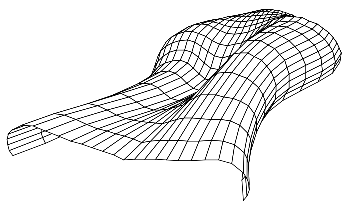
2. **Selecting the Gordon Surfaces tool.**
   ⇒ Drag the cursor on top of the Surfaces tool icon. The icon opens up.
   ⇒ Click on the icon depicting the Gordon surfaces tool icon.

3. **Select the longitudinal curves.**
   Click on each of the longitudinal curves. They are displayed in red. Then press the Return key to validate the selection.



4. **Select the latitudinal curves.**
   Click on each of the latitudinal curves. They are displayed in green. Then press the Return key to validate the selection.
   The surface is generated.

   If curves are connected correctly, the surface is generated, and you can go to step 6.



5. **Correct the incorrect connections of the curves.**
   If the curves were not properly connected, AMAPI 3D will display an error message. In some cases, AMAPI 3D will suggest a connection displayed in yellow. If it is correct for you, press the "Enter" key.

6. **Set the tensions (optional).**
A palette allowing you to set the tensions of the curves is displayed at the top of the screen.
Click on the icon corresponding to the tension you want to adjust.

Icône	**Set**	**Break control** By default, AMAPI 3D takes all the points intersection and curves.
	Set the U (red) and V (green) tensions (default)	Select the breah-points with the point selection accessory .
	Set the U (red) tensions	Select the breah-curves with the point selection accessory.
	Set the V (green) tensions	
	Deselect the break-points and break-curves.	

You will increase or decrease the tensions with the The Tuner: (+/- keys of the keyboard) (see details on page 110).

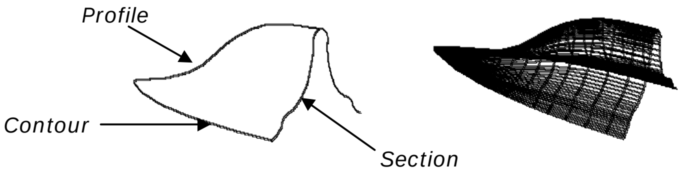
7. **Ending the tool action.**
Validate or put the tool aside to end the tool action (depending on the interface). *See* chapter "How do you end a tool action?" on page 158.

Practical exercises:

- A container
- A toothpaste tube
- Spotlights / Create the surface

Hull Surfaces

This tool is used to generate a surface from three connected curves (a section, a profile, and a contour), each lying on a main plane (top, front, profile). The section is repeated along the length of the profile and of the contour.



Usage:

1. **Creating the three curves.**
   Each curve belongs to a different main plane (top, front, and profile) and the contour and the section share a common point (See chapter "General use of the Drawing tool palette" on page 185).

2. **Selecting the Hull tool.**
   Click in the icon depicting the Hull tool in the Tools Palette.

3. **Creating the surface.**
   You must select the curves in the following order: the section, the profile, and the contour. The surface is created.
   You can cancel the last operation (PC: Ctrl+Z; Mac: Command+Z) if you make a mistake.

4. **Optimizing the mesh.**
   Before dropping the tool, press the "-" key on the numeric keypad to equalize the number of points of the construction curves and the number of facets of the mesh. Once the mesh is optimized, pressing the "-" key will have no effect.

5. **Ending the tool action.**
   Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

Practical exercises:
- Hull for a boat (Example 1) / (1st method: hull) / Step 2
- Hull for a boat (Example 2) / (1st method: hull) / Step 1

7.3 Modeling

This palette includes the tools with which you can model the primitives. With them, you can stretch, smooth, bevel, and so forth.

Icon	Tool name	Description	See
	Deformers	**Global deformers:** They allow to deform a whole object by moving or deforming one of the faces of its surrounding control box. Spherical Taper Twist Bend	on page 245
		Local deformers: They act on the control points of a bounding box to deform a precise area of an object. Mold Stretch Scale Rotate	on page 254
	Bend	The Bend tool distorts the current object according to the path drawn by a reference curve.	on page 262
	Wrap	The Wrap tool allows you to deform an object by mapping it on a shape (Grid, Cylinder or Sphere).	on page 265
	Stretch	The Stretch tool is used to move single vertices or a group of vertices, thus distorting the object.	on page 268
	Delete	The Delete tool supports four delete modes: ♦ Deleting a facet. ♦ Deleting an edge with generation of a new facet. ♦ Deleting a point by removing all the adjacent facets to this point. ♦ Deleting a point with generation of a new facet.	on page 272
	Smooth	The Smooth tool is used to control the number of facets defining a surface and the number of points defining a curve. The higher the smoothing value, the smoother the object looks.	on page 276
	Chamfer (Bevel)	This tool allows you to create bevels.	on page 290

	Thickness	Apply a uniform thickness to a curve, a surface, or a volume. Create an offset of the object.	on page 294
	Cut	The Cut tool provides several ways of cutting an object: ♦ Punch: Punching a surface or a volume using a reference curve. ♦ Boolean: Performs Boolean operations between curves, surfaces, or volumes. ♦ Extract: Extracts a part of the current object to make a new one.	on page 299
	Decimate	This tool allows you to reduce the complexity of an object and the size of the file while preserving the object’s general appearance.	on page 306
	Tessellate	This function subdivides a facet into four facets.	on page 307
	Relief	The Bump tool allows you to modify the surface regularity. There are two subtools: Bump Soften	on page 309

Some modeling tools cannot operate on a NURBS object. To use these tools, you would have to transform your NURBS object into a polygonal model. This transformation is done through the Information tool of the Control Panel (See chapter “Get info” on page 149). However, keep in mind that a NURBS model transformed into a polygonal object cannot be transformed back into a NURBS object. So do not use these tools if you need your models to remain as NURBS objects.

7.3.1 Deform (the global deformers)

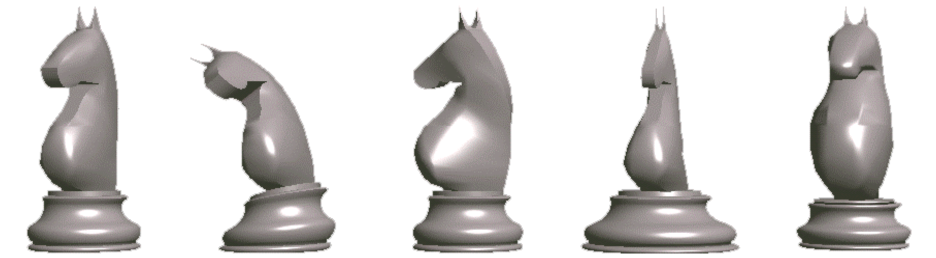
(unfolding)

There are:

Global deformers:
They allow you to deform a whole object by moving or deforming one of the faces of its surrounding control box.

***Local deformers**:*
They act on the control points of a bounding box to deform a precise area of an object.
For more information about the Local deformers, see chapter “Deform (the local deformers)” on page 254.

***This chapter focuses on the Global deformers** only. Global deformers allow you to deform an object by moving or deforming one of the faces of its surrounding control box.*
You act on the bounding box, not on the control points.

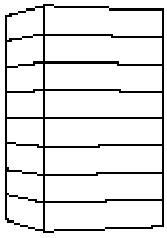


Original object Bent object Twisted object Tapered object Spherically deformed object

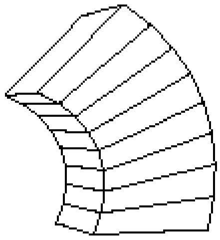
This tool uses the Dynamic Geometry properties.
For more information see chapter “Dynamic Geometry” on page 155.

❑ Bender

This tool allows you to act on a face of the bounding box to bend it around its center of gravity (around a horizontal or vertical axis).
The object will follow the deformation



Original object



Bent object

Using:

1. Selecting an object.

Using the object selection accessory, click on a polygonal object or a group of objects to designate the current object.
To restrict the action to a part of an object, use the appropriate selection accessory (see chapter "The selection accessories" on page 104).

2. Selecting the tool.

Position the cursor over the icon; you will see the global deformer icons displayed.

Click on the icon depicting the "Bend" tool.
The object will be surrounded by a non-meshed control box.

3. Select the axis of the action.
Press the spacebar to toggle the axis of deformation: width or height.

4. Specify the face that will control the action.
Click on the face that you will use to control the deformation.

5. Bend the object.
The data palette displays the angle of rotation with which the control face will rotate around its center of gravity.
There are several ways to set this:

- **Mouse parameter setting**: Move the cursor, then click (see details on page 109).
- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).
- **Remote interaction**
  - The Tuner: (+/- keys of the keyboard) (see details on page 110).
  - The Remote Control (see chapter "The Remote Control" on page 110).
  - The Slider (see chapter "The Slider" on page 110).

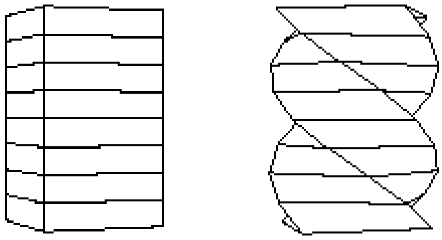
  Then go to the next step or go back to step 3 or 4.

6. **Ending the tool action.**
   End the tool action by putting the tool aside (depending on the interface). See chapter "How do you end a tool action?" on page 158.

Practical exercises:
- Deformed chessmen / Bend a bishop

Twist

This tool allows you to act on a face of the bounding box to twist it around its center of gravity (about its vertical or horizontal axis).
The object will follow the deformation.



Original object *Twisted object*

Usage:

1. **Selecting an object.**
   Using the object selection accessory , click on a polygonal object or a group of objects to designate the current object.
   To restrict the action to a part of an object, use the appropriate selection accessory (see chapter "The selection accessories" on page 104).

2. **Selecting the tool.**
   Position the cursor over the icon; you will see the global deformer icons displayed.
   Click on the icon depicting the "Twist" tool .
   The object will be surrounded by a non-meshed control box.

3. **Select the axis of the action.**
   Press the spacebar to toggle the axis of deformation: width, height, or depth.

4. **Specify the face that will control the action.**
   Click on the face that you will use to control the deformation.

5. **Twist the object.**
   The data palette displays the angle of rotation about which the control face will rotate around its center of gravity.
   There are several ways to set this:
   - **Mouse parameter setting**: Move the cursor, then click (see details on page 109).
   - **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - Using the Tab key (see details on page 109).
     - Clicking in the Data Window (see details on page 109).
   - **Remote interaction**
     Two methods are available:
     - The Tuner: (+/- keys of the keyboard) (see details on page 110).
     - The Remote Control (see chapter "The Remote Control" on page 110).
     - The Slider (see chapter "The Slider" on page 110).
     Then go to the next step or go back to step 3, 4 or 5.

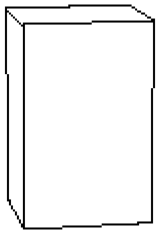
6. **Ending the tool action.**
   End the tool action by putting the tool aside (depending on the interface). See chapter "How do you end a tool action?" on page 158.

Practical exercises:

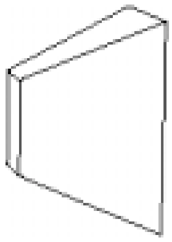
- Deformed chessmen / Twist a knight

Taper

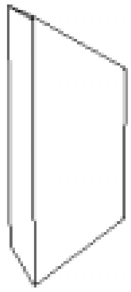
This tool allows you to act on a face of the bounding box to taper or expand it. The object will follow the deformation of the face.



Original object



Tapered object



Expanded object

Usage:

1. **Selecting an object.**
   Using the object selection accessory, click on a polygonal object or a group of objects to designate the current object.
   To restrict the action to a part of an object, use the appropriate selection accessory (see chapter "The selection accessories" on page 104).

2. **Selecting the tool.**
   Position the cursor over the icon; you will see the global deformer icons displayed.
   Click on the icon depicting the "Taper" tool.
   A yellow control box encloses the object.

3. **Select the axis of the action.**
   Press the spacebar to toggle the axis of deformation: width or height.

4. **Specify the face that will control the action.**
   Click on the face that you will use to control the deformation.

5. **Taper or expand the object.**
   The data palette displays the ratio between the expected size of the control face and the initial size. There are several ways to set this:
   - **Mouse parameter setting**: Move the cursor, then click (see details on page 109).
   - **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - Using the Tab key (see details on page 109).
     - Clicking in the Data Window (see details on page 109).
   - **Remote interaction**
     Two methods are available:
     - The Tuner: (+/- keys of the keyboard) (see details on page 110).
     - The Remote Control (see chapter "The Remote Control" on page 110).
     - The Slider (see chapter "The Slider" on page 110).

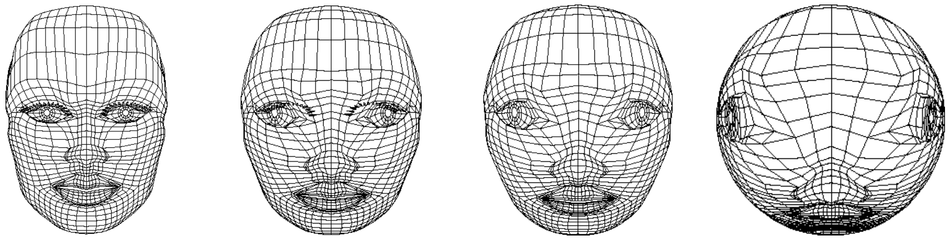
   Then go to the next step or go back to step 4 or 5.

6. **Ending the tool action.**
End the tool action by putting the tool aside (depending on the interface). See chapter "How do you end a tool action?" on page 158.

Practical exercises:
- Deformed chessmen / Taper a bishop

Spherical deformation

The purpose of this tool is to deform the object into a spherical shape.



Original object | *Object lightly deformed with spherical deformer* | *Object strongly deformed* | *Object fully "spherized"*

Usage:

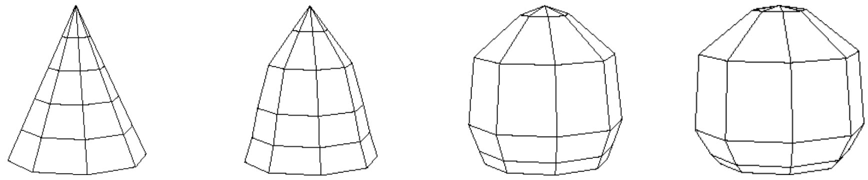
1. **Selecting an object to work with.**
   Click on the object selection accessory to designate the current object.
   To restrict the action to a part of an object, use the appropriate selection accessory (see chapter "The selection accessories" on page 104).

2. **Selecting the tool.**
   Position the cursor over the icon; you will see the global deformer icons displayed.
   Click on the icon depicting the "Spherical deformation" tool .

3. **Setting the radius.**
   AMAPI 3D displays a sphere on which the object will be wrapped. The radius setting is done through the keyboard. Access the Data Window, then enter the values through the keyboard. Two methods are available:
   - Using the Tab key (see details on page 109).
   - Clicking in the Data Window (see details on page 109).

4. **Setting the coefficient.**
   The coefficient defines the amplitude of the wrapping. There are several ways to set this:
   - **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - Using the Tab key (see details on page 109).
     - Clicking in the Data Window (see details on page 109).
   - **The Tuner:** (+/- keys of the keyboard) (see details on page 110).

Example on a cone:



Coeff=0 *Coeff=0.35* *Coeff=0.75* *Coeff=1*

5. **Ending the tool action.**
   End the tool action by putting the tool aside (depending on the interface). See chapter “How do you end a tool action?” on page 158.

7.3.2 Deform (the local deformers)

(subpalette)

There are:

Local deformers*:*
They act on the control points of a bounding box to deform a precise area of an object. There are two kinds of Local deformers:
Local deformers that use a meshed control box*: They use the NURBS methods to mold polygonal objects. As with NURBS models, you will act on the control points of a bounding box, not on the points of the surface of the object. Tthis is how you make local deformations.*
The Local deformation modeler *which allows you to move points belonging to the area of influence according to the offset you apply to a single point.*

Global deformers:
They allow you to deform a whole object by moving or deforming one of the faces of its surrounding control box.
For more information about Global deformers, see chapter "Deform (the global deformers)" on page 245.

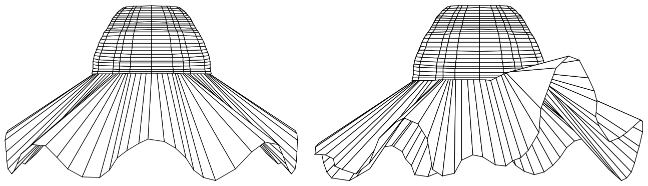
This chapter is about the Local deformers:

Local deformation modeler		Mold
Local deformers that use a meshed control box		Stretch (default)
		Scale
		Rotate

This tool uses the Dynamic Geometry properties.
For more information see chapter "Dynamic Geometry" on page 155.

- The Local deformation modeler

The Mold tool allows you to not only pull a point but also pull the points surrounding it. The strength of the pull will be unevenly applied to the points: the further away from the main selected point, the weaker the force. It is as if you were modeling a clay model. This is a freeform tool. Modifications are done visually and cannot be specified numerically.



Example of use of the Mold tool

There are two ways to use the Mold tool:

- *With interactive control of the area of influence*
- *With interactive control of the force of attraction*

The Mold tool works differently on a NURBS object. You will move points of the control box enclosing the object, in this way distorting the NURBS object.

♦ *Modeling with interactive control of the area of influence*

This method allows you to move points belonging to the area of influence according to the offset you apply to a single point. The further a point of the area of influence is from the main selected point, the smaller the offset applied to it. You can control the area of influence interactively.

Usage:

1. Selecting the element to mold.

Using the object selection accessory, click on the object you want to mold. It becomes the current object.

2. Selecting the Mold tool.

Click on the icon and you will see the local deformer palette displayed.

Click on the icon depicting the "Mold" tool.

The Mold tool is one of the tools which allows you to change the current object while using the tool.
To change the current object while within the tool:

⇒ Press Shift+ESC to select the object selection accessory.
⇒ Click on another object: it becomes the current object.

3. Dynamic Geometry properties.

Depending on how you created the current object, you can work with its Dynamic Geometry properties. This means that you can work on one of the following four finishing levels:
1 – Rough structure
2 – Smoothed structure
3 – Rough object
4 – Smoothed object
In the "Dynamic Geometry" palette, click on the icon depicting the finishing level on which you want to work.

If you decide to work on your model at finishing level "n", then you will no longer be able to work on levels "1" to "n-1" (the icon of the disabled levels will disappear).

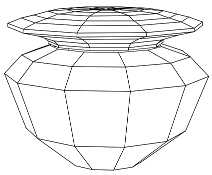
For more information see chapter "Dynamic Geometry" on page 155.

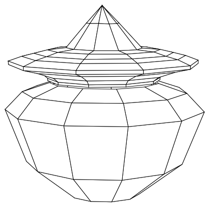
4. Selecting a point of the surface to pull.

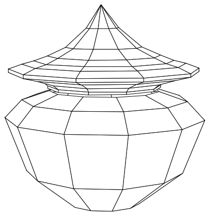
Click on a point of the surface you want to mold.

5. The range of influence of the tool interactively.

AMAPI 3D highlights in red the points of the surface of the object included in the range of influence of the tool. Only those points will be distorted by the action of the tool. You can increase or decrease this range. Setting the range to its minimum size restricts the tool action to the point selected:
You can set this with The Tuner: (+/- keys of the keyboard) (see details on page 110).


Bottle
Not distorted


Distorted bottle
(Reduced range of influence)


Distorted bottle
(Increased area of influence)

You can modify the area of influence while you are moving the cursor (see step 4).

6. **Deforming a surface with or without constraints.**
The selected point follows the cursor movement and all the points included within the area of influence will be moved from their respective positions.
You can modify the area of influence while moving the cursor (see step 5).
Unless you specify otherwise, the cursor can move freely in any direction. AMAPI 3D allows you to apply a constraint to the cursor movement and positioning:
 - Movement constraint along one axis
 - Resetting the axes' increment (step size)
 - Snapping the cursor on existing points
 - Snapping the cursor on a segment
 - Positioning the cursor according to lines of constraint

For more information see chapter "Cursor movement and positioning constraints" on page 98.

7. **Validating the distortion.**
Click on the mouse button to validate the modeling.
Go back to step 3 to model another part of the object.
You can model another part of the object. To do this, go back to step 3 or 4.

8. **Ending the tool action**
Put the tool aside to end the action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

Practical exercises:
- Potato chips / Step 3

♦ *Modeling with interactive control of the force of attraction*

This option gives you, in addition to the control of the area of influence of the tool, control of the force of attraction of the tool. The further away a point (belonging to the area of influence) is from the main selected point, the weaker the force of attraction of the tool and the smaller the offset applied to the point. Therefore, points will be offset differently depending on their location within the area of influence of the tool, as if the surface was an actual clay model. You can ***define both the area of influence and the force of attraction.***

Usage:

1. Selecting the object to mold.

Using the object selection accessory, click on the object you want to mold. It becomes the current object.

2. Selecting the Mold tool.

Click on the icon and you will see the local deformer palette displayed.

Click on the icon depicting the "Mold" tool.

The Mold tool is one of the tools which allows you to change the current object while using the tool.
To change the current object while within the tool:

⇒ Press Shift+ESC to select the object selection accessory.
⇒ Click on another object: it becomes the current object.

3. Dynamic Geometry properties.

Depending on how you created the current object, you can work with its Dynamic Geometry properties. This means that you can work on one of the following four finishing levels:
1 – Rough structure
2 – Smoothed structure
3 – Rough object
4 – Smoothed object
In the "Dynamic Geometry" palette, click on the icon depicting the finishing level on which you want to work.

If you decide to work on your model at finishing level "n", then you will no longer be able to work on levels "1" to "n-1" (the icon of the disabled levels will disappear).

For more information see chapter "Dynamic Geometry" on page 155.

4. Switching to "modeling with interactive control of the force of attraction".

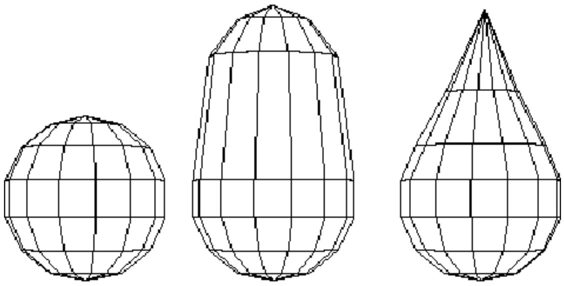
To switch to the "modeling with interactive control of the force of attraction" mode, you can either:
⇒ Click on the corresponding icon in the "Mode" area of the Assistant Palette.
Or
⇒ Use the hotkey: Ctrl+spacebar.

A white circle indicating the area of influence of the tool is then displayed around the cursor.

5. Defining the area of action of the tool.
The white circle defines the area of action of the tool. You can increase or decrease it. The value can be set with The Tuner: (+/- keys of the keyboard) (see details on page 110).

6. Selecting a point to drag.
Click on a point of the surface you want to model.

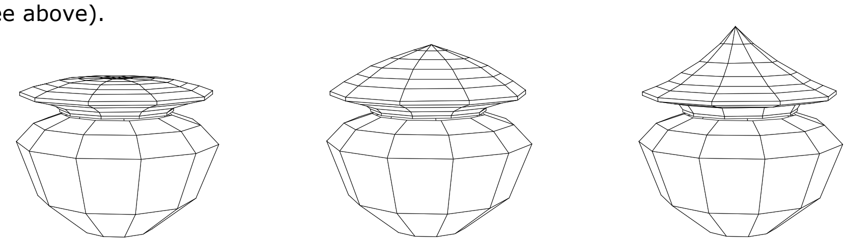
7. Modeling with interactive control of the force of attraction.
The group of points belonging to the area of influence follows the movements of the point you selected. The further away a point is from the selected point, the weaker the force of attraction of the tool. You can modify the force of attraction of the tool using.



Original sphere — *Modeled sphere with a great force* — *Modeled sphere with a weaker force.*

The value can be set with The Tuner: (+/- keys of the keyboard) (see details on page 110).

You can modify the strength of the force of attraction as you are pulling the points (see above).



Bottle Not distorted — *Distorted bottle (with a great force)* — *Distorted bottle (with a weaker force.)*

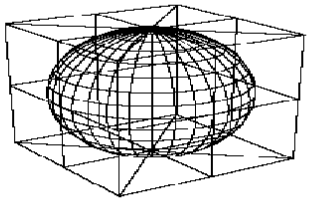
8. Cursor movement and positioning constraints.
Unless you specify otherwise, the cursor can move freely in any direction. AMAPI 3D allows you to apply a constraint to the cursor movement and positioning:
- Movement constraint along one axis
- Resetting the axes' increment (step size)
- Snapping the cursor on existing points
- Snapping the cursor on a segment
- Positioning the cursor according to lines of constraint

For more information see chapter "Cursor movement and positioning constraints" on page 98.

9. **Validating the distortion.**
   Click the mouse button when you are satisfied with the distortion.
   Go back to step 5 to model another part of the object if necessary.
   You can model another part of the object. To do this, come back to step 6.

10. **Ending the tool action**
    Put the tool aside to end the action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

Local deformers that use a meshed control box: Stretch, Scale, Rotate



Usage:

1. **Selecting a polygonal object.**

   Using the object selection accessory , click on a polygonal object or a group of objects to designate the current object.
   To restrict the action to a part of an object, use the appropriate selection accessory (see chapter "The selection accessories" on page 104).

2. **Selecting the Deformation tool.**

   Click on the icon and you will see the local deformer palette displayed.
   A meshed control box encloses the object.
   The default density of the mesh is 3x3x3. This is the minimum density.

3. **Specifying the control box's mesh density (optional).**
   You can modify the mesh density (X, Y or Z) of the control box surrounding the object.
   There are several ways to set this:
   - **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - Using the Tab key (see details on page 109).
     - Clicking in the Data Window (see details on page 109).
   - **The Tuner:** (+/- keys of the keyboard) (see details on page 110).
     The Tuner increments/decrements on the 3 axes simultaneously, not axis by axis.

4. **Editing the control box.**
   The deformation box is now the current object. You will model the object through it: the model will be distorted per the distortions applied to the control box. AMAPI 3D provides three tools for your use:
   - Stretch
   - Scale
   - Rotate

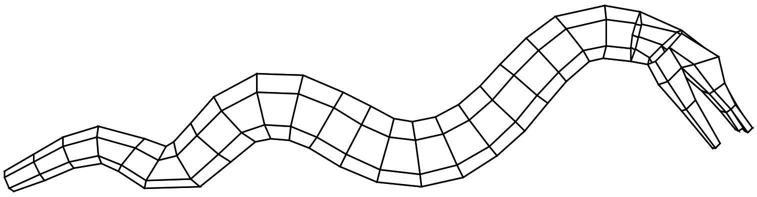
   See the chapter "Stretch" on page 268, "Scale" on page 332, "Rotate" on page 326 for a detailed description.

5. **Ending the tool action.**
   Put the tool aside to end the action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

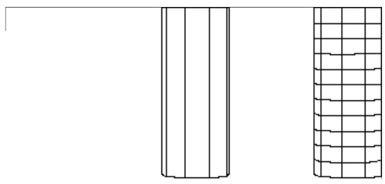
Practical exercises:
- Potato chips / Step 3
- A chair / The seat / Step 7
- A broken egg / Constructing the egg / Step 2

7.3.3 Bend

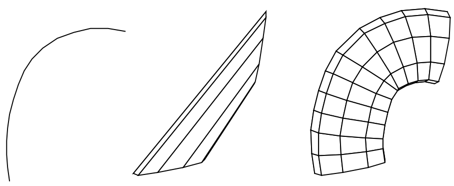
The Bend tool will distort the current object according to the path drawn by a reference curve
There are two ways to use the Bend tool: using an existing reference curve or drawing it within the Bend tool.



Of course, if you want to bend an object, it must be defined by several points along its length. AMAPI 3D cannot correctly bend a cylinder defined by only a single segment. For instance,



Cylinder 1 Defined by a single section — *Cylinder 2 Defined by multiple sections*



Profile — *Cylinder 1 bent* — *Cylinder 2 bent*

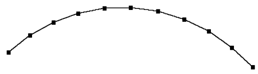
The tool bends objects according to a 2D profile. But you can draw a 3D curve and then bend the object successively in the different planes defined by your curve.

This tool does not use Dynamic Geometry properties. In fact, it will delete the D.G. properties (if any) of your object, and you will no longer be able to use the features of D.G. to modify your object. (AMAPI 3D will not display the palette described above for this object).If you want your object to retain its D.G. properties, ***do not*** *use any of these tools on it.*
For more information see chapter “Dynamic Geometry” on page 155.

❑ To bend an object using an existing curve

Usage:

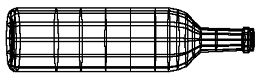
1. **Create a curve using one of the drawing tools if no curve already exists. You can use any type of curve.**



The size of the curve is of no importance, only its shape matters. The bent element will keep its original linear size.

The reference curve does not need to share a common point with the object.

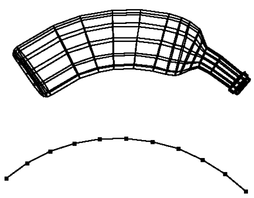
2. **Selecting the element or the part of the element to bend.**
Using the object selection accessory, click on a polygonal object or a group of objects to designate the current object.
To restrict the action to a part of an object, use the appropriate selection accessory (see chapter "The selection accessories" on page 104).



3. **Defining the view.**
It is very important that the plane currently displayed be the same as the plane of the reference curve.

4. **Selecting the Bend tool.**
Click on the icon depicting the Bend tool in the Tools Palette.

5. **Selecting the reference curve and bending the object.**
Click on the curve you want to use as reference to bend the object. The object is bent accordingly to the path drawn by the curve.



6. **Ending the tool action.**
Put the tool aside to end the action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

Practical exercises:
- Hello! (3D text) / Modeling the text / Step 2
- A tube of goo / Bend the tube

- To bend an object using a curve created within the Bend tool

Usage:

1. **Selecting the object to bend.**
   Click with the object selection accessory on the object you want to bend. It becomes the current object.

2. **Selecting the Bend tool.**
   Click on the icon depicting the Bend tool in the Tools Palette.

3. **Creating the reference curve and bending the object.**
   ⇒ Click to position the first point of the reference curve. The curve you are drawing is a Bezier curve.
   ⇒ Create other points to draw your curve.
   ⇒ Press the Return key to end the drawing and bend the current object according to the path of the reference curve.

4. **Ending the tool action.**
   Put the tool aside to end the action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

You can bend the object along different working planes without leaving the tool.

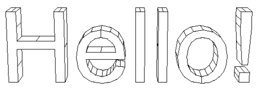
Practical exercises:
- A chair / The seat / Step 5

7.3.4 Wrap

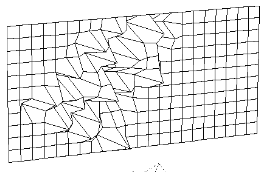
The "Wrap" tool allows you to wrap an object onto a (predefined) shape.

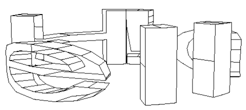
Examples:

Predefined shape

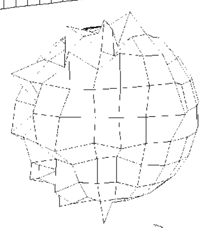


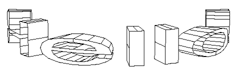
Current object to be wrapped



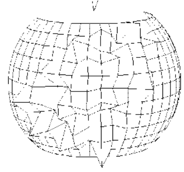


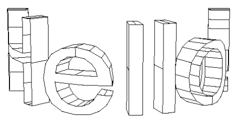
Object wrapped on the shape



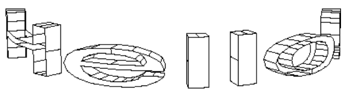


Decreasing the wrapping of the surface.

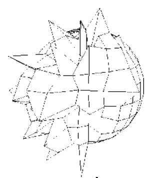


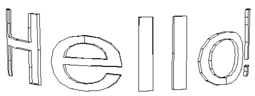


Setting the height of the shape

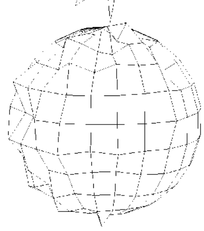


Setting the radius of the shape





Setting the altitude (object thickness)



Usage:

1. Selecting an object to work with.

Click on the object selection accessory to designate the current object.

2. Selecting the tool.

Click on the icon depicting the tool in the Modeling tools palette.

3. Selecting the shape.

A subtools palette appears. Click on the shape you want:

Grid

Cylinder

Sphere

The wrapping is done immediately.

4. Tuning the parameters.

4.1 Setting the parameters.

Depending the kind of shape, you can set some parameters in the Data Window:

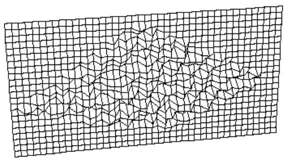
	Parameters
Grid	Width of the grid Height of the grid Altitude (object thickness)
Cylinder	Height of the Cylinder Diameter of the Cylinder Altitude (object thickness)
Sphere	Diameter of the Sphere Altitude (object thickness)

You will set the values using the keyboard. Access the Data Window, then enter the values through the keyboard. Two methods are available:

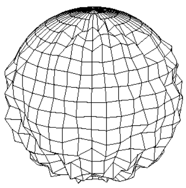
- Using the Tab key (see details on page 109).
- Clicking in the Data Window (see details on page 109).

4.2 Reducing the wrapping surface.

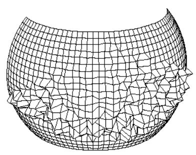
AMAPI 3D wraps the object onto the entire surface of the shape. However, you can reduce the wrapping surface. This setting can be done only through The Tuner: (+/- keys of the keyboard) (see details on page 110).



Object to be wrapped



Object wrapped on a sphere



Projected surface reduction.

4.3 Deletion of the facets under a set limit of altitude.

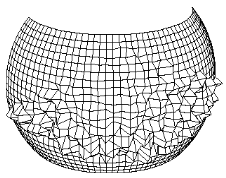
4.3.1 Tool selection

Click on the icon depicting the tool.

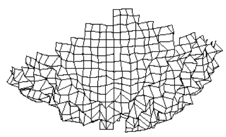
4.3.2 Defining the limit of the altitude.

After the wrapping :
The points of the object located on the wrapping shape surface are at the altitude zero.
The farthest points are at the maximum altitude.
With this tool, you will define a distance under which the facets will be deleted. This distance is defined as a percentage of the maximum altitude. There are two ways to set this :

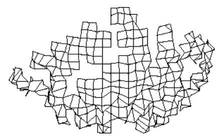
- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).
- **The Tuner**: You can the current data value with the +/- keys of the keyboard (see details on page 110).



Wrapping on a sphere



The facets located at a distance lower than 50% of the maximum altitude are deleted



The facets located at a distance lower than 70% of the maximum altitude are deleted

4.3.2 Validating

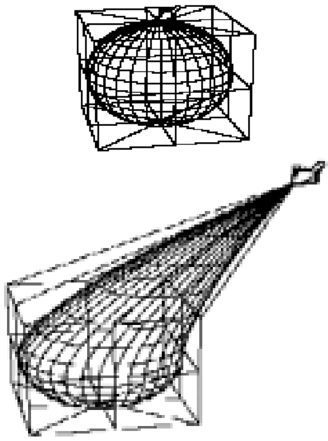
Validate this operation by pressing the « Enter » key

5. Ending the tool action.

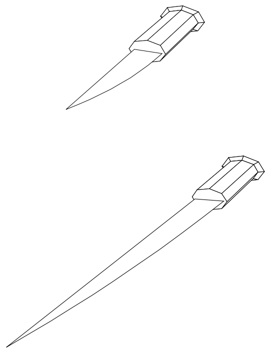
Validate or put the tool aside to end the tool action (depending on the interface). See chapter “How do you end a tool action?” on page 158.

7.3.5 Stretch

The Stretch tool is used to move single vertices or a group of vertices, thus distorting the object.



The Stretch tool applied to a NURBS object



The Stretch tool applied to polygons

This tool uses the Dynamic Geometry properties.
For more information see chapter “Dynamic Geometry” on page 155..

The Stretch tool operates the same way on NURBS objects as on polygonal objects.
However, in the case of NURBS objects, you manipulate the control points of the NURBS Control Box instead of working directly on the object itself. The object will be distorted according to the offset applied to the control points. You will also be able to edit the tangents of the NURBS curves. Instead of editing the control points of the NURBS envelope directly, you will edit the tangents to those points.

Use of the tool

1. Selecting the element to work on.

Using the object selection accessory , click on the object to designate it as the current object.

2. Selecting the Stretch tool.

Click on the icon depicting the Stretch tool in the Tools Palette.

the object selection accessory cursor switches to a Claw.

The Stretch tool is one of the tools that allows you to change the current object while using the tool.

To change the current object while within the tool:

⇒ Press Shift+ESC to select the object selection accessory .

⇒ Click on another object: it becomes the current object.

3. Dynamic Geometry properties

Depending on how you created the current object, you can work with its Dynamic Geometry properties. This means that you can work on one of the following four finishing levels:

1 – Rough structure
2 – Smoothed structure
3 – Rough object
4 – Smoothed object

In the "Dynamic Geometry" palette, click on the icon depicting the finishing level on which you want to work.

If you decide to work on your model at finishing level "n", then you will no longer be able to work on levels "1" to "n-1" (the icon of the disabled levels will disappear).

For more information see chapter "Dynamic Geometry" on page 155.

4. Select the point(s) to pull

By default, the tool pulls a single point. However you can select a group of points. AMAPI 3D provides selection accessories for this. Choose the selection accessory you need. See chapter « How to select a selection accessory?" on page 104. Then select the points depending the selection accessory you have selected.

Selection accessory	Usage
Selection accessory for a single point to be pulled (default).	Click on the point
Group-of-points selection accessory to select points on the current object.	1. Surround the group of points you want to select by successive clicks, then validate by pressing the "Enter" key. 2. Click on a point (in the group) which will be the reference point for the moving all of the selected points.

	The point selection accessory allows you to select points, one at a time, on the current object.	1. Click on each point to be selected, then validate by pressing the "Enter" key 2. Click on a point (within the selected ones) which will be the reference point for moving all of the selected points.

5. **Moving the selection.**
Two perpendicular axes originating from the selected point are displayed as soon as you grab the point. The point can be moved only along the working plane defined by the axes.
Unless you specify otherwise, the cursor can move freely in any direction. AMAPI 3D allows you to apply a constraint to the cursor movement and positioning:
♦ Movement constraint along one axis
♦ Resetting the axes' increment (step size)
♦ Snapping the cursor on existing points
♦ Snapping the cursor on a segment
♦ Positioning the cursor according to lines of constraint
For more information see chapter "Cursor movement and positioning constraints" on page 98.

6. **Validating the point's new position.**
There are several ways to set the positioning:
♦ **Mouse positioning**: Move the cursor then click (see details on page 109).
♦ **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
    ♦ Using the Tab key (see details on page 109).
    ♦ Clicking in the Data Window (see details on page 109).
♦ **Remote interaction**
    ♦ The Remote Control (see chapter "The Remote Control" on page 110).
    ♦ The Slider (see chapter "The Slider" on page 110).

7. **You can pull other points, starting again from step 3.**

8. **Ending the tool action.**
Put the tool aside to end the action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

Practical exercises:
- A chair / The seat / Step 6
- A little ant / Create the nostrils
- A little ant / Puff out the cheeks
- Spotlights / Deform a spotlight using Dynamic Geometry / Methods 1, 2 and 3

Editing the tangents of a NURBS curve

You can edit the tangents of a NURBS curve using the Stretch tool. Instead of editing the control points of the NURBS envelope directly, you will edit the tangents to those points

Usage:

1. **Selecting the Stretch tool.**
First, make sure that the current object is a NURBS curve. Then, click on the icon depicting the Stretch tool in the Tools Palette.

2. **Dynamic Geometry properties.**
Depending on how you created the current object, you can work with its Dynamic Geometry properties. This means that you can work on one of the following four finishing levels:
1 – Rough structure
2 – Smoothed structure
3 – Rough object
4 – Smoothed object
In the "Dynamic Geometry" palette, click on the icon depicting the finishing level on which you want to work.

   If you decide to work on your model at finishing level "n", then you will no longer be able to work on levels "1" to "n-1" (the icon of the disabled levels will disappear).

   For more information see chapter "Dynamic Geometry" on page 155.

3. **The polygon of control is displayed. You can pull those points along the work plane.**

4. **Editing the tangents of a NURBS curve.**
If the current object is a NURBS curve, AMAPI 3D will display an icon in the Mode area. Click on its tangents (or use the hotkey: Ctrl+spacebar) to display the tangents to the points instead of the NURBS envelope. The control polygon disappears.

5. **Manipulating the tangents of a NURBS curve.**
Click on a point of the curve. You will manipulate the tangent to this point. This allows you to control the shape of the curve in a more flexible way.

7.3.6 Delete

The Delete tool is only active on the current object.
There are two types of functionalities:

*“**Deleting on a surface**” (see on page 273).*

- *Deleting **a facet**.*
- *Deleting **a facet**.*
- *Deleting a **point** by removing all the adjacent facets to this poin*
- *Deleting **a point** with generation of a **new facet**.*

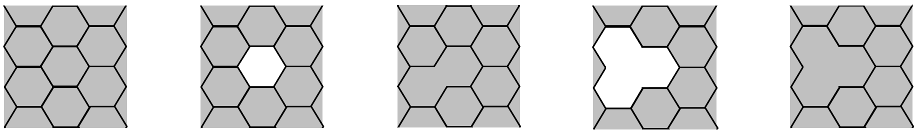
*“**Deleting on a curve**”(see on page 275).*

The Delete tool has no effect on a NURBS object. However, you can transform a NURBS object into a polygonal one using the Information tool of the Control Panel (see chapter “Get info” on page 149). Keep in mind that once a NURBS model has been transformed into a polygonal model, it cannot be transformed back into a NURBS model.

This tool uses the Dynamic Geometry properties. For more information see chapter “Dynamic Geometry” on page 155.

❑ Deleting on a surface

AMAPI 3D supports four delete modes:



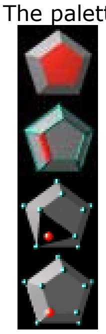
Original surface | *Deleting **a facet** (default mode)* | *Deleting **an edge** and **generating a new facet*** | *Deleting a **point** and **removing all adjacent facets*** | *Deleting **a point** and **generating a new facet***

Usage:

1. Selecting an object (surface) to work with.
Click on the object that you want to work with; it becomes the current object.

2. Delete tool selection.
Click on the icon depicting the Delete tool in the tool palette.
A palette for this tool is displayed at the top of the screen.
If the current object includes openings on its surface, AMAPI 3D will display them in red (see chapter "Open shapes / Closed shapes" on page 152).

3. Mode Selection.
The palette provides four delete modes:



Deleting a **Facet** (default mode)**.**

Deleting an **edge** with generation of a **new facet**.

Deleting a **point** by removing all the adjacent facets to this point.

Deleting a **point** with generation of a **new facet**.

⇒ Click on the Delete mode you need.

4. Selecting the element(s) to be deleted.
Choose the selection accessory you need from the ones displayed by the current tool palette. See chapter:

- "The different selection accessories" on page 106
- "How to select a selection accessory?" on page 104

Then select the elements(s) following the directions for use of the selection accessory you have chosen. See chapter “The different ways to select” on page 105.

You can use the arrow keys of the keyboard to select a facet, an edge, or a vertex on a hidden face of the object (see chapter Navigation” on page 91).

The removed element(s) instantly appear(s).
If this removing has made an opening in the surface, AMAPI 3D will display it in red.
You can return to steps 3, 4 or 5 or go to the next one (see chapter “Open shapes / Closed shapes” on page 152).
You can either go back to steps 3 or 4, or go to the next step.

If you click on a face that has already been removed, AMAPI 3D removes the one behind it (if there is one).

If you make a mistake, press Ctrl+Z (PC), Command+Z (Mac) or select Undo in the Edit menu.

5. Ending the tool action.
Put the tool aside to end the action (depending on the interface). See chapter “How do you end a tool action?” on page 158.

Practical exercises:
- A Champagne cap / The cap’s head / Steps 2 and 6
- A broken egg / Hollow out the egg

Deleting on a curve

Usage:

1. **Selecting the object (curve) you want to work on.**
   Using the object selection accessory , click on the surface you want to work on. It becomes the current object.

2. **Selecting the Delete tool.**
   Click on the icon depicting the Delete tool in the Tools Palette.
   The default tool icon is the Lightning icon.

3. **Selecting the point(s) to be deleted.**
   Choose the selection accessory you need from the ones displayed by the current tool palette. See chapters:
   - "The different selection accessories" on page 106
   - "How to select a selection accessory?" on page 104

   Then select the point(s) following the directions for use of the selection accessory you have chosen. See chapter "The different ways to select" on page 105.

   You can use the arrow keys of the keyboard to select a facet, an edge, or a vertex on a hidden face of the object (see chapter Navigation" on page 91).

   The selected points disappear at once.

   If you click at the end of a curve, the last segment of the curve disappears.

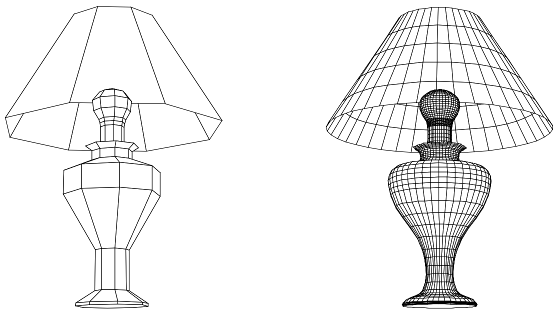
   Use the Undo command to cancel the operation if you make a mistake (Ctrl+Z on PC; Command+Z on Mac).

4. **Ending the tool action.**
   Put the tool aside to end the action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

7.3.7 Smooth

The Smooth tool is used to control the number of facets defining a surface and the number of points defining a curve.
The higher the smoothing value, the smoother the object looks.

A denser mesh generated by Bezier interpolation replaces the original facets.
*You can also use the Smooth tool to **add points to an existing curve**. Finally, a straight line can be transformed into a rounded curve using the Smooth tool.*



Example of use of the Smooth tool

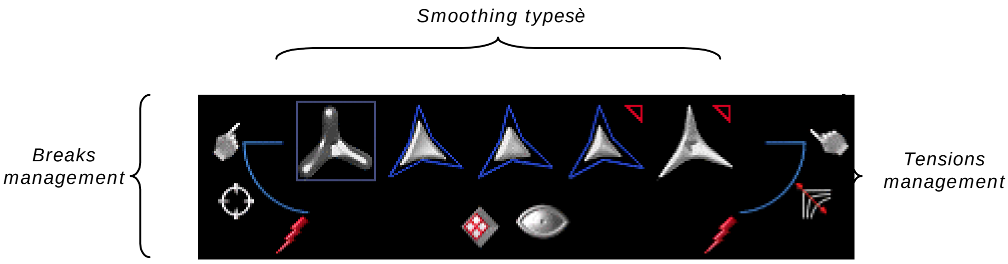
You can choose from:
- *Five smoothing methods for **polygonal surfaces** (see on page 277)*
- *Three smoothing methods for **polygonal curves** (see on page 284)*
- *Smoothing on two axes for **NURBS objects** (see on page 289)*

It is not possible to smooth a group of objects that are not of the same type. (That is, it is not possible to smooth a group of objects including NURBS and polygonal objects).

This tool adds an additional finishing level which will be editable by the tools using the Dynamic Geometry. For more information, For more information see chapter "Dynamic Geometry" on page 155.

The Smooth tool can be very useful for subdividing a segment into N sub-segments of equal size. You simply create a single segment (with only two points: a starting point and an ending point) with the Polyline tool, then use the Smooth tool to subdivide it.

❑ Smoothing polygonal surfaces



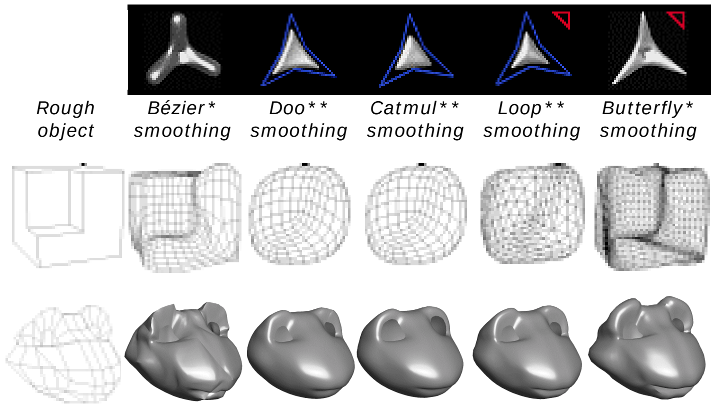
Usage:

1. Selection of the object or a part of the object to be smoothed.

Click on the object selection accessory to designate the current object.
To restrict the action to a part of an object, use the appropriate selection accessory (See chapter "The selection accessories" on page 104).

2. Selecting the Smooth tool.

Click on the icon depicting the tool in the Modeling tools palette.
AMAPI 3D displays a palette of smoothing methods.



There are two kinds of smoothing:

*Internal smoothing	The smoothed shape stays inside the limits defined by the rough object.
** External smoothing	The smoothed shape is outside the limits defined by the rough object.

You can switch from one mode to another at any time by simultaneously pressing the "Ctrl" and the "spacebar" keys of the keyboard.

3. Selecting the smoothing method.

If the object was already smoothed, the default (suggested) smoothing method is the one that was used previously. If the object has not been smoothed before, Bezier smoothing is the default.

To change the smoothing method, you can either:

- Click on the icon corresponding to your choice.
- Switch from one mode to another by simultaneously pressing the "Ctrl" and the "spacebar" keys of the keyboard.

AMAPI 3D displays immediately the palette corresponding to the chosen method.

4. Smoothing setting.

Each smoothing method displays its own settings palette. It allows you to select the areas to be smoothed, the smoothing range, and in some cases to control the breaks and the tensions.

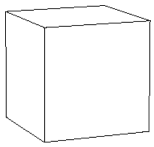
The table below will show you the components of the setting palette and the Data Window for each smoothing method:

	Setting palettes	Data windows		Kind of smoothing: Bezier	Doo	Catmul	Loop	Butterfly	Go to step	
		x	Smoothing range	x	x	x	x	x		4.1
		x	Smoothing angle	x						4.2
Breaks control palette			Edges to be broken selection	x			x	x	4.3.1	4.3
			Vertices (or points) to be broken selection	x					4.3.1	
			Delete all the breaks	x			x	x	4.3.2	
			Partial smoothing	x						4.5
			Mesh preview toggle (Outlines / Full)	x	x	x	x	x		4.6
Tensions control palette			Edge selection for tension setting	x	x	x			4.4.1	4.4
			Point selection for tension setting		x	x			4.4.1	
		x	Tension setting	x	x	x			4.4.2	
			Delete all the tensions	x	x	x			4.4.3	

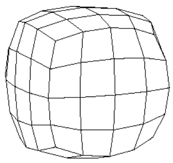
For better performance, AMAPI 3D displays the outlines of the mesh by default. However, you can display the full wireframe at any time (see step4.7).

4.1 Setting the smoothing range

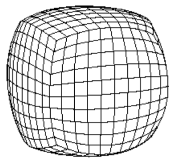
The smoothing range defines the number of facets (for a surface) or edges (for a curve). The higher the range value, the finer the smoothing.



Rough object



Range 2 smoothing



Range 10 smoothing

The Data Windows displays the range value.
There are several ways to set this:
The keyboard: Access the Data Window, then enter the values through the keyboard. Two methods are available:

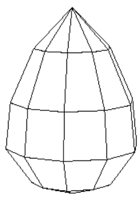
♦ Using the Tab key (see details on page 109).
♦ Clicking in the Data Window (see details on page 109).

The Tuner: You can toggle from a data to another one by pressing the spacebar and tune the current data value with the +/- keys of the keyboard (see details on page 110).

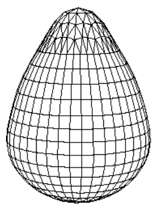
4.2 Setting the break angle

Check the table (see step 4) to see if this setting is available in the smoothing method you chose.

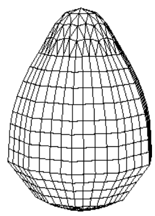
If the angle between two adjacent facets is less than the break angle, the two facets will not be smoothed.



Rough object



Smoothed object
Break angle = 140°
There is no angle less than 140°; the object is fully smoothed.



Smoothed object
Break angle = 150°
In this case, there are angles less than 150°; they were not smoothed.

There are several ways to set this:
The keyboard: Access the Data Window, then enter the values through the keyboard. Two methods are available:

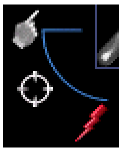
♦ Using the Tab key (see details on page 109).
♦ Clicking in the Data Window (see details on page 109).

The Tuner: You can toggle from one data item to another one by pressing the spacebar. You can adjust the current data value with the +/- keys of the keyboard (see details on page 110).

4.3 Break control

Check the table (see step 4) to see if this setting is available in the smoothing method you chose.

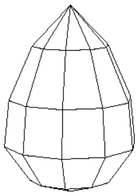
The breaks are edges or vertices that you want to stay sharp.



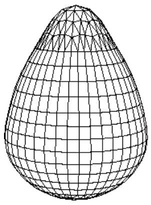
The breaks correspond to the edges or points you want to hold sharp.

Breaks management palette

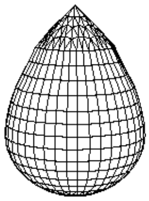
4.3.1 Break creation



Rough object



Object is fully smoothed



Object smoothed
But with edge breaks selection (on the top)

Click on the icon corresponding to the kind of break you need, then take the appropriate selection accessory (see "**How to select a selection** accessory?" on page 104):

Break type	Available selection accessories
Breaks (by edges(	or
Breaks (by points)	or

Select the edges(s) or the point(s) following the directions for use of the selection accessory you have chosen. (See chapter "The selection accessories" on page 104).

The break edges and points are marked in yellow.

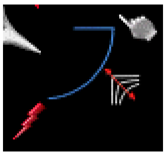
4.3.2 Breaks deletion

Click on the icon to delete the breaks (marked in yellow).

4.4 Tension control

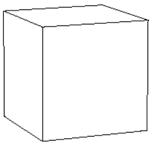
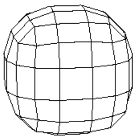
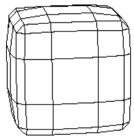
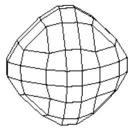
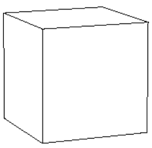
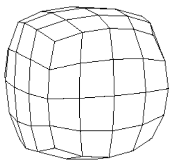
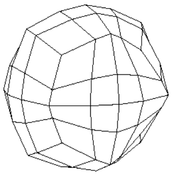
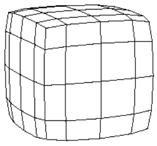
Check the table (see step 4) to see if this setting is available in the smoothing method you chose.

The tension controls how close the smoothing curves are to the shape of the rough object.



The tension allows to the smoothing curves to move closer to the limits made by the rough object.

Tensions palette management

Internal smoothing				
	Rough object	*Smoothed object (the smoothed shape is within the limits of the rough object)*	*Smoothed object* ***tension>0*** *(the smoothed shape comes closer to the rough object)*	*Smoothed object* ***tension<0*** *(the smoothed shape is farther from the rough object)*
External smoothing				
	Rough object	*Smoothed object (the smoothed shape is outside of the limits of the rough object)*	*Smoothed object* ***tension>0*** *(the smoothed shape is farther from the rough object)*	*Smoothed object* ***tension<0*** *(the smoothed shape comes closer to the rough object)*

4.4.1 Restricting tension setting to a part of the object

Tension setting is done on the whole object. To restrict the action to a part of an object, follow the instructions of this step (4.4.1); otherwise, go to the next step (4.4.2).

Click on the icon corresponding to the kind of restriction you need, then take the appropriate selection accessory (see "**How to select a selection** accessory?" on page 104):

Type de restriction en vue d'un réglage de tension	Available selection accessories
Tension (by edges)	or
Tension (by points)	or

Select the edges(s) or the point(s) following the directions for use of the selection accessory you have chosen. (See chapter "The selection accessories" on page 104).

The selected edges and vertices are marked in white.

4.4.2 Tension setting

The Data Window displays the value of the current tension.
There are several ways to set the value:
Mouse Tuner Press and hold the left mouse button. Move the cursor. Release the button at the desired value. (see details on page 109).
The keyboard: Access the Data Window, then enter the values through the keyboard. Two methods are available:

- Using the Tab key (see details on page 109).
- Clicking in the Data Window (see details on page 109).

The Tuner: You can toggle from one data value to another by pressing the spacebar. You can tune the current data value with the +/- keys of the keyboard (see details on page 110).

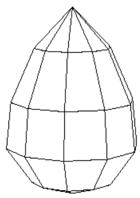
4.4.3 Tension deletion

Click on the icon to delete the tensions (marked in white).

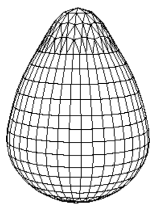
4.5 Partial smoothing

Check the table (see step 4) to see if this setting is available in the smoothing method you chose.
Tension setting is applied to the whole object (excepting any break restrictions you may have set in steps 4.2 and 4.3).
Partial smoothing allows you to smooth only a part of an object.

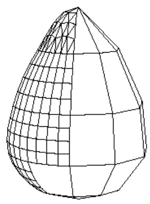
The selection is made with one of the facet selection accessories (and) allowed by this tool. Take the selection accessory for this action. Then select the the point(s) following the directions for use of the selection accessory you have chosen. (See chapter "The selection accessories" on page 104).



Rough object



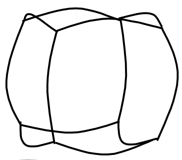
Object is fully smoothed



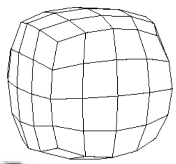
Object partially smoothed

4.6 Mesh/outlines preview toggle

This step is an optional preview.
AMAPI 3D has two display modes:



Mesh outline



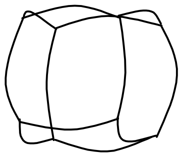
Mesh wireframe

The default is the mesh outline; you can toggle from one display mode to the other.

This is a preview only. If you want to display the full wireframe mesh, go to step 5.

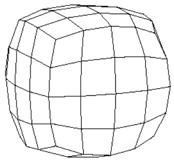
5. Ending the tool action.

AMAPI 3D provides two distinct wireframe display modes:



Mesh outline

To be more efficient, the default display is the mesh outline of the calculated mesh wireframe.
To leave the tool and retain the outline display, go to step 5.1.



Full Mesh wireframe

However, you can ask AMAPI 3D to display the full wireframe mesh.

In this case, go to step 5.2.

5.1 ... displaying the outline only

To keep the outline display, put the tool aside (See chapter "How do you end a tool action?" on page 158.), but do not validate (see step 5.2).

5.2 ... displaying the full mesh wireframe

To display the full mesh wireframe, leave the tool by validating (press the "Enter" key).

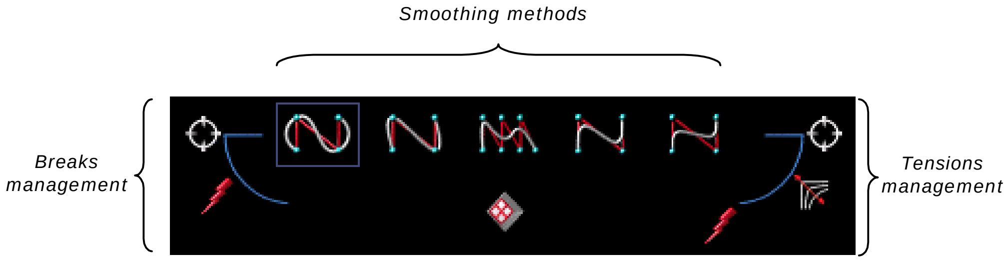
This option is permanent and can dramatically increase the display time. Remember: the more an object is smoothed, the slower the display.

If you want to remove the smoothing, you can do so using the object information dialog (see chapter "Get Info (PC: Ctrl+I; Mac: Command+I)" on page 149. Later you can perform a new smoothing operation.

Practical exercises:

- Pipes / Smoothing
- A champagne cap / Smoothing the cap
- A chair / The seat / Step 2
- A little ant / Smoothing
- Spotlights / Smoothing

Smoothing polygonal curves



Usage:

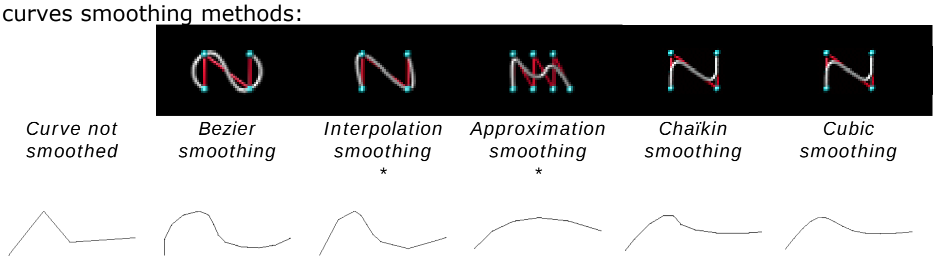
1. Selecting an object (or a part of it) to work with.

Click on the object selection accessory to designate the current object.
To restrict the action to a part of an object, use the appropriate selection accessory (See chapter "The selection accessories" on page 104).

2. Selecting the Smooth tool.

Click on the icon depicting the tool in the Modeling tools palette.

If the current object is a curve, AMAPI 3D displays a palette showing the different curves smoothing methods:



* Generate NURBS curves from polygonal curves.

You can switch from one mode to another at any time by simultaneously pressing the "Ctrl" and the "spacebar" keys of the keyboard.

3. Selecting the smoothing method.

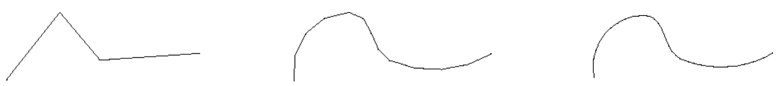
If the object was already smoothed, the default (suggested) smoothing method is the one that was used previously. If the object has not been smoothed before, Bezier smoothing is the default.
To change the smoothing method, you can either:
Click on the icon corresponding to your choice
Switch from one mode to another by simultaneously pressing the "Ctrl" and the "spacebar" keys of the keyboard.

AMAPI 3D displays the palette corresponding to the chosen smoothing method.

4. Smoothing setting.
Each smoothing method displays its own settings palette. It allows you to select the areas to be smoothed, the smoothing range, and in some cases, to control the breaks and the tension.
The table below shows you the components of the settings palette and the Data Window for each smoothing method:

	Setting palettes	Data windows		Kind of smoothing: Bezier	Interpolation	Approximation	Chaîkin	Cubic	Go to step	
		x	Smoothing range	x	x	x	x	x	4.1	
		x	Smoothing angle	x					4.2	
		x	Level (number of point used for calculation)			x			4.3	
Breaks control palette			Points to be broken selection	x					4.4.1	4.4
Breaks control palette			Delete all the breaks	x					4.4.2	4.4
			Partial mmoothing	x					4.6	
Tension control palette			Points selection for tension settings	x			x	x	4.5.1	4.5
Tension control palette		x	Tension setting	x			x	x	4.5.2	4.5
Tension control palette			Delete all the tensions	x			x	x	4.5.3	4.5

4.1 Setting the smoothing range
The smoothing range controls the number of edges (for a curve). The higher the range value, the finer the smoothing.



Rough object *Range 2 smoothing* *Range 10 moothing*

The Data Windows displays the range value.
There are several ways to set this:
The keyboard: Access the Data Window, then enter the values through the keyboard. Two methods are available:
- Using the Tab key (see details on page 109).
- Clicking in the Data Window (see details on page 109).

The Tuner: You can toggle from one data item to another by pressing the spacebar. You can tune the current data value with the +/- keys of the keyboard (see details on page 110).

4.2 Setting the break angle

Check the table (see step 4) to see if this setting is available for the smoothing method you chose.

If the angle between two adjacent edges is less than the break angle, the two edges will not be smoothed.
There are several ways to set this:
The keyboard: Access the Data Window, then enter the values through the keyboard. Two methods are available:

- Using the Tab key (see details on page 109).
- Clicking in the Data Window (see details on page 109).

The Tuner: You can toggle from one data item to another by pressing the spacebar. You can tune the current data value with the +/- keys of the keyboard (see details on page 110).

4.3 Setting the level

Check the table (see step 4) to see if this setting is available for the smoothing method you chose.

The level is the number of points used for the calculation.
There are several ways to set this:
The keyboard: Access the Data Window, then enter the values through the keyboard. Two methods are available:

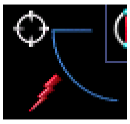
- Using the Tab key (see details on page 109).
- Clicking in the Data Window (see details on page 109).

The Tuner: You can toggle from one data item to another by pressing the spacebar. You can tune the current data value with the +/- keys of the keyboard (see details on page 110).

4.4 Selecting breaks

Check the table (see step 4) to see if this setting is available for the smoothing method you chose.

Breaks are edges or vertices that you want to stay sharp.



The breaks correspond to the edges or points you want to hold sharp.

Breaks management palette

4.4.1 Creation of breaks

Click on the icon corresponding to the breakpoints icon, then take the appropriate selection accessory (see "**How to select a selection** accessory?" on page 104)".

Kind of break	Available selection accessories
Break (by points)	or

Select the point(s) following the directions for use of the selection accessory you have chosen. (See chapter "The selection accessories" on page 104).
The break edges and points are marked in yellow.

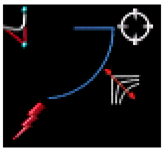
4.4.2 Deleting breaks

Click on the icon to delete the breaks (marked in yellow).

4.5 Tension tuning

Check the table (see step 4) to see if this setting is available for the smoothing method you chose.

The tension controls how close the smoothing curves are to the shape of the rough object.



The tensions allow to the smoothing curves to go closer to the limits made by the rough object.

Tensions management palette

4.5.1 Restricting the tension setting to a part of the object

Tension setting is done on the whole object. To restrict the action to a part of an object, follow the instructions of this step (4.4.1);otherwise, go to the next step (4.4.2).

Click on the icon corresponding to the kind of restriction you need, then take the appropriate selection accessory (see "**How to select a selection** accessory?" on page 104):

Tension setting	Available selection accessories
Tension (by points)	or

Select the edges(s) or the point(s) following the directions for use of the selection accessory you have chosen. (See chapter "The selection accessories" on page 104).
The selected edges and vertices are marked in white.

4.5.2 Tension setting

The Data Window displays the value of the current tension.
There are several ways to set the value:
Mouse Tuner Press and hold the left mouse button. Move the cursor. Release the button at the desired value (see details on page 109).
The keyboard: Access the Data Window, then enter the values through the keyboard. Two methods are available:

- Using the Tab key (see details on page 109).
- Clicking in the Data Window (see details on page 109).

The Tuner: You can toggle from one data value to another by pressing the spacebar. You can tune the current data value with the +/- keys of the keyboard (see details on page 110).

4.5.3 Deleting the tensions

Click on the icon to delete the tensions (marked in white).

4.6 Partial smoothing

Check the table (see step 4) to see if this setting is available for the smoothing method you chose.

Tension setting is applied to the whole object (excepting any break restrictions you may have set in steps 4.2 and 4.3).

Partial smoothing allows you to smooth only a part of an object.

The selection is made with one of the facet selection accessories ( and ) allowed by this tool. Take the selection accessory for this action. Then select the point(s) following the directions for use of the selection accessory you have chosen. (See chapter “The selection accessories” on page 104).

5. Ending the tool action.

Put the tool aside to end the action (depending on the interface). See chapter “How do you end a tool action?” on page 158.

❑ Smoothing NURBS objects

Usage:

1. Selecting the element to work with.

⇒ Click with the object selection accessory on the element you want to work with. It becomes the current element.

2. Select the Smooth tool.

Click on the icon depicting the tool in the palette.

3. Smoothing range modification.

When you smooth a NURBS model, you can set the range in two directions ("U" and "V"):
"U" is the direction of creation of the element (commonly the horizontal axis).
"V" is the perpendicular direction to the direction of creation of the element (commonly the vertical axis).
The data palette displays the "U" and "V" values; There are several ways to set this:

- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109). .
- **Remote interaction**
  - The Tuner: (+/- keys of the keyboard) (see details on page 110).
  - The Remote Control (see chapter "The Remote Control" on page 110).
  - The Slider (see chapter "The Slider" on page 110).

Click on the current object with the object selection accessory : the object is displayed smoothed.

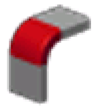
4. Add a point (curve) or a mesh (volume).

Mouse positioning: Move the cursor, then click (see details on page 109).

5. Ending the tool action.

Put the tool aside to end the action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

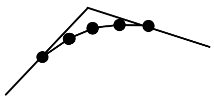
7.3.8 Chamfer (Bevel)



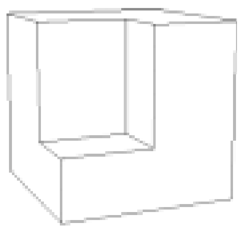
This tool allows you to create a bevel on:

- ***the edge of a surface or a volume (edge mode).***
- ***an angle of a surface or a volume (point mode).***
- ***a point of a line (point mode).***

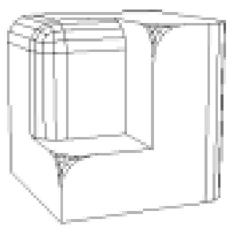
The Chamfer tool will create internal or external bevels, depending on the orientation of the edges of the model. You will be able to create bevels of variable radius. In some cases you will find it useful to bevel a group of objects.



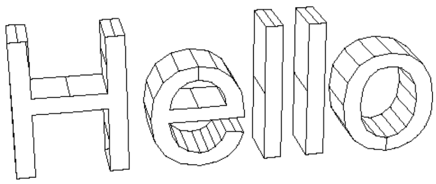
Chamfer applied to a curve



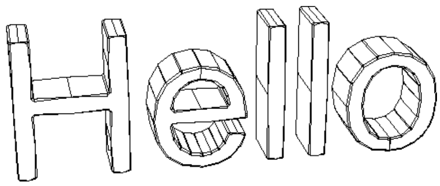
Volume not beveled



Chamfer applied to a volume



Group of objects not beveled



Group of objects beveled

POINT mode: *This chamfer style creates arcs around each selected point and creates a curved surface between these arcs. The edges are not modified (they are just shorter close to the chamfered points). For example, the rounded corners of a die could be created using this chamfer style.*

EDGE mode: *This chamfer style replaces the selected edges by cylindrical parts; each end of the edge is replaced by an arc and a ruled surface is built within these arcs. At points that share two or more chamfered edges, the results could look like point mode chamfering.*

The Chamfer tool does not work on NURBS objects. However, you can convert a NURBS object into a polygonal object using the Information tool of the Control Panel. (See chapter “Get info” on page 149). Keep in mind that once a NURBS object is converted to a polygonal object, it cannot be converted back into a NURBS object.

This tool does not use Dynamic Geometry properties. In fact, it will delete the D.G. properties (if any) of your object, and you will no longer be able to use the features of D.G. to modify your object. (AMAPI 3D will not display the palette described above for this object).If you want your object to retain its D.G. properties, ***do not*** *use any of these tools on it. For more information see chapter "Dynamic Geometry" on page 155..*

Usage:

1. Selecting the chamfer tool .
Click on the icon depicting the tool in the Modeling tools palette.

2. Selecting a subtool in the chamfer tool palette.
AMAPI 3D displays a tool palette.
Click on the subtool you need and go to the corresponding step.

Subtool	Go to step...
Create a chamfer on an edge	Step 3.1
Create a chamfer on a point	Step 3.2
Modify the chamfer radius on a point	Step 5
Delete the chamfers on a selection	Step 4
Display contour/wireframe	Step 7

3. Create a chamfer.

3.1 Create a chamfer on edges.

3.1.1 Minimum angle value selection:

AMAPI 3D immediately selects all the edges of the faces where the angle value is greater than the set angle value (this is like the smoothing break angle).
There are several ways to set this:

- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).
- **Remote interaction**
  - The Tuner: (+/- keys of the keyboard) (see details on page 110).
  - The Remote Control (see chapter "The Remote Control" on page 110).
  - The Slider (see chapter "The Slider" on page 110).

The setting of this value can be done with the Tuner only if you click on the "Angle" button first.

3.1.2 Edges selection:

The edges selection will be made with an edge selection accessory (and) of this tool. Take the selection accessory for this action. Then select the point(s) following the directions for use of the selection accessory you have chosen. (See chapter "The selection accessories" on page 104).
The selection is a toggle switch. If you select an edge or a group of edges that is already selected, it will be deselected.
Then go to step 4.

3.2 Create a chamfer on points.

Point selection is done using a point selection accessory (i and). of this tool. Take the appropriate selection accessory. Then select the point(s) following the directions for use of the selection accessory you have chosen. (See chapter "The selection accessories" on page 104).

The selection is a toggle switch. If you select a point or a group of points that is already selected, it will be deselected.

If you select the vertex of an edge already chamfered, the chamfer of this edge will be sharp on the selected vertex. If you don't want to create this sharp point, reselect the vertex to deselect it.

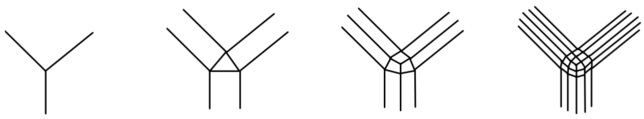
4. Chamfer radius and range modification.

The Data Window displays the radius, the range, and an angle.

The radius

Chamfer with a small radius *Chamfer with a bigger radius*

The chamfer range

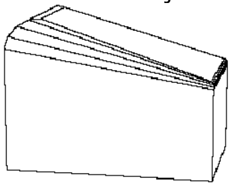


Without chamfer *Range 0 Chamfer* *Range 1 Chamfer* *Range 2 Chamfer*

There are several ways to set this:

- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).
- **Remote interaction**
  - The Tuner: You can toggle from one data value to another by pressing the spacebar. You can tune the current data value with the +/- keys of the keyboard (see details on page 110).
  - The Remote Control (see chapter "The Remote Control" on page 110).
  - The Slider (see chapter "The Slider" on page 110).

5. **Modify the chamfer radius on a point.**
The chamfer radius is the same for the whole selection (step 3). You can specify a different radius for a specified points of the object.



Click on the "Modify the chamfer" button.

Points selection is done with one of the point selection accessories (i and). of this tool. Take the selection accessory appropriate for this action. Then select the point(s) following the directions for use of the selection accessory you have chosen. (See chapter "The selection accessories" on page 104).
Modify the radius of the selected points (see step 4).
Deselect the modified points until the radius you have set is correct. Deselection of the points is done with one of the point selection accessories (i and). of this tool. Take the selection accessory appropriate for this action. Then select the point(s) following the directions for use of the selection accessory you have chosen. (See chapter "The selection accessories" on page 104).

6. **Delete the chamfer on a selection.**
If you want to delete the chamfer on a chamfered area, click on the "Delete chamfer" icon. The cursor is changed to the edge selection accessory **.** You will be able to surround the area inside which all the edges and points that are already selected will be deselected.

7. **Toggle: Display Contour / Wireframe.**
The "Display Contour / Wireframe" button allows you to shift between these two display modes.

8. **Chamfer validation.**
To validate the chamfer, Press the Return key. AMAPI 3D displays the selected object or part of the selected object completely chamfered.
If you don't validate the chamfer, your tool will not be chamfered. However, AMAPI 3D keeps all the data you have set in memory and you will recover it by re-entering in the Chamfer tool.

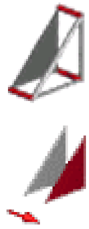
9. **Ending the tool action.**
Put the tool aside to end the action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

Practical exercises:

- Pipes / Make the elbow
- A glass / Drawing the construction curves / Step 3
- An acoustic baffle / Baffle chamfering
- A playing card, a die and a token / Playing card chamfer
- A playing card, a die and a token / Chamfer the die
- A playing card, a die and a token / Chamfer the token

7.3.9 Thickness

Moving the cursor over the Thickness tool icon automatically opens a sub-palette containing the two tools that do the following:



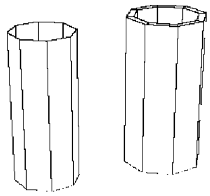
- *Apply a uniform thickness to a curve, a surface or a volume.*
- *Create an offset of the object (curve, surface or volume).*

The Thickness tool does not work in NURBS mode. However, you can transform a NURBS object into a polygonal one using the Information tool of the Control Panel (see chapter "Get info" on page 149). Keep in mind that once a NURBS model has been transformed into a polygonal model, it cannot be transformed back into a NURBS model. If you want your NURBS object to remain as such, do not use this tool.

This tool does not use Dynamic Geometry properties. In fact, it will delete the D.G. properties (if any) of your object, and you will no longer be able to use the features of D.G. to modify your object. (AMAPI 3D will not display the palette described above for this object).If you want your object to retain its D.G. properties, ***do not*** *use any of these tools on it. For more information see chapter "Dynamic Geometry" on page 155.*

Applying a thickness to a surface or a volume

Applying a thickness to a volume or a surface will create facets parallel to each of the facets of the original object and positioned at a user-specified distance from the original facets.



Usage:

1. **Select the surface or volume you want to apply thickness to.**
   Click with the object selection accessory on the object you want to work with.

2. **Select the Thickness tool.**
   Click on the icon depicting the Thickness tool in the Tools Palette.
   A red preview of the thickness is displayed on the facet of the object perpendicular to the point of view.

3. **Setting the thickness.**
   There are several ways to set this:
   - **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - Using the Tab key (see details on page 109).
     - Clicking in the Data Window (see details on page 109).
   - **The Tuner:** (+/- keys of the keyboard) (see details on page 110).

4. **Changing the position of the thickness.**
   Press the spacebar to toggle the position of the thickness from the inside of the surface to the outside.
   Dropping the tool (depending on the interface selected) at this stage will cancel the operation.

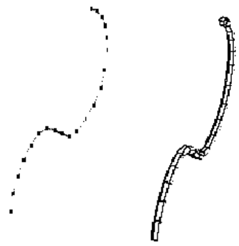
5. **the thickness applied to the whole object.**
   Click on the object with the object selection accessory .
   The thickness is applied on the whole object.
   You can go back to step 3 to make modifications or go to the next step.

6. **Ending the tool action.**
   Validate the tool action (press the Return key) or put the tool aside. (depending on the interface). See chapter "How do you end a tool action?" on page 158.
   The thickness is applied to the whole object and the object selection accessory reappears.
   Dropping the Thickness tool without previously visualizing the thickness being applied to the whole object (step 5) will cancel the operation.

Practical exercises:
- A house / The walls / Step 4
- A house / The peaks / Step 4
- A broken egg / Give thickness to the egg

❑ Applying thickness to a curve

If you apply thickness to a curve, you will generate a "tube".



Usage:

1. Select the curve you want to apply thickness to.

Click with the object selection accessory on the curve you want to apply thickness to.

2. Select the Thickness tool.

Click on the icon depicting the Thickness tool in the Tools Palette.
A preview of the thickness is displayed in red on a segment of the curve.

3. Setting the thickness.

There are several ways to set this:

- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).
- **The Tuner:** You can toggle from one data value to another by pressing the spacebar. You can tune the current data value with the +/- keys of the keyboard (see details on page 110).

4. Setting the number of points defining the "tube".

To set the number of points of the generated surface, you can:
⇒ Use the "+" and "-" of the numeric keypad.
⇒ Use the "+" and "–" buttons of the Assistant Palette.
Press the Tab key twice and enter a number of points.

Dropping the tool at this stage (depending on the interface) will cancel the operation.

5. Visualizing the thickness applied to the whole object.

Click on the curve with the object selection accessory.
The thickness is displayed on the whole object.
If you are not satisfied with the result, go back to step 3 to make modifications.
Go to the next step if you are satisfied.

6. Ending the tool action

Validate the tool action (press the Return key) or put the tool aside. (depending on the interface). See chapter "How do you end a tool action?" on page 158.

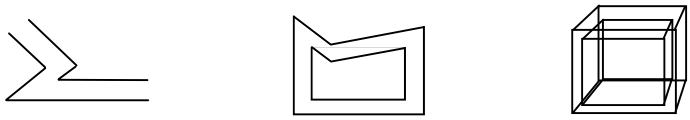
Dropping the Thickness tool without previously visualizing the thickness applied to the whole object (step 5) will cancel the operation.

Practical exercises:

- Pipes / Set the diameter of the pipe

Creating an offset

This is an extension of the Thickness tool. ***It creates a new object, which is parallel, segment by segment, to the current object, be it a curve, a surface, or a volume.*** *It is called an* ***offset.***



Usage:

1. **Select the object.**
   Click on the object you want to create an offset from.

2. **Select the Thickness tool,**
   Click on the icon depicting the Thickness tool in the Tools Palette.
   A preview of the thickness is displayed in red on a segment of the curve.

3. **Setting the offset value.**
   There are several ways to set this:
   - **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - Using the Tab key (see details on page 109).
     - Clicking in the Data Window (see details on page 109).
   - **The Tuner:** There are several ways to set this (see details on page 110).

   Dropping the tool now (depending on the interface) will cancel the operation.

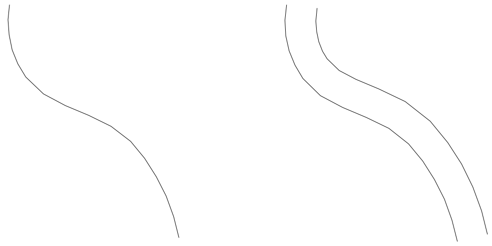
4. **Setting the position of the offset ("inside" / "outside").**
   Press the spacebar to change the position of the offset.
   Dropping the tool now (depending on the interface) will cancel the operation.

5. **Validate the action.**
   Click on the current object with the object selection accessory
   The whole offset is displayed.

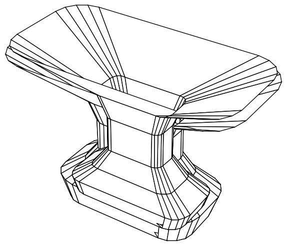
6. **Applying modifications.**
   Go back to step 4 if you want to make modifications to the offset.
   Go to the next step if you are satisfied.

7. **Ending the tool action.**
   Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

When dropping the Thickness tool after having created an offset, the current object will be the created offset.



Offset of a curve

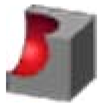


Offset of a surface

Using this tool, you could create a vase with variable thickness, modifying only the inside or the outside of the thickness (the original object and its offset).

7.3.10 Cut

The Cut tool provides several ways of cutting an object:



- ***Punch:*** *Punching a surface or a volume using a reference curve (see on page 300).*
- ***Boolean:*** *Performs Boolean operations between curves, surfaces or volumes (see on page 303).*
- *Extract:* ***Extracts a part of the current object to make a new one (see on page 305).***

The Cut tool cannot work on NURBS objects, so it will automatically convert a NURBS object into a polygonal object when you apply the tool to the object. NOTE: Once a NURBS object has been converted into a polygonal object, it cannot be converted back into a NURBS object. Do not use this tool if you want to keep the NURBS information.

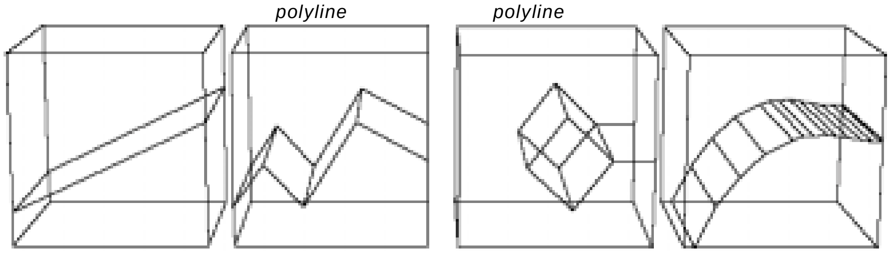
This tool does not use Dynamic Geometry properties. In fact, it will delete the D.G. properties (if any) of your object, and you will no longer be able to use the features of D.G. to modify your object. (AMAPI 3D will not display the palette described above for this object).If you want your object to retain its D.G. properties, ***do not*** *use any of these tools on it. For more information see chapter "Dynamic Geometry" on page 155.*

- Punch

The cut (punch) tool cuts a surface or a volume using a reference curve.
The projection will be perpendicular to the plane or the reference curve.
The reference curve can be an open or a closed curve that you have created previously or that you create with this tool. If you use a closed curve, AMAPI 3D will create a hole in the object and an object capping this hole. This capping object is an individual entity and can be moved or deleted.

Different examples of punches on a cube.

Punched with a line — *Punched with a polyline* — *Punched with a closed polyline* — *Punched with a curve*



If the Punching object is a closed polyline, the tool creates a capping object

The Punching curve can only be made with the Drawing tool

♦ *Punching object created in the tool (polyline only).*

Usage:

1. Selecting the element or the part of the element to work on.

Click on the object selection accessory to designate the current object.
To restrict the action to a part of an object, use the appropriate selection accessory (See chapter "The selection accessories" on page 104).

You may need to change the viewpoint or working plane depending on the cutting plane you want to define. (See chapter "Navigation" on page 91 or "Working Plane" on page 131.)

2. Selecting the Cut tool.

Click on the icon depicting the Cut tool in the Tools Palette.

3. Applying the tool.

Click again on the object to cut.

4. Drawing the Punching object.

⇒ 1st point:
- ♦ Click to set its position.

  Or
- ♦ Press the Tab key to enter precise numerical coordinates. Press Return to validate.

⇒ 2nd point:
- ♦ Click to set its position.

  Or
- ♦ Press the Tab key to enter precise numerical coordinates. Press Return to validate.

⇒ Position the "n" following points the same way if necessary. If you want to close the drawing, press and hold the Shift key to snap the cursor to a point.

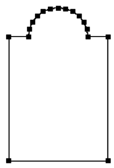
⇒ Press Return to validate.

The shape is cut out from the model.
If the Punching object was a closed curve, AMAPI 3D creates an object capping this hole. It can be moved or deleted.

Practical exercises:
- A cone on a sloping plane / The sloping plane / Step 2
- A broken egg / Break the egg / Method 3

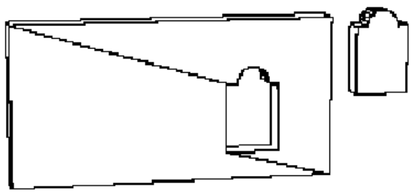
♦ *Punching object created in the Drawing tool.*

Usage:

1. **Creating the reference curves.**
Use the Drawing tools to create a closed or open 2D curve (see chapter "Open shapes / Closed shapes" on page 152). This curve will be projected onto the object to be punched. If the reference curve is a closed curve, it will create a hole in the object.

If the reference curve is an open curve it will cut the object following the profile of the curve and divide it into two parts.

2. **Positioning the reference curve.**
The reference curve must, in the current view, be superimposed onto the object to be cut. The distance between the reference curve and the object is of no importance. The projection will be made perpendicular to the plane of the reference curve, which is why you may have to reposition the reference curve (using the Move tool in the Assembly Palette).

3. **Selecting the object to punch.**
Click on the object selection accessory to designate the current object.
To restrict the action to a part of an object, use the appropriate selection accessory (See chapter "The selection accessories" on page 104).


4. **Selecting the Cut tool.**
Click on the icon depicting the Cut tool in the Tools Palette.


5. **Designating the reference curve and punching the object.**
Click on the reference curve.
Depending on the complexity of the computation you may see some computation windows displayed.
The shape is cut out from the model.
If the Punching object was a closed curve, AMAPI 3D creates an object capping this hole. It can be moved or deleted.

The result of using the cut tool is two different objects: the punched object (with a hole) and the cut that you may edit or save separately.

Practical exercises:

- An acoustic baffle / Cutting the cube with the line
- An acoustic baffle / Punch the loudspeaker's hole / Step 3

Boolean

A Boolean operation is the computation of the intersection of two objects. The objects can be 2D curves, surfaces, or volumes.
AMAPI 3D will display the different possible results. You will select the results that you want.

If you need to generate two different types of intersection, save the objects you are intersecting *before* starting the Boolean operation. You can validate only one result of a Boolean operation at a time. You can use the saved objects to do the second Boolean operation.

Usage:

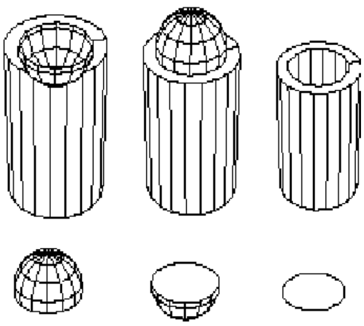
1. **Selecting one of the objects.**
   Using the object selection accessory, click on one of the objects you want to intersect. It becomes the current object.
   If you want to keep the original objects, save them before performing the Boolean operation.

2. **Selecting the Boolean tool.**
   Click on the icon depicting the Boolean tool in the Tools Palette.

3. **Selecting the second object.**
   Using the object selection accessory, click on the second object you want to intersect with the current object.

   The intersection is computed. It may take some time depending on the complexity of the operation. A first result is displayed.

4. **Displaying the different possible results.**
   To have AMAPI 3D display successively all of the elementary intersections: Use the Tuner (see chapter "The Tuner" on page 110).



The two intersected objects are a sphere and a cylinder.
AMAPI 3D generates six possible results.

5. **Selecting and validating one result.**
   Once the intersection you are looking for is displayed, press the Return key to select it.
   You can choose only one result.

6. **Ending the tool actions**
   Put the tool aside to end the action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

   If you drop the tool before validating a result, the Boolean operation will be canceled.

Practical exercises:

- A mouse on a piece of cheese / The cheese / Step 2
- A tiled floor / Create geometric shapes / Steps 4 and 5
- A chair / The whole chair / Step 2
- Intersecting pipes / Make the crossing / Step 2

Extract

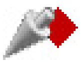
This tool extracts a part of the current object (adjacent faces) to make a new entity.

Usage:

1. **Selecting an object to make an extraction.**
   Using the object selection accessory , click on the object of interest.

2. **Selecting the Cut tool.**
   Click on the icon depicting the Cut tool in the Modeling palette.

3. **Extraction.**
   AMAPI 3D provides several selection accessories. Take the selection accessory which is appropriate for what you want to do. See chapter "How to select a selection accessory?" on page 104. Then select the point(s) following the directions for use of the selection accessory you have chosen.

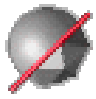
Available accessories	Usage
 The group-of-facets selection accessory	Surround the group of facets you want to select with successive clicks, then validate using the "Enter" key.
 The facet selection accessory (one at a time)	Click on each facet, then validate using the "Enter" key.

4. **Move the extracted part (optional).**
   The Data Window displays the X, Y, and Z coordinates.
   There are several ways to set this:
   - **Mouse positioning**: Move the cursor, then click (see details on page 109).
   - **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - Using the Tab key (see details on page 109).
     - Clicking in the Data Window (see details on page 109).
   - **Remote interaction**
     - The Remote Control (see chapter "The Remote Control" on page 110).
     - The Slider (see chapter "The Slider" on page 110).

Practical exercises:

- A broken egg / Break the egg / Method 1

7.3.11 Decimate



Decimation allows you to reduce the complexity of an object and the size of the file while preserving the object's general appearance.
It uses a polygon reducer which operates on polygonal objects only (not NURBS objects). (See chapter "Polygonal and NURBS drawing modes" on page 153).

This tool does not use Dynamic Geometry properties. In fact, it will delete the D.G. properties (if any) of your object, and you will no longer be able to use the features of D.G. to modify your object. (AMAPI 3D will not display the palette described above for this object).If you want your object to retain its D.G. properties, ***do not*** *use any of these tools on it. For more information see chapter "Dynamic Geometry" on page 155.*

Usage:

1. **Selecting the element you want to simplify.**
   Click with the object selection accessory on the element you want to simplify. It becomes the current element.

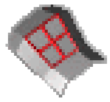
2. **Selecting the Decimation tool.**
   Click on the icon depicting the tool in the Modeling Tools Palette.

3. **Percentage of decimation modification.**
   There are several ways to set this:
   - **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - Using the Tab key (see details on page 109).
     - Clicking in the Data Window (see details on page 109).
   - **Remote interaction**
     - The Tuner: (+/- keys of the keyboard) (see details on page 110).
     - The Remote Control (see chapter "The Remote Control" on page 110).
     - The Slider (see chapter "The Slider" on page 110).

   AMAPI 3D displays the simplified object. You can repeate this step or go on to the next one.

4. **Ending the tool action.**
   Put the tool aside to end the action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

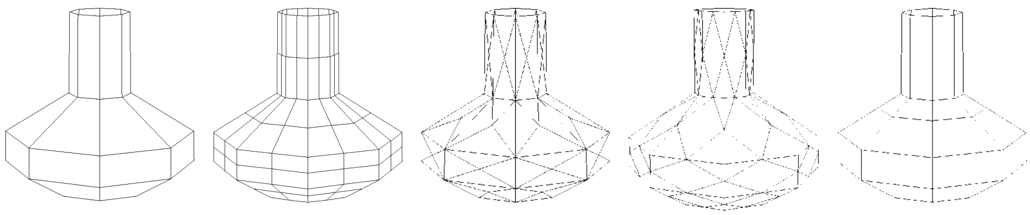
7.3.12 Tessellate



This function subdivides one or all the facets of an object.
You can choose from the following modes:

- *Rectangular tessellation (default)*
- *Triangular tessellation*
- *Diamond-shaped tessellation*
- *Adding a slice*

This tool does not use Dynamic Geometry properties. In fact, it will delete the D.G. properties (if any) of your object, and you will no longer be able to use the features of D.G. to modify your object. (AMAPI 3D will not display the palette described above for this object).If you want your object to retain its D.G. properties, ***do not*** *use any of these tools on it. For more information see chapter “Dynamic Geometry” on page 155.*



Original object | *Rectangular tessellation* | *Triangular tessellation* | *Diamond-shaped tessellation* | *Adding a slice*

Each of these tessellation types are named after the shapes they create on a rectangular surface.

Usage:

1. Selecting the element you want to modify.

Click with the object selection accessory  on the element you want to simplify. It will becomes the current element.

2. Selecting the Tessellation tool.

In the Modeling Tools palette, move the cursor to this icon , and this icon  will appear on its left.
Click on this icon.
A palette is displayed on the top of the screen showing several tessellation types.

3. Selecting the appropriate tessellation mode

Click on the icon corresponding to the action…		…then go to step
	Rectangular tessellation (default)	4
	Triangular tessellation	4
	Diamond-shaped tessellation	4
	Adding a slice	5

4 Rectangular, triangular or Diamond-shaped tessellation

4.1 Selection

Tessellation is done on the whole object.
To restrict the action to a part of an object, use the appropriate selection accessory: facet selectors (or) for a surface or edge selectors (or) for a curve (See chapter "How to select a selection accessory? » on page 104).
With this accessory, select the desired element(s) (The different ways to selecton page 105). If you select an element that is already selected, it will be deselected.

You can use the arrow keys of the keyboard to select a facet, an edge, or a vertex on a hidden face of the object (see chapter "Navigation" on page 91).

4.2 Tessellation validation

There are several ways to do this:

- By pressing the "Enter" key. AMAPI 3D displays the modified object. You can either:
    - Repeat the selection step 4.
    - Return to step 3 to select a new Tessellation mode.
    - Ending the action by going to step 6.
- Return to step 3.

5 Adding a slice

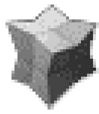
AMAPI 3D offers you a selection accessory to choose a starting point to create a new slice.
For a volume: you will create a new slice
For a curve: you will add a point
AMAPI 3D displays the modified object. You can either:

- Add a new slice by repeating step 5.
- Return to step 3 to select a new Tessellation mode.
- Ending the action by going to step 6.

6. Ending the tool action.

Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

7.3.13 Relief

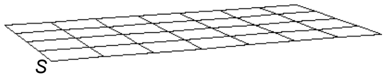


The "Bump" tool allows you to perturbate a surface. It includes a tools subpalette:

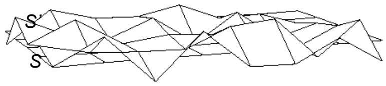
- *Bump*
- *Soften*

Bump

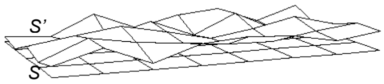
The Bump tool moves the points of a surface, on the both sides of it, in order to give it some relief.
The points are randomly displaced (up and down). The perturbed points will always stay within the range that you specify.



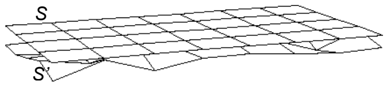
S = Surface not perturbated



S = Surface not perturbated
S'= S perturbated (-n < range < n)



S = Surface not perturbated
S' = S perturbated (0 < range < n)



S = Surface not perturbated
S'= S perturbated (-n < range < 0)

Usage:

1. **Selecting an object to work with.**
   Click on the object selection accessory  to designate the current object.
   To restrict the action to a part of an object, use the appropriate selection accessory (See chapter "The selection accessories" on page 104).

2. **Selecting the tool.**
   Click on the icon depicting the "Bump" tool .

3. **Restricting the action to a part of the object (optional).**
   If you have already selected part of the object at step 1, or if you want to apply the action to the whole object, go to the next step.
   To restrict the action to a part of an object, use the appropriate selection accessory (See chapter "The selection accessories" on page 104).

4. **Setting the perturbation range amplitude.**
   The Data Window (bottom left of the screen) displays the amplitude limits.
   - **Maximum** (upper limit)
   - **Minimum** (lower limit)

There are several ways to set this:

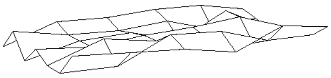
- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).
- **The Tuner:** (+/- keys of the keyboard) (see details on page 110).

5. Launching a new random calculation (optional).
As you know, the displacement of the points is computed randomly.
Each time you press the spacebar, a new random calculation is lauched, and the appearance of the surface changes.
At the end of this step, you can return to step 4 or go to the next step.

6. Ending the tool action.
Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

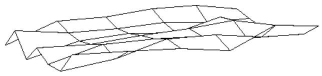
Soften - Stress

The "Soften/Stress" tool allows you to decrease or increase the perturbations of a surface.

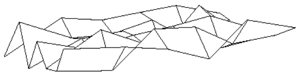


S = Original surface

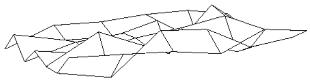
S with a softened relief



S with a softened relief but with the boundary vertices frozen



S with an increased perturbation of the relief

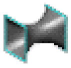


S with an increased perturbation of the relief but with the boundary vertices frozen

Usage:

1. **Selecting an object to work with.**
   Click on the object selection accessory  to designate the current object.
   To restrict the action to a part of an object, use the appropriate selection accessory (See chapter "The selection accessories" on page 104).

2. **Selecting the tool.**
   Put the cursor over the  icon and you will see the icon depicting the "Soften" tool  displayed also. Click on it.
   A subpalette will appear:

    Freeze the boundary vertices

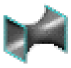
    Deselect all

    Apply MidMid/Relax mode

3. **Select the soften mode.**
   A subpalette will appear.
   Click on the soften mode you want:

    Relax mode (default)

    MidMid mode

4. **Freeze boundary vertices** (optional).
    If the current object is a surface, you may click on this icon to exclude its edges from the softening (hold them sharp).

5. Restrict the action to a part of the object (optional).
If you already have selected a part of the object at the step 1 or if you want to apply the action to the whole object, go to the next step.

To restrict the action to a part of an object, use the appropriate selection accessory (See chapter "The selection accessories" on page 104).The available accessories will be different depending the softening mode you had chosen at the step 4 :

Relaxation mode	…you will select the edges with one of the following accessories:
Mid-mid mode	…you will select the points with one of the following accessories:

For each new selection, AMAPI 3D computes the warping. Thanks to this, you will may pass from the step 5 to step 6 (or reverse) and see the result you get, before going to the step 7 to end the action.

To delete all the selections and returning to the begining of this step, click on this icon .

6. Setting the algorithm parameters.
The Data Window (bottom left of the screen) displays the parameters for the softening algorithm:

- **Coefficient**: Algorithm weight. A negative coefficient increases the relief; a positive one reduces (softens) it.
- **Level**: Number of times to iterate.

There are several ways to set these parameters:

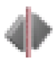
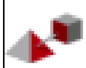
- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key **(see details on page 109).**
  - Clicking in the Data Window (see details on page 109).
- **The Tuner:** You can toggle from one data value to another by pressing the spacebar. You can tune the current data value with the +/- keys of the keyboard (see details on page 110). The Tuner has no effect on the "Coefficient" parameter.

For each new selection, AMAPI 3D computes the warping. Thanks to this, you will may pass from the step 5 to step 6 (or reverse) and see the result you get, before going to the step 7 to end the action.

7. Ending the tool action.
Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

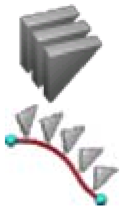
7.4 Assembly

This palette includes the tools to place and orient the elements. Rotate, Weld and Duplicate are examples of actions you can do with the Assembly tools.

Icon	Tool name	Description	See
	**Duplicate Repeate**	Use the Duplicate tool to create copies of the current object. You can:  Duplicate: Create multiple copies of the current object  Repeate: Duplicate the current object along a path or on the facets of another object	on page 314
	**Symmetry**	Use this tool to create a mirror image of an element	on page 323
	**Rotate**	Use the Rotate tool to rotate the current object	on page 326
	**Move**	Use the Move tool to change the position of an object	on page 330
	**Scale**	This tool is used to change an object’s dimension, either keeping its original proportions or distorting it horizontally or vertically.	on page 332
	**Snap**	Use this tool to: ♦ Move an object so that a point of this object is positioned exactly on a point of another object. ♦ Move only a part of the object (a point or a group of points) so that a point of the selection is positioned exactly on a point of another object. Of course, this will distort the current object. ♦ Align an object relative to another one. Define a horizontal or vertical constraint to the Snap tool so as to align a point of the current object horizontally or vertically with the point of another object.	on page 336
	**Lay On**	You will use this tool to lay a facet of an object onto the facet of another object.	on page 339
	**Weld**	The Weld tool is used in two completely different cases: When you want to weld two or more objects together: the welded objects become a single entity. When you want to merge several points of the same object into a single point.	on page 341
	**Unfold**	Use the Unfold tool ro create a 2D flat, unfolded version of your 3D object.	on page 345

7.4.1 Duplicate - Repeate

Use the Duplication tool to create copies of the current object. You can:



- *"**Duplicate**" see on page 315.*
  - *"Single copy"see on page 315.*
  - *"Multiple copies with a copy offset and rotation" see on page 316.*

- *"**Repeate**" see on page 318.*
  - *"Multiple copies along a path" see on page 318.*
  - *"Multiple copies on the facets of an object (surface or volume)"see on page 320.*

This tool lets the current object keep its Dynamic Geometry properties and passes them on to the generated object.
For more information see chapter "Dynamic Geometry" on page 155.

Duplicate

Click on this icon if you want to create multiple copies of the current object with a copy shift and rotation.

♦ Single copy

Usage:

1. Selecting an object or a part of it to work with.
Click on the object selection accessory to designate the current object.
To restrict the action to a part of an object, use the appropriate selection accessory (See chapter "The selection accessories" on page 104).

2. Selecting the Duplication tool.
Click on the icon depicting the Duplication tool in the Tools Palette.
The Hand cursor is displayed.

3. Selecting the element to duplicate.
Click on the element you want to duplicate.
A bounding box containing the copy appears where you clicked.

If you do not click directly on an object, AMAPI 3D will select the object nearest to the point you indicated.

4. Setting the shift of the copy.
The Data Window, at the bottom left of the screen, displays the X,Y and Z shift values.
There are several ways to set this:

- **Mouse positioning**: Move the cursor, then click (see details on page 109).
- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).

5. Applying a constraint to the cursor movement (optional).
You can apply a vertical or horizontal constraint to the cursor movements to position the copy precisely. Use the spacebar to do so. See chapter "Movement constraint along one axis" on page 98.

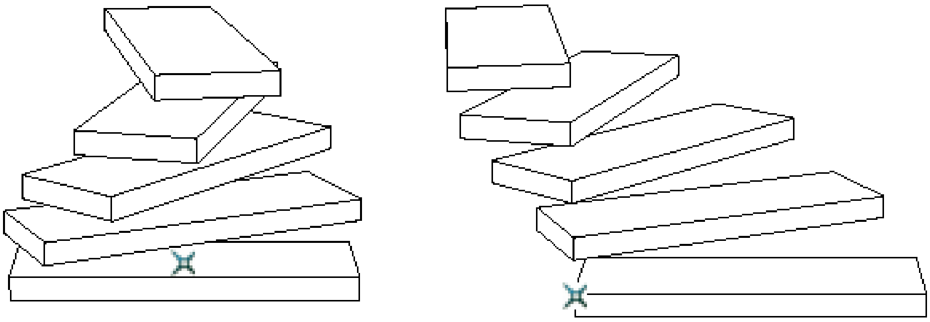
6. You can create additional copies of other elements by going back to step 2.

7. Ending the tool action.
Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

Practical exercises:

- A house / The peaks / Step 5a
- A tiled floor / Create geometric shapes / Step 3

♦ ***Multiple copies with a copy offset and rotation***



Reference point (default) *Reference point (after repositioning)*

Nombre de copies= 5 ; Décalage x=0, y=5, z=0 ; Rotation x=0, y=25, z=0

Usage:

1. **Selecting the element to duplicate.**
   Click with the object selection accessory on the object to duplicate. It becomes the current object.

2. **Selecting the Duplication tool.**
   Click on the icon depicting the Duplication tool in the Tools Palette.

3. **Changing the reference point (optional).**
   The reference point designates the rotation axis passing point.
   To do this, you need the reference point selection accessory (see "How to select a selection accessory?" on page 104).
   The cursor takes the shape of a cross, allowing you to set the reference point to the desired location on the original object.
   The center of gravity of the original object can be designated as the reference point.

4. **Specifying the number of copies.**
   You will set this value using the keyboard. Access the Data Window, then enter the values through the keyboard. Two methods are available:
   - Using the Tab key (see details on page 109).
   - Clicking in the Data Window (see details on page 109).

   If you enter a number N, you will get N times the original object (not the original object + N copies).

5. **Specifying the copy offset.**
   The Data Window at the bottom left of the screen displays the X, Y, and Z offset values of each copy of the object. Access the Data Window, then enter the values through the keyboard. Two methods are available:
   - Using the Tab key (see details on page 109).
   - Clicking in the Data Window (see details on page 109).

6. Specifying an angle of rotation (optional).
The Data Window at the bottom left of the screen displays the X, Y, and Z rotation angle values of each copy of the object relative to the previous. The object turns aronnd the axis.
Access the Data Window, then enter the values through the keyboard. Two methods are available:

- Using the Tab key (see details on page 109).
- Clicking in the Data Window (see details on page 109).

7. Ending the tool action.
Validate or put the tool aside to end the tool action. (depending on the interface). See chapter "How do you end a tool action?" on page 158.

Copies are generated as a group of objects. Use the Ungroup tool in the Control Panel if you want to ungroup them. (See chapter "Group-Ungroup" on page 140).

Practical exercises:

- A house / The rafters / Step 7

- Repeate

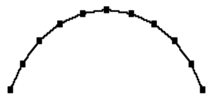
Click on this icon to duplicate the current object along a path or on the facets of a surface or a volume.

♦ *Multiple copies along a path*

Usage:

1. Creating the path used for the duplication.

To create a curve, see chapter "Drawing" on page 185.

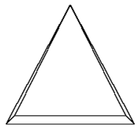


Example: Reference curve

The number of copies will be equal to the number of points defining the reference curve.

2. Creating the object to duplicated (if it does not already exist). Make sure that it is the current object.

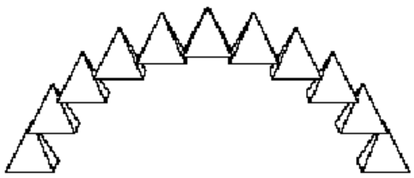
We will use a pyramid for this example.



3. Selecting the Duplication tool.
Click on the icon depicting the Duplication tool in the Tools Palette.

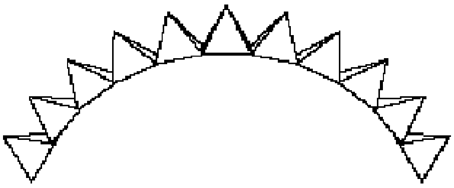
4. Changing the reference point (optional).
The reference point here designates the point on the copy that will be positioned on the points of the reference curve.
To do this, you need the reference point selection accessory  (see "How to select a selection accessory?" on page 104).
The cursor takes the shape of a cross, allowing you to set the reference point to the desired location on the original object.
The center of gravity of the original object can be designated as the reference point.

5. Selecting the reference curve to launch the duplication.
Click on the reference curve. The duplicated elements are displayed, while the original object disappears.
The copies are positioned along the curve with one copy per point describing the curve. The reference point of the copy is snapped to its corresponding point of the curve.



Example of repetition along a reference curve

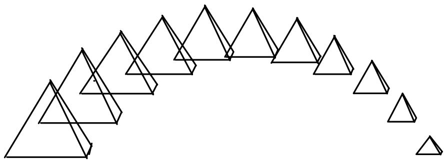
6. **Modifying the orientation of the copies (optional).**
   By default, the copies have the same orientation as the original.
   Press the spacebar to change the orientation of the copies.
   - 1st press: Copies are oriented along the X axis.
   - 2nd press: Copies are oriented along the Y axis.
   - 3rd press: Copies are oriented along the Z axis.
   - 4th press: the copies' facets are laid on the points of the curve.



Example of repetition along a reference curve

7. **Optional progressive scaling of the copies.**
   You can optionally apply a progressive scale to the copies. The first copy is considered to have a scale of 1.
   There are several ways to set this:
   - **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - Using the Tab key (see details on page 109).
     - Clicking in the Data Window (see details on page 109).
   - **The Tuner:** (+/- keys of the keyboard) (see details on page 110).

   AMAPI 3D will interpolate the size of the intermediate copies.



Progressive scaling of the copies.

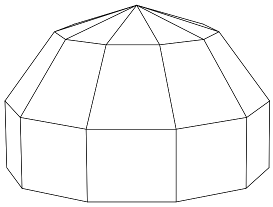
8. **Ending the tool action.**
   Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

The reference curve and the original model are transferred to the hidden scene. If you want them to reappear in the main scene, use the Unhide tool of the Control Panel. (See chapter "Hide-Unhide" on page 138).

♦ *Multiple copies on the facets of an object (surface or volume)*

Usage:

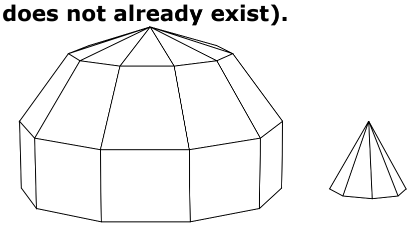
1. Creating the target object.
Create a volume or a surface onto whose facets the copies will be laid.
Use the tools of the Construction Palette.



Example of a target surface

⚠ The number of copies equal the number of facets in the target object.

2. Creating the element to be duplicated (if it does not already exist).



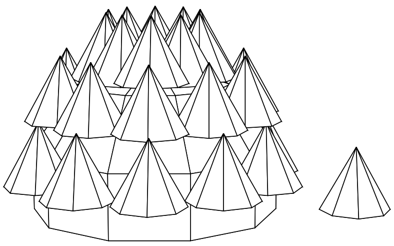
Here, we decided to duplicate a cone.

3. Selecting the Duplication tool.
Click on the icon depicting the Duplication tool in the Tools Palette.

⚠ Make sure that the current object is the one you want to duplicate.

4. Optional modification of the reference point.
The reference point designates the point on the copy that will be positioned on the center of geometry of the facets of the target object.
The center of gravity of the original object can be designated as the reference point.
To do this, you need the reference point selection accessory (see "How to select a selection accessory?" on page 104).
This accessory allowing you to set the reference point at the desired location on the original object.

5. Selecting the target object and starting the duplication.
Click on the target object.
The copies are displayed while the original object and the target object are sent into the Hidden Scene.
There is now one copy per facet of the target object. Each copy is connected by the center of a facet (user defined) to the target object.

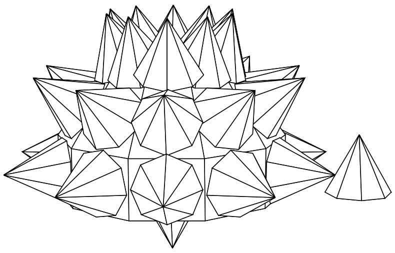


6. Modifying the orientation of the copies (optional).

By default, the copies have the same orientation as the original element.

Press the spacebar to change the orientation of the copies.

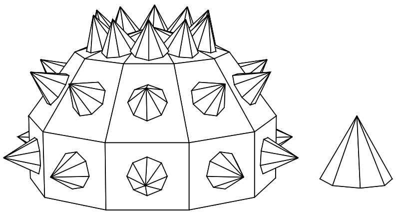
- 1st press: Copies are oriented along the X axis.
- 2nd press: Copies are oriented along the Y axis.
- 3rd press: Copies are oriented along the Z axis.
- 4th press: The copies' facets are laid on the points of the surface.



7. Modifying the size of the copies (optional).

You can increase or decrease the size of the duplicated elements. There are several ways to set the size ratio:

- **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - Using the Tab key (see details on page 109).
  - Clicking in the Data Window (see details on page 109).
- **The Tuner:** (+/- keys of the keyboard) (see details on page 110).



8. Assigning a scale factor to the size of each copy.

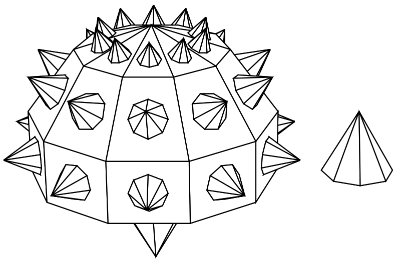
Each copy / facet pair defines a scale factor based on their relative sizes.

You can choose to assign one of those scale factors to all the other copy / facet pairs.

⇒ Click on the icon in the Mode area of the Assistant Palette (or use the hotkey: Ctrl+spacebar).

⇒ Then designate the copy / facet pair that presents the scale ratio you want to assign to all the other copy / facet couples: You will have to select the copy / facet couples of which the size ratio fits. Select this reference facet with the point selection accessory .

this scale ratio and have it automatically assigned to all the other copy / facet pairs.



9. Ending the tool action.

Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

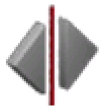
The object orientation on the support facet depends of the orientation of the normal to this facet (see chapter "Orienting the normals » on page 348).

The target object and the original object are sent in the hidden scene once the duplication is done. Use the Hide-Unhide tool to bring them back in the main scene if you need to. (See chapter "Hide-Unhide" on page 138).

Practical exercises:

- A house / The tiles / Step 4
- A tiled floor / Generating the tile floor / Step 2
- Teeth / Half jaw

7.4.2 Symmetry



Use this tool to create a mirror image of an element.

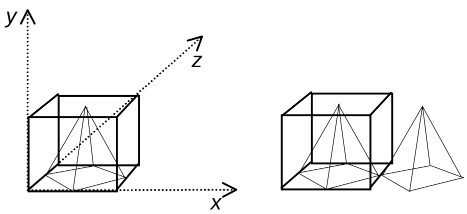
- *Creating the mirror image of a 2D or a 3D element that is not lying on one of the three orthogonal planes (see below).*
- *Creating the mirror image of a 2D element lying on one of the three orthogonal planes (see on page 325).*

This tool lets the current object keep its Dynamic Geometry properties and passes them on to the generated object.

For more information see chapter “Dynamic Geometry” on page 155.

❑ Creating the mirror image of a 2D or a 3D element that is not lying on one of the three orthogonal planes

AMAPI 3D surrounds the element in a box whose facets define the different planes of symmetry available.



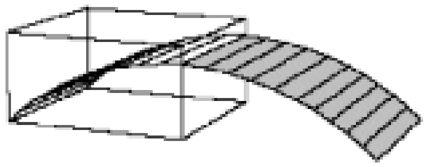
Usage:

1. **Selecting an object or a part of it to work with.**
   Click on the object selection accessory to designate the current object.
   To restrict the action to a part of an object, use the appropriate selection accessory (See chapter “The selection accessories” on page 104).
   You cannot make a mirror image of part of a curve.

2. **Selecting the Symmetry tool.**
   Click on the icon depicting the Symmetry tool in the Tools Palette.
   A white bounding box encloses the selection.

3. **Moving the plane of symmetry, if necessary.**
   The default plane of symmetry is one of the faces of the bounding box.
   You may want to choose a different plane of symmetry. AMAPI 3D lets you specify a point which the plane of symmetry will go through This point must be set on an existing point of the scene. You may need to create a point specifically for the purposes of this operation.
   To move the symmetry plane, you will need the reference point selection accessory (see "How to select a selection accessory?" on page 104). This accessory allows you to position this point.

4. **Selecting the plane of symmetry.**
   Click on a face of the bounding box to designate it as the plane of symmetry.
   The mirror image appears.



5. **Making additional mirror images.**
   Go back to step 3 to produce additional mirror images, changing the view if necessary.

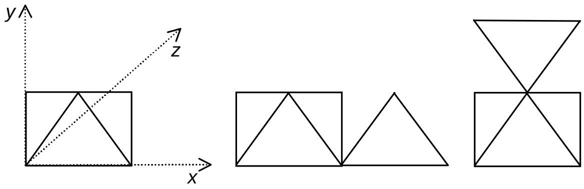
6. **Ending the tool action.**
   Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

Practical exercises:

- A Champagne cap / The cap's head / Step 4
- A house / The rafters / Step 5
- A mouse on a piece of cheese / The mouse / Steps 3 and 5
- Hull for a boat 1 (1st method: hull) / Step 3
- Hull for a boat 1 (2nd method: Coons) / Step 2
- Hull for a boat 1 (3rd method: ruled surface) / Step 2
- Hull for a boat 2 (2nd method: Coons) / Step 2
- Hull for a boat 2 (3rd method: ruled surface) / Step 2
- Teeth / The jaw
- A little ant / Modeling the whole head

- Creating the mirror image of a 2D element lying on one of the three orthogonal planes

AMAPI 3D surrounds the element by a frame whose sides define the different axes of symmetry.



Usage:

1. **Selecting the element or the part of the element you want to make a mirror image of.**
   Click on the object selection accessory to designate the current object.
   To restrict the action to a part of an object, use the appropriate selection accessory (See chapter "The selection accessories" on page 104).
   You cannot make a mirror image of part of a curve.

2. **Selecting the Symmetry tool.**
   Click on the icon depicting the Symmetry tool in the Tools Palette.
   A white rectangle encloses the selection.

3. **Designating the axis of symmetry.**
   You can either:
   ⇒ Click on the icon button in the Assistant Palette corresponding to the chosen direction.
   ⇒ Press the spacebar to toggle from one axis to the other.

4. **Moving the axis of symmetry.**
   The possible axes of symmetry are positioned by default along the edges of the white rectangle.
   AMAPI 3D allows the axis of symmetry to go through a point not belonging to the edges of the white rectangle. This point must be set on an existing point of the scene. You may need to create a point specifically for the purposes of this operation.
   To move the symmetry plane, you will need the reference point selection accessory (see "How to select a selection accessory?" on page 104). This accessory allows you to position this point.

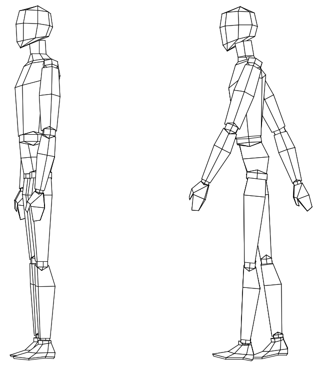
5. **Selecting the side where the mirror image will be made (if you did not move the axis of symmetry).**
   Click on the side of the rectangle where you want to see the mirror image created.

6. **Creating additional mirror images.**
   Go back to step 3 to produce additional mirror images, changing the view if necessary.

7. **Ending the tool action.**
   Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

7.4.3 Rotate

Use the Rotate tool to rotate the current object.
You can define the center of rotation and the plane of rotation.



Example of rotation of part of an object

Rotate an object by a given angle (see below).

Rotate an object in view to align one point of it with the rotation center and one point selected in the scene (see on page 328).

This tool can use the Dynamic Geometry properties. For more information see chapter "Dynamic Geometry" on page 155.

Rotate an object by a given angle

Usage:

1. Selecting an object or a part of it to work with.

Click on the object selection accessory to designate the current object.
To restrict the action to a part of an object, use the appropriate selection accessory (See chapter "The selection accessories" on page 104).

2. Selecting the Rotate tool.

Click on the icon depicting the Rotate tool in the Tools Palette.
A circle appears around the element or around the selected part of the element.

The Rotate tool is one of the tools that allows you to change the current object while using the tool.

To change the current object while within the tool:

⇒ Press Shift+ESC to select the object selection accessory .
⇒ Click on another object: it becomes the current object.

3. Dynamic Geometry properties.

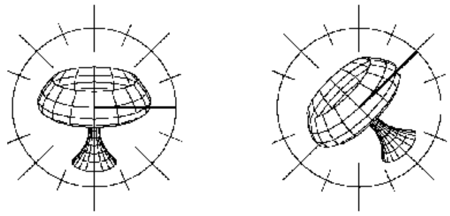
Depending on how you created the current object, you can work with its Dynamic Geometry properties. This means that you can work on one of the following four finishing levels:
1 – Rough structure
2 – Smoothed structure
3 – Rough object
4 – Smoothed object

In the “Dynamic Geometry” palette, click on the icon depicting the finishing level on which you want to work.

If you decide to work on your model at finishing level “n”, then you will no longer be able to work on levels “1” to “n-1” (the icon of the disabled levels will disappear).

For more information see chapter “Dynamic Geometry” on page 155.

4. **Changing the plane of rotation.**
   You can change the plane of rotation. Use the arrow keys of the numeric keypad to change the plane. (See chapter “Navigation” on page 91).



   The circle of rotation is displayed on the selected plane.
   The axis of rotation is always perpendicular to the plane of rotation.

5. **Defining the center of rotation.**
   The center of rotation is set by default on the center of geometry of the element.
   It is identified by the following icon:
   To move it, you will need the reference point selection accessory (see “How to select a selection accessory?” on page 104).
   This accessory allows you to click on the new position. The center of rotation will be set on the closest existing point of the scene.

6. **Setting the rotation increment value.**
   With the Tuner (see chapter “The Tuner” on page 110),
   you can increase or decrease the rotation increment of the circle of rotation.

7. **Doing the rotation.**
   There are several ways to set this:
   - **Mouse Tuner** Press and hold the left mouse button. Move the cursor. Release the button at the desired rotation. (see details on page 109).
   - **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - Using the Tab key (see details on page 109).
     - Clicking in the Data Window (see details on page 109).
   - **Remote interaction**
     - The Remote Control (see chapter “The Remote Control” on page 110).
     - The Slider (see chapter “The Slider” on page 110).

8. **Ending the tool action.**
   Validate or put the tool aside to end the tool action (depending on the interface). See chapter “How do you end a tool action?” on page 158.

If, while selecting the Rotation tool, you simultaneously press the Control key, AMAPI 3D will automatically generate a copy of the current object. This copy becomes the current object and the rotation will be applied to it. The original object will reappear at the next screen redraw.

Practical exercises:
- Intersecting pipes / Making the crossing / Step 1

- Rotate an object in view to align one point of it with the rotation center and one point selected in the scene

You will select:

- *An object to be rotated*
- *The rotation center "C"*
- *A point "P1" to be aligned ("P1" belongs to the current object)*
- *A point "P2" (anywhere in the scene) which with "C" will define the alignment line.*

Before alignment *After alignment*

Usage:

1. Selecting an object or a part of it to work with.

Click on the object selection accessory to designate the current object.
To restrict the action to a part of an object, use the appropriate selection accessory (See chapter "The selection accessories" on page 104).

2. Selecting the Rotation tool.

Click on the icon depicting the Rotation tool in the Tools Palette.
A circle appears around the selected element or around the selected part of the element.

The Rotate tool is one of the tools that allows you to change the current object while using the tool.
To change the current object while within the tool:

⇒ Press Shift+ESC to select the object selection accessory .
⇒ Click on another object: it becomes the current object.

3. Dynamic Geometry properties

Depending on how you created the current object, you can work with its Dynamic Geometry properties. This means that you can work on one of the following four finishing levels:
1 – Rough structure
2 – Smoothed structure
3 – Rough object
4 – Smoothed object
In the "Dynamic Geometry" palette, click on the icon depicting the finishing level on which you want to work.

If you decide to work on your model at finishing level "n", then you will no longer be able to work on levels "1" to "n-1" (the icon of the disabled levels will disappear).

For more information see chapter "Dynamic Geometry" on page 155.

4. Changing the plane of rotation (optional).
You can change the plane of rotation. Use the arrow keys of the numeric keypad to change the plane. (See chapter "Navigation" on page 91).
The circle of rotation is displayed on the selected plane.
The axis of rotation is always perpendicular to the plane of rotation.

5. Defining the center of rotation.
The center of rotation is set by default on the center of geometry of the element.
It is identified by the following icon: 

You can define a different center of rotation:
⇒ On PC: Click the right mouse button.
Or
⇒ On Mac: Click the mouse button and simultaneously press the Option key.

The cursor switches to the following shape: 
Click on the new position. The center of rotation will be set on to the nearest existing point of the scene.

6. Alignment.
⇒ Select the point "P1" as follows: hold the Shift key pressed and click on any point of the current object
⇒ Select the point "P2" as follows: hold the Shift key pressed and click again on any point of any object of the scene. AMAPI 3D will align the two points.

7. Ending the tool action.
Put the tool aside to end the action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

7.4.4 Move

Use the Move tool when you want to change the position of an element in the scene.

Although this tool doesn't use Dynamic Geometry properties of the selected object, it doesn't prevent you from using the D.G. properties of the object in the future. For more information see chapter "Dynamic Geometry" on page 155.

Usage:

1. **Select the element.**
   Using the object selection accessory , click on the element. It becomes the current element.

2. **Select the Move tool.**
   Click on, the icon depicting the Move tool in the Tools Palette.

   The Move tool is one of the tools that allows you to change the current object while you are using the tool.
   To change current object while within the tool:
   ⇒ Press Shift+ESC to select the object selection accessory .
   ⇒ Click on another object: it becomes the current object

3. **Setting the position of the origin.**
   You need to set the position of the origin. It must be set on an existing point of the scene. Click on the point to designate it: it will become the reference point for all the operations performed within this tool. If you click in an empty area, AMAPI 3D will automatically select the nearest point.

4. **Specifying a movement or cursor positioning constraint:**
   Move the cursor; the object or its bounding box (depending the selected interface, see chapter "Work Space" on page 439) follows the cursor movement. The movement is limited to the current working plane.
   Unless you specify otherwise, the cursor can move freely in any direction. AMAPI 3D allows you to apply a constraint to the cursor movement and positioning:
   - Movement constraint along one axis
   - Resetting the axes' increment (step size)
   - Snapping the cursor on existing points
   - Snapping the cursor on a segment
   - Positioning the cursor according to lines of constraint

   For more information see chapter "Cursor movement and positioning constraints" on page 98.

5. **Moving and positioning the object:**
   The Data Window, at the bottom left of the screen, displays the X,Y and Z coordinates.
   There are several ways to set the object position:
   - **Mouse positioning**: Move the cursor, then click (see details on page 109).
   - **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
     - Using the Tab key (see details on page 109).
     - Clicking in the Data Window (see details on page 109).
   - **Remote interaction**
     - The Remote Control (see chapter "The Remote Control" on page 110).
     - The Slider (see chapter "The Slider" on page 110).

6. **Ending the tool action.**
   Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

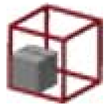
You can also access the Move tool by pressing and holding down the mouse button.

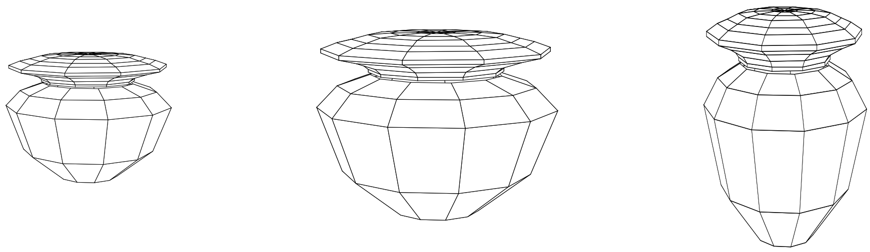
If, while selecting the Move tool, you simultaneously press the Control key, AMAPI 3D will automatically generate a copy of the current object. This copy becomes the current object and will be moved with the Move tool. The original object will reappear at the next screen redraw.

Practical exercises:
- A house / The main beam / Step 3
- A chair / The whole chair / Step 1

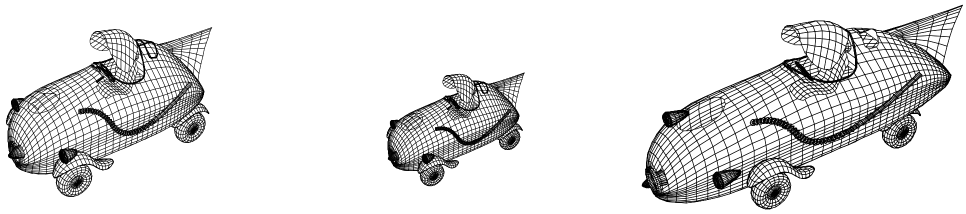
7.4.5 Scale

This tool is used to change an object's dimension, either keeping its original proportions or distorting it horizontally or vertically.





Original object | *Scaled object maintaining its original proportions* | *Vertically scaled object*



Original object | *Scaled object maintaining its original proportions* | *Horizontally scaled object*

Scale tool usage examples

This tool uses the Dynamic Geometry properties of the selected object. For more information. For more information see chapter "Dynamic Geometry" on page 155.

Usage:

1. Selecting an object or a part of it to work with.

Click on the object selection accessory to designate the current object. To restrict the action to a part of an object, use the appropriate selection accessory (See chapter "The selection accessories" on page 104).

2. Selecting the tool.

Click on the icon depicting the Scale tool in the Tools Palette.
A bounding box now surrounds the selection.

The Scale tool is one of the tools that allows you to change the current object while you are using the tool.
To change current object while within the tool:

⇒ Press Shift+ESC to select the object selection accessory .
⇒ Click on another object: it becomes the current object.

3. Dynamic Geometry properties

Depending on how you created the current object, you can work with its Dynamic Geometry properties. This means that you can work on one of the following four finishing levels:
1 – Rough structure
2 – Smoothed structure
3 – Rough object
4 – Smoothed object
In the "Dynamic Geometry" palette, click on the icon depicting the finishing level on which you want to work.

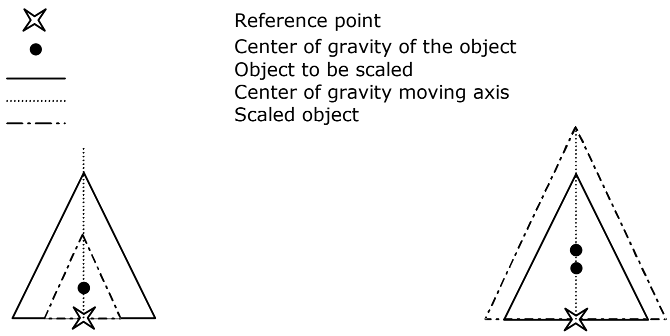
If you decide to work on your model at finishing level "n", then you will no longer be able to work on levels "1" to "n-1" (the icon of the disabled levels will disappear).

For more information see chapter "Dynamic Geometry" on page 155.

4. Reference point positioning (optional).

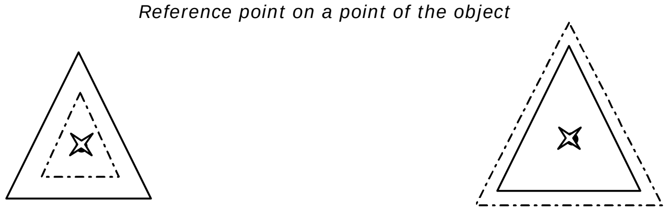
The reference point and the center of gravity of the object define the moving axis.
The center of gravity of the object is moved along this axis with a distance that is proportional to the scaling applied to the object.
Position the reference point according to the desired results.

Examples:

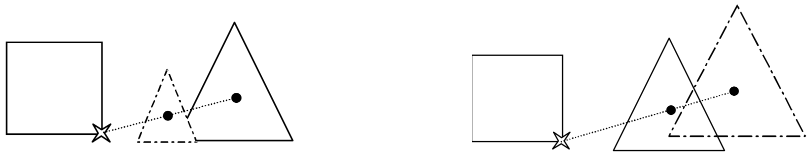


Reference point on the bottom of the object (default position)

Reference point on a point of the object



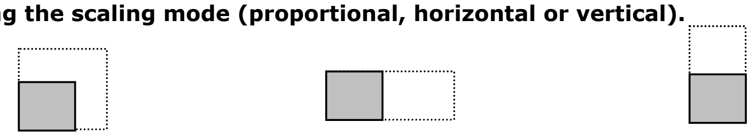
Reference point on the center of gravity of the object to be scaled



Reference point on a point of another object of the scene

The reference point icon is a little cross: 
The AMAPI 3D default position is the bottom of the center of the face of the cube.
If you want to move this point you need the reference point selection accessory  (see "How to select a selection accessory?" on page 104).
This accessory allows you to select the new position of the reference point.

5. Choosing the scaling mode (proportional, horizontal or vertical).



Proportional scale (default scaling mode)   *Horizontal distortion*   *Vertical distortion*

To select the scaling mode, there are two available methods: with the Assistant Palette or the spacebar (see chapter "Positioning the cursor according to lines of constraint" on page 101).

6. Scaling.
The data palette displays the width, the height and the depth of the current object.
There are several ways to scale an object. Select the one you need from the table below.

Setting new measurements	Go to step 6.1
Setting a proportional scaling percentage	Go to step 6.2
Setting a target surface value	
Setting a target volume value	

6.1 Set the measurements

The Data Window, at the bottom left of the screen, displays the width (X), the height (Y), and the depth (Z) of the current object. There are several ways to set this:

- ♦ **Mouse parameter setting**: Move the cursor, then click (see details on page 109).
- ♦ **The keyboard:** Access the Data Window, then enter the values through the keyboard. Two methods are available:
  - ♦ Using the Tab key (see details on page 109).
  - ♦ Clicking in the Data Window (see details on page 109).
- ♦ **Remote interaction**
  - ♦ The Tuner: You can toggle from one data value to another by pressing the spacebar. You can tune the current data value with the +/- keys of the keyboard (see details on page 110).
  - ♦ The Remote Control (see chapter "The Remote Control" on page 110).
  - ♦ The Slider (see chapter "The Slider" on page 110).

Then go to step 7.

6.2 Scaling in Percentage, Surface , Volume, Length

To access the « Percentage, Surface, Volume, Length », click on the icon (or press simultaneously the « CTRL » key and the « space bar » of the keyboard).
Depending the kind of the current object, the data palette displays the scaling percentage, the surface, the volume or the length.
Press the "Tab" key to access the data palette (it is always with this "Tab" key you will toggle from a data to another one) or click on the data to be modified.
Enter the wanted values and press the "Enter" key to validate.

7. Ending the tool action.

Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

If, while selecting the Scale tool, you also press the Option key, AMAPI 3D will automatically create a copy of the current object and the scaling operations will be applied to the copy generated. The original object will reappear at the next screen redraw.

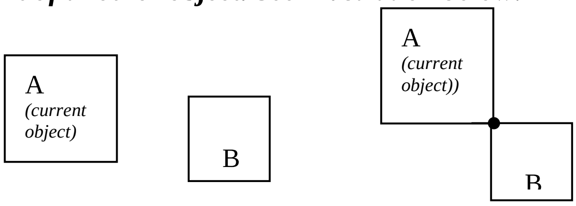
Practical exercises:

- A little house / The little house's roof / Step 4
- A Champagne cap / The cap's head / Step 3
- A house / The tiles / Step 3
- A chair / The seat / Step 3
- A playing card, a die and a token / Basic construction base

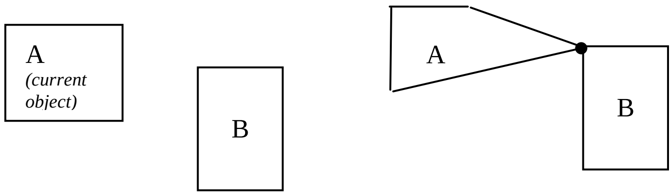
7.4.6 Snap

Use the Snap tool to:

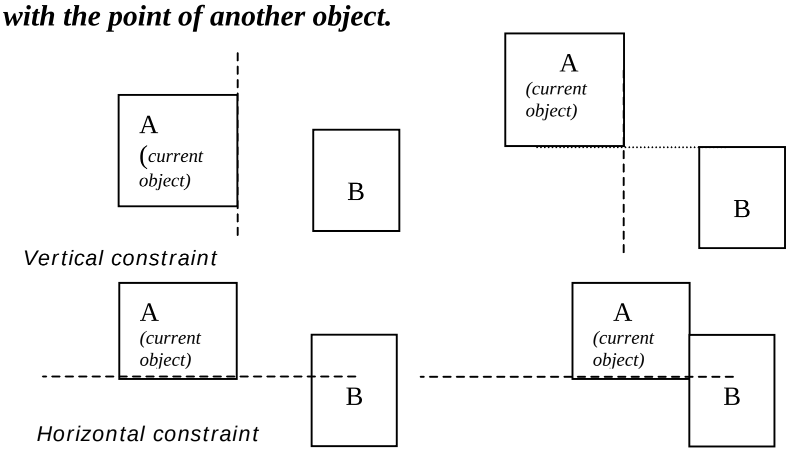
***1 – Move** an object so that a point of this object is positioned exactly (snapped to) **a point of another object.** See illustration below:*



***2 – Move only part of the element** (a point or a group of points) so that a point of the selection **is positioned exactly on a point of another object.** Of course, this will distort the current object:*



3 – Align an object relative to another one. Define a horizontal or a vertical constraint to the Snap tool so as to align a point of the current object horizontally or vertically with the point of another object.



This tool uses the Dynamic Geometry properties.
For more information see chapter "Dynamic Geometry" on page 155.

Usage:

1. Selecting an object or a part of it to work with.

Click on the object selection accessory to designate the current object.
To restrict the action to a part of an object, use the appropriate selection accessory (See chapter "The selection accessories" on page 104).

2. Select the Snap tool.
Click on the icon depicting the tool in the Tools Palette.

The Snap tool is one of the tools that allows you to change the current object while you are using the tool.
To change current object while within the tool:

⇒ Press Shift+ESC to select the object selection accessory .
⇒ Click on another object: it becomes the current object.

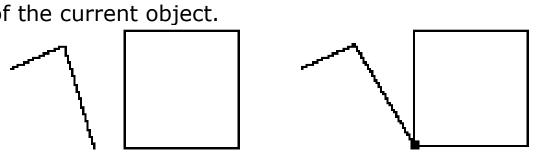
3. Dynamic Geometry properties.
Depending on how you created the current object, you can work with its Dynamic Geometry properties. This means that you can work on one of the following four finishing levels:
1 – Rough structure
2 – Smoothed structure
3 – Rough object
4 – Smoothed object
In the "Dynamic Geometry" palette, click on the icon depicting the finishing level on which you want to work.

If you decide to work on your model at finishing level "n", then you will no longer be able to work on levels "1" to "n-1" (the icon of the disabled levels will disappear).

For more information see chapter "Dynamic Geometry" on page 155.

4. Defining a constraint (if you want to align objects).
Set a horizontal or vertical constraint if you want to align objects. See chapter "Positioning the cursor according to lines of constraint" on page 101.

5. Defining the point to snap on the object.
Click on a point of the current object.



6. Define the Snapping point.
Click on a point of another element of the scene: This is the point to which the point selected on the current object will snap to.
♦ If no constraint was defined: The current object will move and be snapped to the snapping point.
♦ If you set a constraint: The point selected on the current object will be aligned horizontally or vertically with the snapping point of the 2nd object (depending on the constraint defined).

7. Ending the tool action.

Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

You can use other types of constraints with the Snapping tool**:**

- An existing point
- A point along a segment
- Constraint lines

(See chapter "Cursor movement and positioning constraints" on page 98).

Snapping a point or a group of points of an object onto a point of another object achieves the same result as pulling a point or a group of points of an object using the Stretch tool while holding down the Shift key so that the cursor snaps onto a point of another object.
See chapter "Stretch" on page 268. See chapter "Cursor movement and positioning Constraints / Snapping the cursor on existing points" on page 100.

If, while selecting the Snapping tool, you simultaneously press the Control key, AMAPI 3D will automatically generate a copy of the current object. This copy becomes the current object and the tool action will be applied to it. The original object will reappear at the next screen redraw.

Practical exercises:

- A little house / The little house's roof / Step 1
- A house / The peaks / Step 5b
- A house / The main beam / Step 2
- A house / The rafters / Step 4

7.4.7 Lay On

Use the Lay On tool to lay a facet of an object onto the facet of another object.
The two elements will remain distinct objects.

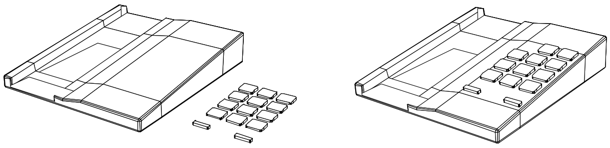
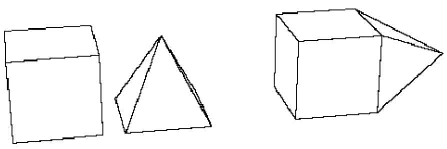


Illustration of the use of the Lay On tool

This tool does not use Dynamic Geometry properties. In fact, it will delete the D.G. properties (if any) of your object, and you will no longer be able to use the features of D.G. to modify your object. (AMAPI 3D will not display the palette described above for this object).If you want your object to retain its D.G. properties, ***do not*** *use any of these tools on it. For more information see chapter "Dynamic Geometry" on page 155.*

Usage:

1. **Selecting the element you want to move.**
   Using the object selection accessory , click on the element you want to move.
2. **Selecting the Lay On tool.**
   Click on the icon depicting the Lay On tool in the Tools Palette.
3. **Designating the facet.**
   AMAPI 3D selects the lowest facet of the object by default.
   Click on a different facet if necessary. It turns red.
4. **Selecting a target facet on another element of the scene.**
   Click on a facet of another element of the scene.
   The selected facet of the current facet is laid flat onto the facet of the second object (center of facet to center of facet).



In this example, the base of the pyramid is laid onto one side of the cube.

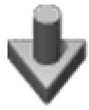
The normal of the facet of the second object will determine on which side the current object's facet will be laid onto. In the case of a closed object, normals are usually oriented toward the outside of the object. But in the case of a 3D surface, you may need to change the orientation of the normal of the target facet to place the current object correctly. (See chapter "Orienting the normals" on page 348).

5. **Ending the tool action.**
Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

Practical exercises:

- A cone on a sloping plane / Put the cone on the sloping plane

7.4.8 Weld



The Weld tool is used in two completely different cases:

1. ***When you want to weld two or more elements together:** the welded elements **become a single entity***
2. ***Weld several points of the same object** Use the Weld tool when you want to **merge several selected points into a single point**. This point will replace the other ones and will be positioned at the center of the geometry of the selection. You can:*
   Weld selected points on an object.
   Weld all the nearest points of an object.

*This tool does not use Dynamic Geometry properties. In fact, it will delete the D.G. properties (if any) of your object, and you will no longer be able to use the features of D.G. to modify your object. (AMAPI 3D will not display the palette described above for this object).If you want your object to retain its D.G. properties, **do not** use any of these tools on it. For more information see chapter "Dynamic Geometry" on page 155.*

❑ Welding different objects together

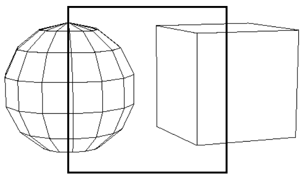
Welding objects together will transform them in to a single entity (but it will not distort them).

*You cannot weld together **closed curves** and **open curves having no common point.***

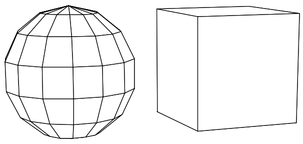
Usage:

1. **Select the Weld tool.**
   Click on the icon depicting the Weld tool in Tools Palette.
   The Lasso cursor is displayed when you select the Weld tool.

2. **Select the elements to weld.**
   AMAPI 3D displays the group-of-points selection accessory .
   With it, select at least one point of each object to weld.



Lasso selection of at least one point of each object.



The objects are welded. There is now only one object (entity). The sphere and the cube are displayed in cyan, the color of the current object.

Welding automatically eliminates the redundant points.

Welded objects can not be "unwelded". You must undo the operation (Ctrl+Z on PC; Command+Z on Mac; or select Undo in the Edit Menu) if you make a mistake.

3. **Ending the tool action.**
   Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

If, while drawing curves, you mistakenly created two different curves where you wanted only one, weld those two curves together. They will become one single curve. But remember that you cannot weld together open curves that do not share a common point (see chapter "Open shapes / Closed shapes" on page 152).

Practical exercises:

- A Champagne cap / The cap's head / Step 5
- A Champagne cap / Head and body assembly
- A house / The peaks / Step 6
- A house / The rafters / Step 6
- A little ant / Constructing half of the head / Steps 3 and 4
- A little ant / Modeling the whole head

❑ Welding points within an object

♦ *Welding selected points*

Welding several points of the same object means to merge the selected points into a single point. This point will replace the other ones and will be positioned at the center of geometry of the selection. The shape of the element will be modified.

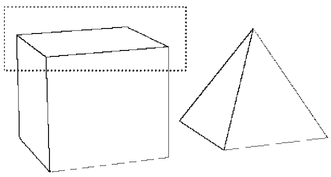
Usage:

1. **Selecting the element or the part of the element to be welded.**
   Click with the object selection accessory on the element to be selected.

2. **Selecting the Weld tool.**
   Click on the icon depicting the Weld tool in the Assembly palette.
   The Lasso cursor is displayed when the Weld tool is selected.

3. **Selecting the points to weld.**
   Surround the points using the Lasso.

4. **Ending the selection.**
   Press the Return key to end and validate the selection. The selected points will be merged into one, positioned at the center of the geometry of the selection.

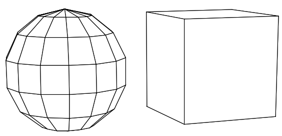


In this example, the four points of the top of the cube are welded together, transforming the cube into a pyramid.

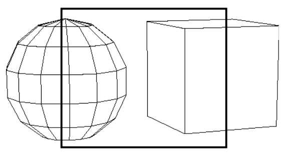
Selection using the Lasso

5. **Ending the tool action.**
   Put the tool aside to end the action (depending on the interface). See chapter “How do you end a tool action?” on page 158.

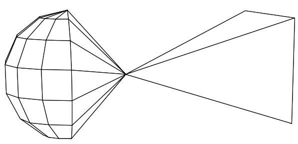
You can weld two objects together into one single object, and then weld points of the new single object together.



This sphere and this cube were welded together into a single object (See paragraph Welding different objects together).



Selecting points of the same object using the Lasso.



The selected points are merged into a single point.

Now, you can put the tool aside or do a new welding.

See Practical Exercise:
- A little house / The little house's roof / Steps 2 and 3.
- A cone on a sloping plane / The cone / Step 3
- A house / The peaks / Step 2

♦ *Weld the nearest points*

The Weld tool gives you the option of welding the closest points of an object. You set the maximum distance which determines if two points are close or not.
This tool must not be confused with the Decimation tool ((See chapter « Decimate » on page 306).

Usage:

1. **Selecting the element or the part of the element to be welded**
   Click with the object selection accessory on the element to be welded.

2. **Selecting the Weld tool.**
   Click on the icon depicting the Weld tool in the Assembly palette.

3. **Specifying the maximum distance between two "close" points.**
   The data palette displays the distance. There are several ways to set this:
   The keyboard: Access the Data Window, then enter the values through the keyboard. Two methods are available:
   - ♦ Using the Tab key (see details on page 109).
   - ♦ Clicking in the Data Window (see details on page 109).

   The Tuner: (+/- keys of the keyboard) (see details on page 110).
   Now, you can leave the tool by going to the next step, or make a new welding.

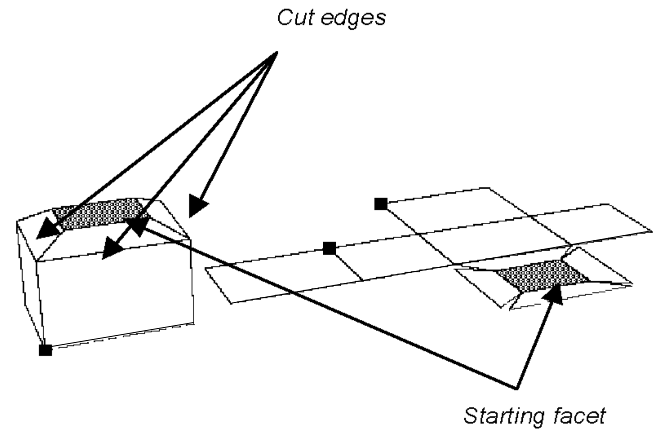
4. **Ending the tool action.**
   Put the tool aside to end the action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

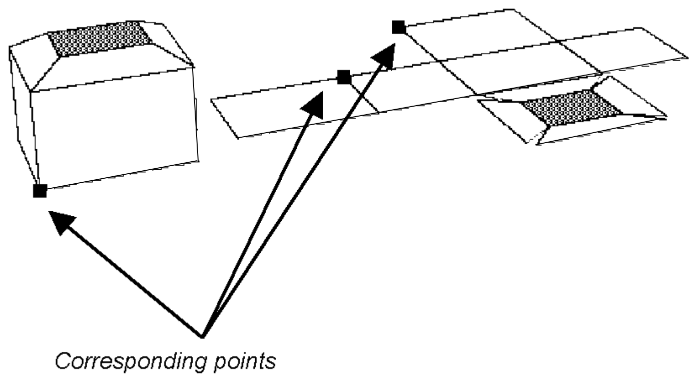
7.4.9 Unfold

Use the Unfold tool to create a 2D flat, unfolded version of your 3D object. For instance, if you create the 3D model of a paper cube, the Unfold tool will create the flat 2D parts (or pattern) for constructing the cube.

The unfolding operation is a 3-step process:

1. Select the edges along which the cutting will be done.
2. Select the facet from which the unfolding will be made.
3. Check the connections between the points and facets of the original model (in 3D) and the points and facets of the resulting pattern (in 2D)





This tool lets the current object keep its Dynamic Geometry properties but does not pass them on to the generated object.

For more information see chapter “Dynamic Geometry” on page 155.

Usage:

If the current element has already been unfolded and you select the Unfold tool again, you will automatically work on the unfolded version. See the section on corresponding points to see how to work on a pattern.

1. Selecting the element to Unfold.

Click with the object selection accessory  on the element you want to unfold.

2. Selecting the Unfold tool.

Click on the icon depicting the Unfold tool in the Tools Palette.
AMAPI 3D opens a sub-palette of tools that you will use during the different steps of the unfolding process.

3. Designating the cut edges, if necessary.

If no cut edges are selected before launching the Unfold tool, AMAPI 3D will select them automatically.
You can choose to:

♦  **Have the cut edges go through the horizontal edges.**
AMAPI 3D allows you to designate the horizontal edges as cut edges (if there are any).
There are two ways to select them:
⇒ **Through the Palette**: Click on the icon button depicting the horizontal axis in the Palette.
Or
⇒ Through the keyboard: Press the spacebar.

♦  **Have the cut edges go through the vertical edges.**
AMAPI 3D allows you to designate the vertical edges as cut edges (if there are any).
There are two ways to select them:
⇒ **Through the Palette**: Click on the icon button depicting the vertical axes in the Palette.
Or
⇒ Through the keyboard: Press the spacebar twice.

♦  **Have the cut edges go through specific edges.**
AMAPI 3D allows you to select the individual edges along which the object will be cut (surrounding edges with the Lasso or point by point with the Bullseye).
Always press the Return key to validate the selection.
To change the selection accessory, you can either use:
⇒ **The Palette**: Click on the icon depicting the tool in the Palette.
Or
⇒ **The mouse**:
On PC: Click the right mouse button.
On Mac: Press the Option key and simultaneously click the mouse button.

If you did not select enough edges to correctly unfold the shape, AMAPI 3D will automatically select additional edges.

- **Deselecting edges.**
  You can deselect automatically all the cut edges previously selected. Click on the Deselect tool icon in the sub-palette.

4. Designating the starting facet (optional).
If you do not select a starting facet for the cut before launching the operation, AMAPI 3D will select one automatically.
The goal here is to select the facet from which the shape will be unfolded.

To do this, you must take the facet selection accessory available in this tool (See chapter "The selection accessories" on page 104).
With it, you will select the facet (of the current object) from which the unfolding will begin.

5. Unfold.
Click on the Unfold icon in the Unfold sub-palette
The original object is still displayed, unmodified, along with the flat unfolded pattern

6. Visualizing corresponding points and facets between the original 3D object and the unfolded pattern.

- **Visualizing corresponding points.**
  Once the model is unfolded, the point selection accessory is displayed. Use it to see the corresponding points between the 3D model and the pattern:
  ⇒ Click on a point on the pattern (or on the 3D model). The corresponding point on the 3D model is highlighted (or on the pattern).
  ⇒ Click on other points to highlight their counterparts.
- **Visualizing corresponding facets.**
  To do this, you must take the facet selection accessory available in this tool (See chapter "The selection accessories" on page 104).
  This selection accessory allows you to select facets either on the 3D model or on the unfolded pattern. The corresponding facet on the other object is highlighted.

7. Ending the tool action.
Validate or put the tool aside to end the tool action (depending on the interface). See chapter "How do you end a tool action?" on page 158.

Practical exercises:
- An acoustic baffle / Unfolding the baffle box

7.5 Advanced tools

This is a palette of advanced tools complementing the main tool palettes. You can find it in the menu. It can only be accessed through the Tools / Advanced tools menu item.

7.5.1 Bezier

This command is used to create Bezier splines.

7.5.2 Orienting the normals

The normal of a facet determines its orientation, either external or internal. Normally, facets are oriented toward the outside of the object. Use this tool if you want to visualize or modify the orientation of a facet:
This feature can also be accessed through the Information tool of the Control Panel (see chapter “Get Info (PC: Ctrl+I; Mac: Command+I)” on page 149).

Usage:

1. **Using the object selection accessory , click on the element you want to work with.**
2. **Select the “Orient normals” command**
   The cursor is displayed.
3. **You can reverse the orientation of all the facets at once.**
   Press the Return key before proceeding to any other operation.
4. **Click on a facet to display its normal orientation.**
   A short line indicates the orientation of the normal. If necessary, rotate the view to get a clear view of the normal’s direction.
5. **Press the spacebar to reverse the normal orientation.**
   You can then go back to step 3 if necessary.
6. **Ending the tool action.**
   Validate or put the tool aside to end the tool action (depending on the interface). See chapter “How do you end a tool action?” on page 158.

7.5.3 Closing an object

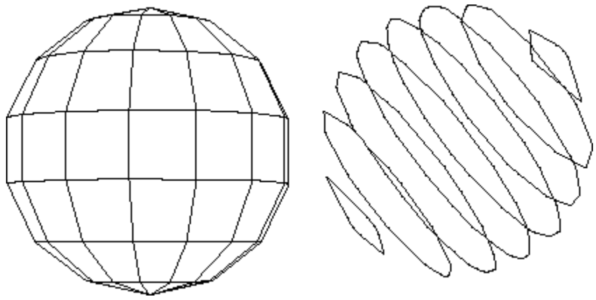
This is a generic tool for closing shapes. You can use this tool if, for instance, you extruded a closed curve and forgot to cap the extremity. You can close any opening of a shape, including openings due to deleted facets (see chapter "Open shapes / Closed shapes" on page 152).

7.5.4 Reversing a curve

This tool is used to reverse the direction of curve.

7.5.5 Cut by plane

This tool is combination of two tools: Cut and Extract Curve. It creates the section curves of a profile.
First indicate the starting point of the sections, then the end point. Finally indicate the interval between each section.



Original sphere *Sphere cut by plane*

7.6 NURBS mode

AMAPI 3D supports two different object creation (drawing) modes: **polygonal** mode and **NURBS** mode. For more information on those modes, see chapter "Polygonal and NURBS drawing modes" on page 153.

You can switch from one mode to another as follows:
- Selecting "NURBS Mode" in the "Edit" menu.
- Clicking on the "NURBS" or "POLY" button in the "Menu" area of the Assistant Palette.
- Using the hotkeys (on PC: CTRL+B, on Mac: Command+B).

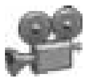
8 Rendering

Rendering and animation features are grouped together in a single module called the "Animation & Rendering" module.

You can enter this module by clicking on the  *icon in the "Mode" area of the Assistant Palette. Or you can press the spacebar to toggle from "Modeling" mode to "Animation & Rendering" mode.*
A new tool palette containing the tools used for high quality rendering will be displayed. The Rendering module has three parts:

 *Materials*

 *Lightimg*

 *Cameras*

8.1 Definitions

RENDERING computes and displays a scene. Computations are based on pre-defined algorithms that take into account: the geometry of the objects (i.e., modeling), the materials applied to those objects (e.g., metal, marble, wood), the lighting, the point of view and, finally, the interactions between these elements (e.g., shadows, reflections, etc.).

A **MATERIAL** determines the appearance of the surface of a simulated material. It is defined by one or more layers: **the uniform level zero layer** and **a superposition of upper level layers.** Upper level layers can be made up of textures or mappings.

LIGHTING is the propagation of rays of light coming from a natural or artificial light source.

The **POINT OF VIEW** is what is displayed in front of the user. The point of view is determined by the eye position, a target point (defining the sight direction. See chapter " Point of view (Eye – Target point)" on page 134 and a field of vision.

A camera is the instrument used to set the point of view.

8.2 Rendering parameters

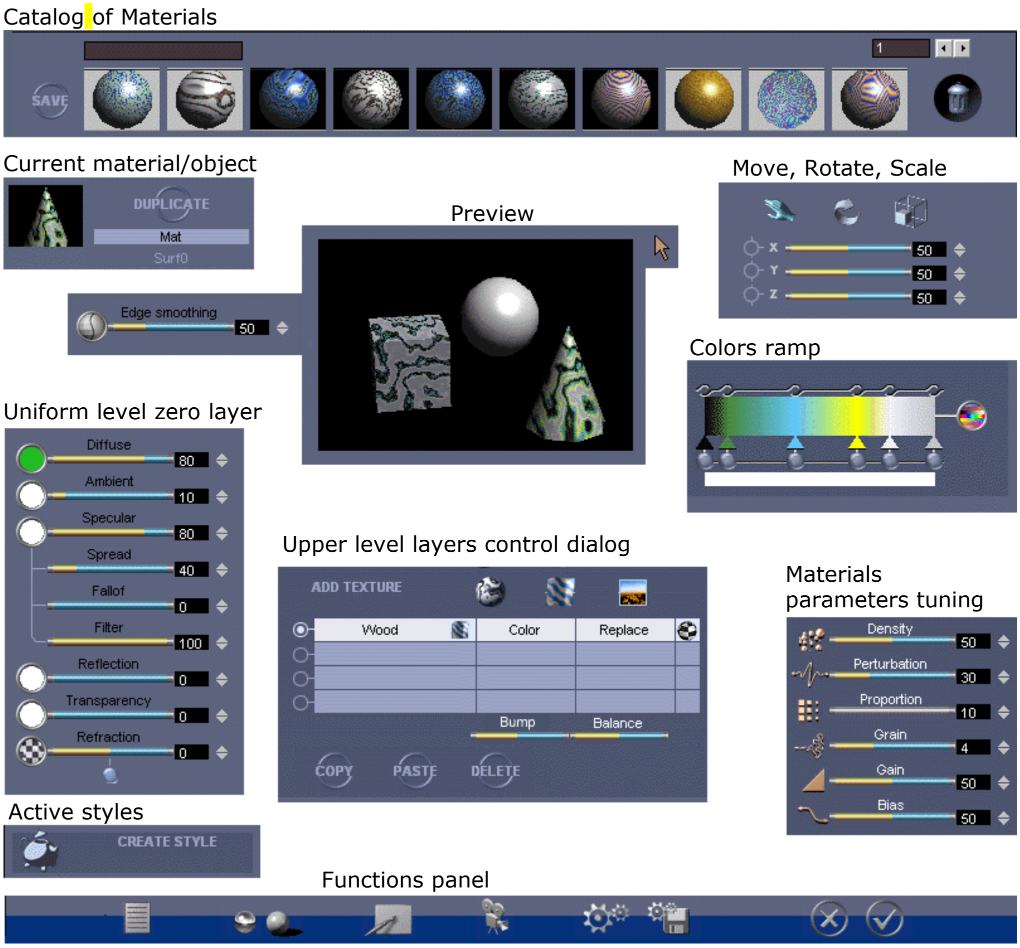
The Rendering parameters are defined through a dialog box opened by:

- The "Rendering" menu.
- The "Rendering" editor.
- The keyboard shortcut (PC: Ctrl+J; Mac: Command+J).

For more information, see chapter "Finalization and saving" on page 365.

8.3 Material Editor

With the Material Editor, you can:
Assign a material to one or several objects of the scene.
Create a brand new material.
Create a new material by modifying an existing material in the Material Catalog.
Control the assignment of materials in the scene.
At all times you can see the resulting effect in the real-time rendering preview window.
To select the Material Editor, click on the icon depicting the "Animation & Rendering" palette or in the Control Panel.



8.3.1 Definitions

A **MATERIAL** determines the appearance of the surface of a simulated material. It is described by one or several layers: **the uniform level zero layer** and **a superposition of upper level layers** (textures or mapping). The upper level layers can interact with the lower level layer.

The **uniform level zero layer** is described by the following characteristics: the ambient color, the diffuse color, the shininess, the transparency, the reflection, and the refraction.

A **3D TEXTURE** algorithmically describes the structure of a pattern in three dimensions. An object to which you apply a 3D texture is "sculpted" in this material. You can modify the parameters defining this structure (scale, perturbation, octave, orientation, etc.). You can also define the colormap of a 3D texture.

A **2D TEXTURE** algorithmically describes the structure of a pattern in two dimensions. You can map a 2D texture, and modify the parameters defining its structure (scale, perturbation, grain, etc…), and also define its colormap.
A 2D texture is mapped to the surface of an object. You can control certain parameters such as the type of mapping, the rotation, the placement, and the scaling.

MAPPING is the projection of a bitmap image or of a 2D texture onto the surface of an object. There are different mapping types depending on how the image is projected and on the interaction between the projection and the object's surface. You can modify other parameters (scale, repetition, orientation, etc.).

The **STYLE** defines a different way ("artistic rendering") of drawing an object. It is characterized by a contour line and a fill color.

The **CATALOG OF MATERIALS** stores material files that will be used later (e.g., oak wood, gnarled wood, blue marble, tile floor, etc.).

The **SCENE MANAGER** is a tool used to manage the materials used in a scene (see chapter "Scene Manager / Classification by material" on page 125).

<table>
<tr><th></th><th colspan="2">Layers</th><th>Tuning parameters</th></tr>
<tr><td rowspan="4">Material</td><td colspan="2">Uniform layer (level 0)</td><td>(ambient color, brilliance, transparency…)</td></tr>
<tr><td rowspan="3">Upper level layers</td><td>3D Texture:
3D algorithmic pattern</td><td>3D structure parameter pattern
(density, perturbation, proportion…)
+
Color ramp
+
Influence on the layer below
(channel, operator)</td></tr>
<tr><td>Bitmap picture mapping</td><td>Mapping type
(sphere, cylinder, plane…)
+
Mapping parameters
(positioning, orientation, scaling…)
+
Influence on the layer below
(channel, operator)</td></tr>
<tr><td>2D Texture:
mapped 2D algorithmic pattern

(This texture allows you to set algorithmic parameters as well as mapping parameters)</td><td>2D structure parameter pattern
(density, perturbation, proportion…)
+
Color ramp
+
Mapping type
(sphere, cylinder, plane…)
+
Mapping parameters
(positioning, orientation, scaling…)
+
Influence on the layer below
(channel, operator)</td></tr>
</table>

8.3.2 General principles

❑ Material Editor - Scene manager (Materials)

THE MATERIAL EDITOR MODULE is used **to create or modify a material.** You can create a brand new material or rework an existing one from the Material Catalog.

THE SCENE MANAGER ("Materials" thumbnail) included in the Control Panel is the tool which **manages the materials of the scene** (see chapter "Classification by material" on page 125).
In some cases, it may be useful to open both the Scene manager and the Material Editor. In this case, you will have to open the Scene manager ("Materials" thumbnail) again.

❑ Assign a material already used in the scene

If you want to assign a material already used in the scene to an object, it may be better to use the Scene Manager's tool for managing the material in the scene (See chapter "Classification by material" on page 125).

❑ Assign a material from the catalog to several objects of the scene

If you want to assign the same material to several objects of the scene, it may be advantageous to group them first. This way they will reference only one material, and any modification of this material will be applied to all of the objects (even if they have been ungrouped).
If the objects are ungrouped and you want to assign a different material to one of them, you must change its material (not modify it) (see chapter "Duplicating a material" on page 359).

If you assign a material directly from the catalog to an object, AMAPI 3D adds it to the materials list controlled by the Scene manager.
That means if you assign the same material to different objects x times, the Scene manager will store the same material x times with different names, and if you modify the material of one of the objects, only that object will have its material altered.

❑ Create a brand new material

1. Open the Material Editor.
2. Make sure the object you want to work with is the current object. Its material becomes the current material.
3. It is up to you to set the level zero layer parameters (color, brilliance ...).
4. Next you can create upper level layers (3D texture, 2D texture mapping, or image mapping).
    - For each "3D Texture" or "2D Texture" layer, you must choose a primary texture (wood, marble, ...) to be used as a basis for working.
    - For each "Image mapping" layer, you must choose the picture to be mapped.
5. For each upper level layer, you must specify its influence on the layer below.
6. Then, you will adjust the parameters to customize the new material.

❑ Modify a material from the catalog

1. Open the Material Editor.
2. Choose the material in the catalog, either in the "Primary materials" directory, or in another materials directory.
3. Drag the material to be modified onto one of the objects in the scene. It becomes the current material and will be added to the materials list controlled by the Scene manager.
4. The material is already defined. It may have one or several layers (textures or image mapping). You can:
   - ♦ Add a new layer.
   - ♦ Delete a layer.
   - ♦ Modify the parameters setting of each of them.
5. Save this new material if you think you might need to re-use it in another scene.

❑ Modify a material already used in the scene

1. Open the Material Editor.
2. Make sure the object you want to work with is the current one. Its material becomes the current material.
3. The material is already defined. It may have one or several layers (textures or image mapping). You can:
   - ♦ Add a new layer.
   - ♦ Delete a layer.
   - ♦ Modify the parameters setting of each of them.
4. Save this new material if you think you might need to re-use it in another scene.

8.3.3 The Preview

- The display

The central area provides an interactive preview of the rendered scene. You will be able to see how the material looks applied to an object while you are adjusting its parameters.

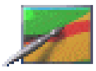
AMAPI 3D assigns a default material to all the objects.

The Preview calculation has been optimized to make the computation and the display very fast while you are tuning the materials.
The preview display does not take into account the following parameters:
The size of the rendered picture
Anti-aliasing
Shadows

For more information about the finalization parameters, see chapter "Finalization and saving" on page 365.

By clicking on the "Compute & Display" icon, you will start the final calculation including all finalization parameters (see chapter "Compute and display the rendering" on page 365).

You can reduce the display time of the Preview by disabling raytracing and shadows parameters (see chapter "Preview preferences" on page 364).



At any time, you can request a new preview rendered display by clicking on the "Repaint" icon or by pressing the "Enter" key (see chapter "The " on page 364).

- Navigation

You may need to use the navigation arrows to view the scene from a different angle (see chapter "Navigation" on page 91).

You can also create a new point of view, and change the point of view by using the  icon (See chapter " Point of view (Eye – Target point)" on page 134).

- Edge smoothing

A slider allows you to specify the break angle between two adjacent facets. If the angle between the two adjacent facets is less than the break angle, the two facets will not be smoothed.
A null value generates flat rendering, a 180° angle value smooths all edges.

8.3.4 Current material and current object concepts

❑ Current object

You open the Material Editor with the current object (or group) (voir "Current object concept" on page 166). A small thumbnail at the top left of the dialog box displays this object; its name is written in white.

❑ Current material

The material of the current object becomes the current material: this is this one you will modify.
The name of the current material is written at the righthand side of the thumbnail.
The Material Editor displays all its parameters.
All the objects in the scene with the same material will be affected.
If there are several objects with the same material in a scene and you want to modify the material of only one, you must separate it from the other by duplicating its material (See chapter "Duplicating a material" below).

❑ Changing the current object or material

You can change the current object (or material) at any time.
Two methods are available:

♦ Method 1 (selection in the scene)
Click directly on the object in the preview area. You may need to use the navigation arrows to view the scene from a different angle (see chapter "Navigation" on page 91).
♦ Method 2 (selection by name)
    1. Click on the  icon (in the Ccommands bar at the bottom of the Material Editor). The list of the objects of the scene will appear.
    2. Drag the cursor until it reaches the one you want, and click again to validate.

❑ Modifying the name of the current material

AMAPI 3D names each new material as "Mat" (default) and numbers it according to its order of creation.
You can change the current material's name by clicking on it and entering a new name.
Then, if you want save it in the Material catalog, you can give it another name (see chapter "The Catalog of Materials" on page 361.

❑ Duplicating a material

This operation must be done if the same material is assigned to several objects and you want to change the material of only one object.
Material duplication is, in fact, the creation of a new material which is identical to the current one.
To do this, just click on the "Duplicate" button.
This new material has the same name as the original material, but incremented by one.
This name will be added to the materials list of the current scene.
This new material becomes the current material due to the fact it is assigned to the current object.

After material duplication, the current object will have its own material which can be modified independently.
You can change the name of this new material (see chapter "Modifying the name of the current material" on page 359.

⚠ Be sure the current object is not grouped with others before opening the Material Editor.

8.3.5 The Catalog of Materials

The Catalog of Materials indexes all the material files saved on the hard disk. You can assign one of these materials to any object of the scene. You can also save your own materials in the directory.

❑ Changing the directory

AMAPI 3D provides an assortment of pre-made materials organized into themes. The catalog displays all the materials from a directory. You can browse it to assign a material to the current object, or to save new materials. "Primary materials" is the default directory. You can use these materials as is or use them as a base for making new materials.

1st method:

1. Click on the icon. The directory list will appear.
2. Drag the cursor toward the one you want and lick again to validate the selection.

2nd method:

Press the spacebar and follow the instructions in the dialog box.

❑ Browsing the catalog

There are several ways to browse the pages of the Materials Catalog.

♦ ***Displaying a page of the catalog***

A thumbnail displays each material file of the current directory.
If you click on one of them AMAPI 3D surrounds it in yellow and displays its name in an editable window.

♦ ***Scrolling through the pages of the catalog***

Scrolling through the pages of the catalog replaces the entire line of thumbnails (a page) by the next page or the previous page.

You can:

⇒ Use the Tuner (the + - keys of the numeric keypad) (see chapter "The Tuner "- / +" on page 103).

⇒ Enter a page number: A box displays the current page number in the Catalog. Click on the box and type the number of the page you wish to see. Press Enter to validate and see the page.

⇒ Use the scrolling cursors: Click on the right arrow to display the next page or click on the left arrow to display the previous page.

Assigning a material from the catalog to an object

You can assign a material from the catalog to the objects of the scene.

Assigning a material to an object:
1. Select a material directory (see chapter "Changing the directory" on page 361).
2. Browse the Catalog to choose a material to be applied (see chapter "Browsing the catalog" on page 361).
3. Place the cursor over the thumbnail which depicts this material, then press and hold the mouse button.
4. Move the cursor into the Preview window and place it over the object to be textured.
5. Release the mouse button.

Assigning a material to all the objects of a group:
1. Select a material directory (see chapter "Changing the directory" on page 361).
2. Browse the Catalog to choose a material to be applied (see chapter "Browsing the catalog" on page 361).
3. Place the cursor over the thumbnail which depicts this material, then press and hold the mouse button.
4. Move the cursor into the Preview window and place it over an object of the group to be textured.
5. Press and hold the "Shift" key before releasing the mouse button.

Each material assignment creates a new material in the scene's materials list.
If you assign the same material x times to different objects, the Scene manager will consider them to be x materials with the same name. If, afterwards you modify the material of one of these objects, only this object will be alltered because the other ones have different materials (even though they have the same name).
If you want to assign the same material to several objects of the scene, it would be better to group them first. This way they will reference only one material, and any modification of this material will be applied to all these objects (even if they have been ungrouped).

Saving a material in the catalog

If you wish to use a material of the current scene in another scene, you will have to save this material in a materials directory.

1st method:
1. Select a materials directory (see chapter "Changing the directory" on page 361).
2. Make sure the current material is the one you want to save (see chapter "Current material and current object " on page 359).
3. Click on the "Save" button. AMAPI 3D stores the material as a material file in the current materials directory. You will be asked to specify a name.

2nd method:
1. Select a materials directory (see chapter "Changing the directory" on page 361).
2. Make sure the current material is the one you want to save (see chapter "Current material and current object " on page 359).
3. Browse the Catalog until you find an empty box (see chapter "Browsing the catalog" on page 361). Then click on this box.
4. AMAPI 3D stores the material as a material file in the current materials directory. You will be asked to specify a name.

Be careful to index your materials and save only those which might be useful.

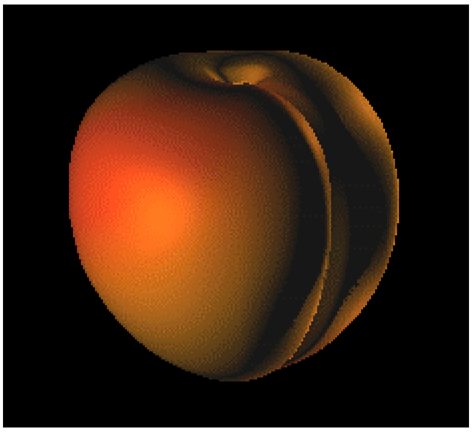
Renaming a material from the catalog

1. Click on the box of the catalog which contains the material to be renamed. AMAPI 3D surrounds it in yellow and displays its name in the editable area.
2. Click in this area, enter a new name, then validate by pressing the "Enter" key.

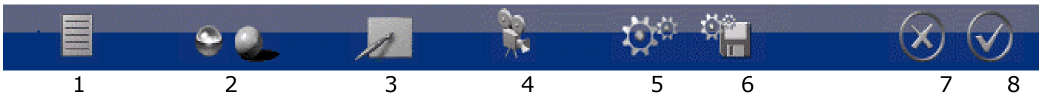
Deleting a material from the catalog

You can delete a material from the catalog. Be careful: this operation permanently erases the file from the hard disk. You will not be able to recover it.

1. Click on the thumbnail which depicts this material, then press and hold the mouse button.
2. The cursor icon is changed to a hand: this allows you to move the cursor to the trash.
3. Release the mouse button when the cursor is over the trash.
4. The box is empty, the file is deleted.



8.3.6 The Command bar



1. Objects list
2. Preview preferences
3. Repaint
4. Point of view
5. Compute and display the rendering
6. Rendering parameters
7. Cancel
8. Validate

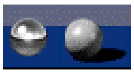
❑ Objects list

At any moment you can change the current object (and the current material too). Two methods are available:

1st method (selecting in the scene)
Click on the object directly in the display area of the scene. You can use the navigation arrows to view the scene from a different angle (see chapter "Navigation" on page 91).

2nd method (selection by name)
1. Click on the "Objects list" icon (in the Command bar at the bottom of the Material Editor). The Objects list of the scene will appear.
2. Drag the cursor until it reaches the object you want, then click again to validate.

❑ Preview preferences

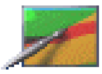


To reduce the display time of the Preview, AMAPI 3D allows you to optionally disable the following calculations:

- Ray Tracing
- Shadows display

These are only Preview options. They do not affect the full image rendering.

❑ Repaint



At any time, you can request a new preview rendered display by clicking on the "Repaint" icon or by pressing the "Enter" key.

❑ Point of view

The Point of View specifies what the user can see. The Point of View is defined by the observer's eye and a target point defining the eye direction and the field of view.
You can save the current Point of View and recall it again to look at the scene under the same conditions.
The Rendering interface "Point of View" icon works exactly like the "Point of View" icon from the Control panel . See chapter " Point of view (Eye – Target point)" on page 134.

- To save the current Point of View, see chapter
- To recall a Point of View, see chapter
- To delete a Point of View, see chapter

Compute and display the rendering

The rendering display is different of the preview (See chapter "The Preview" on page 358) because it includes all the rendering finalization parameters, such as the picture's size, anti-aliasing, and shadow calculations. For more information about the finalization parameters, see chapter "Finalization and saving" below.
The final render takes longer to display than the preview render.

To display the final rendering, click on the "Compute and display" icon.

Finalization and saving

You set the parameters of the final rendering through a dialog box. You can save the final rendered picture. Click on the icon depicting this function to get the dialog box. You can access it through the "Render" menu, or through a keyboard shortcut (PC: Ctrl+J; Mac: Command+J).

♦ *Camera*

You can select camera 0 or 1 (if 1 or 2 cameras were created) and display the camera's view in the Viewer window. This will also be the view used for still image rendering and animation.

♦ *Anti-aliasing*

This feature gets rid of the "jaggies" surrounding shaded shapes.
Select the level of anti-aliasing you want (from 0 to 3)
The use of anti-aliasing increases the rendering time.

♦ *Shadows*

Check this box to compute and display shadows.

♦ *Automatic smoothing*

A slider allows you to tune the break angle between two adjacent facets. If the angle between the two adjacent facets is less than the break angle, the two facets will not be smoothed.
A null value generates a flat rendering, a 180° angle value smooths all edges.

♦ *Background color*

Specifies the background color to be used during rendering.

♦ *Background image*

Check this box to display a background image when rendering the scene. The image is not visible when modeling, but is displayed in the preview window of the Material Editor and in the rendered image.

♦ *Environment*

Check this check box if you want to add an environment picture which will be reflected by all the objects of the scene. This effect is visible only in the Material Editor preview window and while rendering.

♦ *Fog*

You can use a slider to adjust the fog density.

⚠ Do not use a black background: the objects will disappear.

♦ *Image size*

You set the rendered image size in pixels.

♦ *Compute and display the rendering*

The rendering display is different from the preview (see chapter "The Preview" on page 358) because it includes all the rendering finalization parameters, such as the picture size, anti-aliasing, and shadow calculations. For more information about the finalization parameters, see chapter "Finalization and saving" on page 365.
The finalized rendering display time is longer than the preview display time.

To display the final rendering, click on the "Compute and display" icon.

♦ *Finalization and saving*

You set the parameters of the final rendering through a dialog box. You can save the final rendered picture and specify the picture file format (PICT, BMP, JPEG, or TGA), the file name, and the destination folder.

♦ *Defocus Dei support*

Defocus Dei is a utility that computes a depth of field from an already rendered image so as to make it more realistic.

❑ Cancel

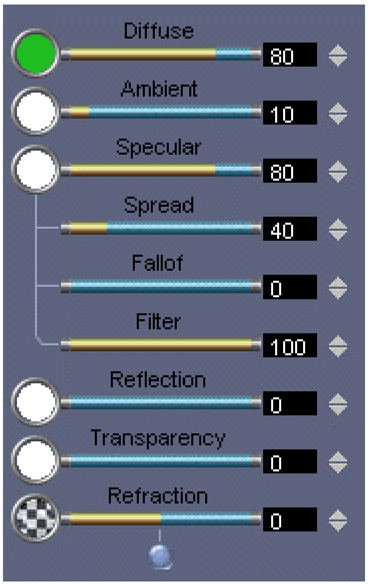
Click on the "Cancel" button to leave the Material Editor without saving the modifications you made.

❑ Validate

The "Validate" button applies the current material to the current object and leaves the Material Editor. Its name will be added to the material list of the current scene (this list is controlled by the Scene Manager see chapters "The Scene Manager" on page 114 and "Classification by material" on page 125). If you do not save the current material, it will not be displayed by the Catalog.

If you later decide you need to reuse this material, you can reload your file and save this material in the catalog.

8.3.7 The uniform zero level layer



When opening the Material Editor, AMAPI 3D automatically opens the Catalog of Materials and the main window with a dialog box which allows you to set the uniform zero level layer parameters: diffuse color, ambient color, specular reflection, transparency, and refraction.

- Diffuse color

The diffuse color is the color that the object reflects when lighted by a direct light (daylight or artificial light). This color will be mixed with the specular color.
To modify the diffuse color:

1. You can choose between two interfaces to select the color:
   - The triangle of colors: Place the cursor over the sampling circle and press and hold the mouse button. The triangle of colors will appear. Drag the cursor toward its base to select the saturated color, then choose the shade in the triangle itself. Release the mouse button. To cancel, release the mouse button outside of the triangle of colors.
   - The standard dialog box : PC (Double-click on the sampling circle); Mac (Option click on the sampling circle). Choose the color per its instructions. Click on the "OK" button if the color setting is OK. If not click on "Cancel".
2. You can then tune the color proportion with the slider or by directly entering the value in the appropriate data window on the right hand side of the slider.

- Ambient color

The ambient color is the color of the object in the darkness. (In the complete dark, only the ambient light is used. If the ambient parameter is set to none, the object is not visible).

1. You can choose between two interfaces to select the color: the triangle of colors or the standard dialog box (for details see chaper “Diffuse color” on page 367).
2. You can then tune the color proportion with the slider or by directly entering the value in the appropriate data window on the right hand side of the slider.

- Shininess

Shininess is the capacity of an object to reflect light. Shininess is defined by the color, the intensity, and the size of the halo of reflected light.
For instance:
A polished surface has a small and intense reflection.
A matte surface has a wide and weak reflection.

♦ ***The Specularity***

The Specularity sets the color and intensity of the reflection of an object.

1. You can choose between two interfaces to select the color: the triangle of colors or the standard dialog box (for details see chaper “Diffuse color” on page 367).
2. You can then tune the color proportion with the slider or by directly entering the value in the appropriate data window on the right hand side of the slider.

♦ ***The Spread***

The Spread sets the size of the reflection.
You can set the value using the slider or by directly entering the value in the appropriate data window on the right hand side of the slider.

♦ ***The Falloff***

The falloff defines how the reflection is diffused along the surface of the object.

You can set the value using the slider or by directly entering the value in the appropriate data window on the right hand side of the slider.

♦ ***The Filter***

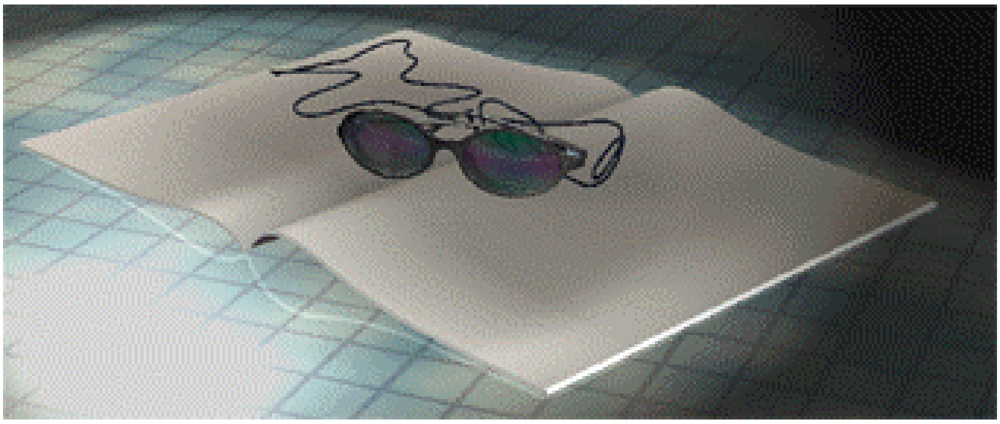
The Filter controls the influence of the color of the lighting on the color of the reflection (tuned by the Specularity). If the Filter is set to the minimum, the reflective color is the same as the light color. If the Filter is set to the maximum, the lighting has no influence (the reflection has the color defined by the Specularity).
You can set the value using the slider or by directly entering the value in the appropriate data window on the right hand side of the slider.

❑ Reflection

Surfaces can reflect surrounding colors. Reflection defines the ratio between incident light and reflected light (when a surface is lighted).

To modify the reflection:
1. You can choose between two interfaces to select the color: the triangle of colors or the standard dialog box (for details see chaper “Diffuse color” on page 367).
2. Then, set the reflection amount with the slider or by directly entering the value in the appropriate data window on the right hand side of the slider.

i It is time consuming to compute reflections because because ray-tracing is used in the computation.



- Transparency

Transparency is the ability of a material to let light go through it, and therefore let objects positioned behind it be seen. The more transparent a surface is, the more light goes through it.
A black color indicates that a material is not transparent (i.e., opaque), while a withe color indicates that a material is completely transparent.
Materials are opaque by default.

To modify the transparency:

1. You can choose between two interfaces to select the color: the triangle of colors or the standard dialog box (for details see chaper “Diffuse color” on page 367).
2. Then, set the transparency amount with the slider or by directly entering the value in the appropriate data window on the right hand side of the slider.

- Refraction

The propagation of a light beam through a translucent or transparent material is determined by refraction. Light beams will be bent to a greater or lesser extent depending on the material they go through, as each material has a different refractive index.
A refraction type and a slider are used to define the refraction index. Of course, those settings are useful only for transparent materials.
Set the refraction amount with the slider or by directly entering the value in the appropriate data window on the right hand side of the slider.
This slider includes a reset button which is used to set the refraction value to zero if you click on it.
Note that these settings are effective only if the material contains transparency settings.

Refraction is time consuming because ray-tracing is used to calculate the path of the light rays for each pixel.

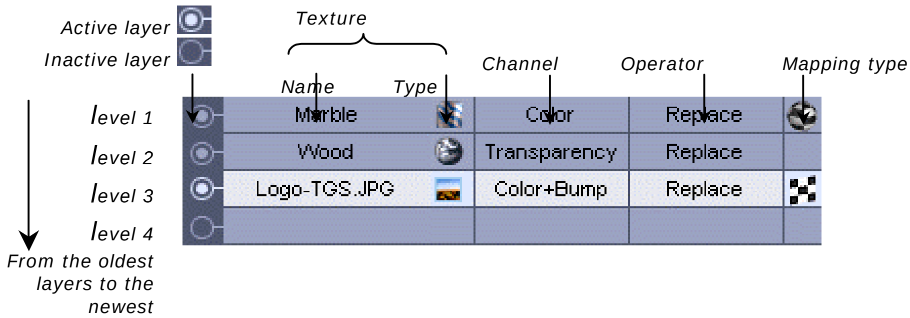
8.3.8 The upper layers

We have seen that a material is defined by one or several layers: the uniform zero level layer and a superimposition of upper layers which may be textures or mappings.

A material has at least a uniform zero level layer. Up to four upper layers (textures or mappings) can be superimposed on the uniform zero level layer.
You can define interactions between components of upper level layers and one or several of the attributes of the uniform zero level layer.

- Displaying the list of layers

AMAPI 3D displays the ordered list of the existing layers (max 4).
The line corresponding to the current layer is displayed with a lighter background.



- Current layer concept

AMAPI 3D displays the ordered list of the existing layers (max 4). Click on the line you want to set: this is the current layer.
It is displayed with a lighter background.

- Activating or deactivating a layer

To deactivate an active layer, click on its corresponding check box. Do the same operation to activate a layer.

Active layer
Inactive layer

- Copying a layer

Make sure the layer to be copied is the current one (see chapter "Current layer concept" on page 371). Then click on the "Copy" button. The layer is copied.

- Pasting a layer

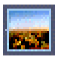
Make sure the layer to be copied is the right one (see chapter "Copying a layer" above). Then click on the "Paste" button.
The layer is added to the list of existing layers and will become the current layer.

- Deleting the current layer

Make sure the layer to be copied is the current one (see chapter "Current layer concept" on page 371). Then click on the "Delete" button. The last layer becomes the current layer.

- Adding a new layer

Click on one of the following buttons to add a new layer:

	3D texture	See chapter "3D Texture » on page 374 to set the parameters.
	2D texture	See chapter "2D texture " on page 385 to set the parameters.
	Image mapping	See chapter "Image mapping" on page 382 to set the parameters.

A new layer will be added to the list of existing layers and will become the current layer. It will have the highest rank in the list of layers.
AMAPI 3D automatically opens a dialog box corresponding to the type of layer created.
If you selected "Image mapping" , Amapi opens a dialog box used to specify the image file.
To set the parameters, see the chapter corresponding to the type of mapping chosen.

- Interactions between the current layer and the underneath layer

*You can define an interaction between the current layer and the underneath layer. The "**operator**" defines the nature of the influence of the current layer on the layer below. The operation is made on one **channel;** you can tune the amount with the **balance**.*

♦ ***The channels***

Click on the box corresponding to the current layer. AMAPI 3D displays a list of channels. Click on the one of your choice.

- Color (default)
- Ambient color
- Diffuse proportion
- Specular proportion
- Specular color
- Bump *
- Reflection
- Transparency
- Color + Bump *

* The “Bump” slider allows you to control the direction and the amplitude of the bumps:
If Bump =-100, the direction of the bumps will be negative (hollows).
If Bump =+100, the direction of the bumps will be positive (bumps).
If Bump = 0, you will get no bumps.
This channel can work with the “Replace” operator.

♦ ***The operators***

The “operator” defines the nature of the operation.
Click on the box corresponding to the current layer. AMAPI 3D displays a list of operators. Click on the one of your choice.

- Replace (default): The components of the upper level replace the components of the level below.
- Mix: The components of the current level are mixed with the components of the destination.
- Add: Adds the values of both components.
- Subtract: Subtracts the values of the components of the current level from the components of the destination.
- Lighter: Takes the texture only if it is lighter than the color.
- Darker: Takes the texture only if it is darker than the color.
- Multiply: Multiplies the values of both components.

♦ ***The balance***

Controls the proportion of the components of the uniform zero level layer compared to the components of the current upper level layer. The higher this value is, the greater the influence of the current layer.

⚠ Of course, the “Replace” operator will not be affected by the balance setting.

8.3.9 3D Texture

A 3D texture algorithmically describes the structure of a pattern in 3 dimensions. An object to which you apply a 3D texture is thus "sculpted" out of the texture. Or, if you prefer, you can imagine that you are submerging the object in a tub filled with the texture.
AMAPI 3D provides some primary textures that you can use as the basis for other textures.
You will be able to modify the texture parameters, such as the proportion, the perturbation, the grain, the density, the orientation, etc. You can also control colors by customizing the color ramp.

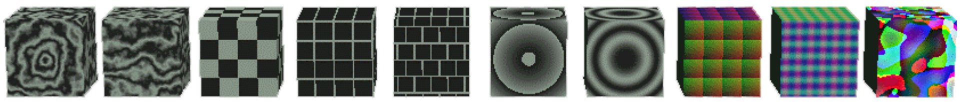
❑ Creating a 3D texture


You can create a 3D texture like we saw in chapter "The upper layers" on page 371. Make sure that the texture layer to be tuned is the current layer (see chapter "Current layer concept" on page 371).

♦ ***Basic textures***

A 3D texture layer is built from a primary 3D texture. AMAPI 3D displays a list of primary 3D textures from which you can select the one most appropriate for your project. The default primary texture selected by AMAPI 3D is the first one in the list.

1. Click in the box corresponding to the texture. The list of the available primary 3D textures is displayed.



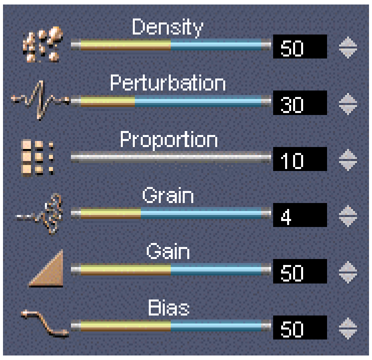
Wood Marble Checker Grid Brick Radial Smooth radial Ramp Smooth ramp Noise

2. Drag the cursor onto your choice and click again to validate it.

♦ ***Interactions between the current layer and the layer below***

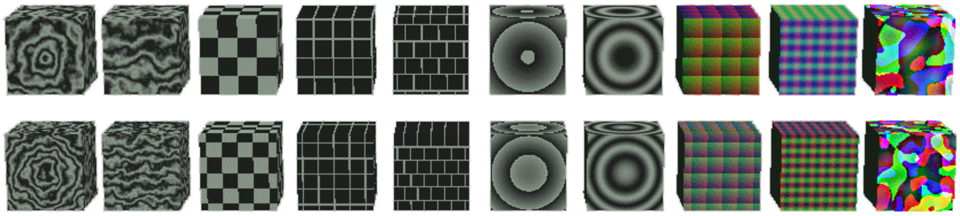
You can define an interaction between the current layer and the layer below. For more information, see chapter "Interactions between the current layer and the underneath layer" on page 372.

Setting the parameters defining the algorithms



♦ *Density*

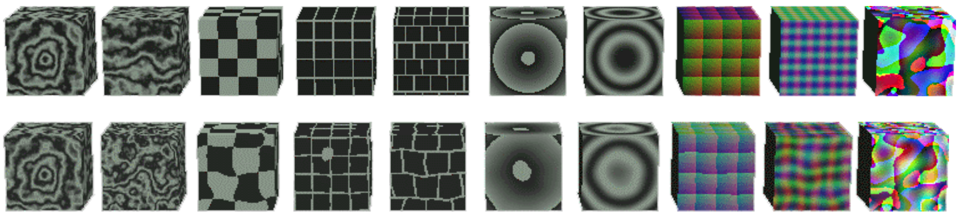
Increases the number and size of the patterns applied to a given surface.
This parameter can be set for the surface as a whole or along one of the three orthogonal axes. For instance: as you increase the Size parameter of a tiling texture applied to the floor of a room, you will see the size of the tiles decrease and their number increase.
This parameter is used only for the texture of type "cylinder" and "plane".
You can set the value using the slider or by directly entering the value in the appropriate data window on the right hand side of the slider.



Wood	Marble	Checker	Grid	Brick	Radial	Smooth radial	Ramp	Smooth ramp	Noise

♦ *Perturbation*

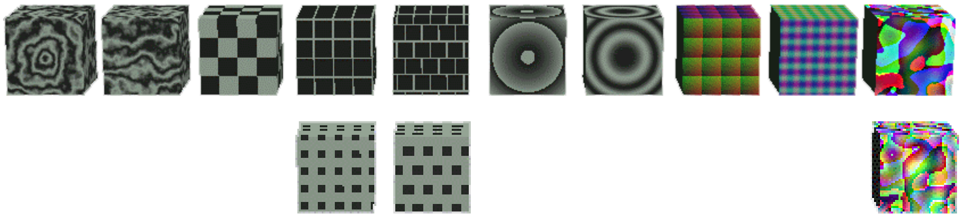
You can modify the regularity of a texture's pattern through the Perturbation parameter. The basic pattern of the texture is obtained with the Perturbation set to zero. For instance, the wood texture will show regular concentric circles, the marble texture will display linear strata. The higher the perturbation index, the more distorted the texture will be.
You can set the value using the slider or by directly entering the value in the appropriate data window on the right hand side of the slider.



Wood	Marble	Checker	Grid	Brick	Radial	Smooth radial	Ramp	Smooth ramp	Noise

♦ *Proportion*

Defines the relative importance of two parameters of a pattern. For instance, in a brick texture, you can modify the thickness of the concrete relative to the bricks. This parameter modifies only the "brick", "grid" or "noise" textures.
You can set the value using the slider or by directly entering the value in the appropriate data window on the right hand side of the slider.



Wood Marble Checker Grid Brick Radial Smooth radial Ramp Smooth ramp Noise

♦ *Grain*

Like for a photograph, the grain determines the sharpness of the definition of a texture. You can set the grain value between 1 and 8. The higher the value, the sharper the grain and the longer the rendering time. You can assess the sharpness by looking closely at the texture.
You can set the value using the slider or by directly entering the value in the appropriate data window on the right hand side of the slider.

⚠ The grain is taken into account only if Perturbation is not set to zero.

ℹ Once the texture computed, you can adjust two paramaters: the gain and the bias (see details below).

♦ *Gain*

The gain can be compared to the contrast tuning of a television set: it interacts directly with the color ramp (See chapter "Editing the color ramp" on page 378).
The gain changes the weight given to the breakpoints, depending of their position along the color ramp (at the extremities or center).

- If Gain = 50 (default): the texture follows the color ramp instructions.
- If Gain < 50: AMAPI 3D will give more weight to the colors placed at the extremities of the color ramp. The transition from the darker colors to the lighter ones will be faster, toning down the intermediate colors. You will see less detail. The effect on the texture is like a blur.
- If Gain > 50: AMAPI 3D will give more weight to the colors at the center of the color ramp. The texture will have thin veins, the texture will appear sharper.

You can set the value using the slider or by directly entering the value in the appropriate data window on the right hand side of the slider.

♦ ***Bias***

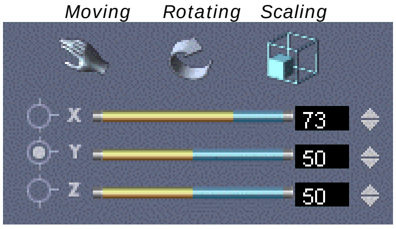
The Bias moves the breakpoints more or less, depending of their position along the color ramp (left/right). The effect of the tuning is to change the size of the texture veins (See chapter “Editing the color ramp” on page 378.).

- If Bias = 50 (default): the texture follows the color ramp instructions.
- If Bias < 50: AMAPI 3D will move the breakpoints to the right side of the color ramp: the veins will be widened on the left side and narrowed on the right side.
- If the ramp contains dark colors on the left side and light colors on the right, the darker veins will be widened and the lighter veins will be narrowed. The whole texture will be darker.
- If Bias > 50: AMAPI 3D will move the breakpoints to the left side of the color ramp: the veins will be widened on the right side and narrowed on the left side.
- If the ramp contains dark colors on the left side and light colors on the right, the darker veins will be narrowed and the lighter veins will be widened. The whole texture will be lighter.

You can set the value using the slider or by directly entering the value in the appropriate data window on the right hand side of the slider.

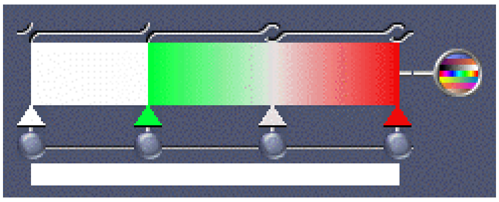
❑ Moving, rotating, and scaling a 3D texture

Moving *Rotating* *Scaling*



You can move the 3D texture on the current object. You can rotate or scale it, too.
Click on the icon corresponding to the operation you want to do. This will be done following the X, Y, or Z plane, whichever is closest to the current plane of view. You may need to use the navigation arrows to view the scene from a different angle (see chapter Navigation” on page 91).
The setting can be done with the sliders or by directly entering a value (x,y,z) in the appropriate data window on the right hand side of the sliders.
To increase or decrease several values at the same time, check the boxes on the left of the sliders before using them.

❑ Editing the color ramp



The color ramp defines the distribution of colors of a pattern. You can define uniform or shaded strips of colors. The width of each strip will determine the proportions of the colors.

♦ *What is a breakpoint?*

A breakpoint controls the color of the part of the color ramp.
A breakpoint is shown by a little arrow with a round handle which allows you to move it along the color ramp.
The color of the part of the color ramp controlled by a breakpoint depends on:
The color of the breakpoint (see details below).
The kind of breakpoint (see details below).

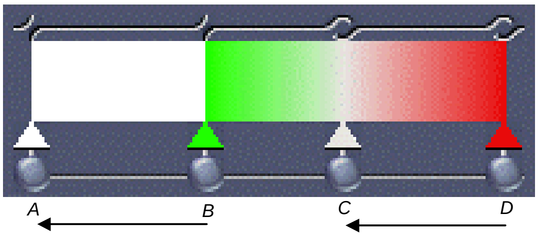
♦ *The different kinds of breakpoints*

There are two kinds of breakpoints:

Shaded (default): You will get a color gradient (shaded colors) between this breakpoint and the next breakpoint to the left.

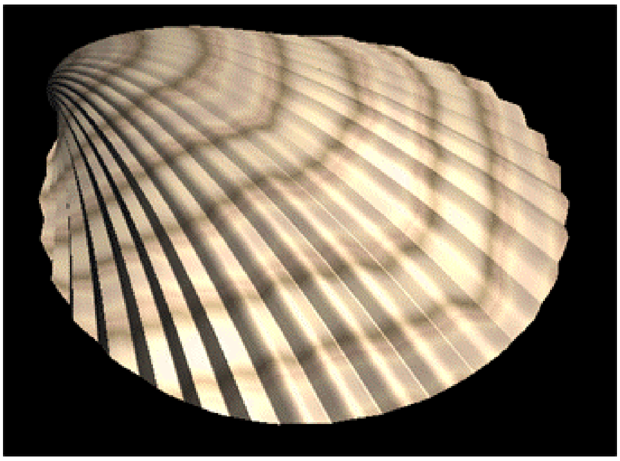
Uniform: The part of the color ramp between the breakpoint and the next breakpoint placed to its left takes the color of the point from the left.

Click on the icon depicting the type of breakpoint to toggle between breakpoint types.



Control area of breakpoint "B" (uniform). It takes the color of point "A".

Control area of breakpoint "D" (shaded). It is shaded between the color of point "C" and the color of point "D".



- ***Changing the color of a breakpoint***

You can choose between two interfaces to select the color:

- The triangle of colors: Position the cursor over the triangle of colors of the breakpoint and press and hold the mouse button. The triangle of colors will appear. Drag the cursor toward its base to select the saturated color, then choose the shade in the triangle itself. Release the mouse button. To cancel, release the mouse button outside of the triangle of colors.
- The standard dialog box : PC (Double-click on the triangle of colors of the breakpoint); Mac (Option click on the triangle of colors of the breakpoint). Choose the color per its instructions. Click on the "OK" button if the color setting is OK. If not click on "Cancel".

- ***Add a breakpoint***

Click in the ramp at the exact place where you want to insert a breakpoint. The point which has been created takes the color of the clicked point and will be shaded (default). You can then change the color or the type (see above).

- ***Deleting a breakpoint***

1. Click and hold the mouse button on the round handle of the breakpoint you want to delete.
2. Move the cursor out of the color ramp. A red cross shows you are deleting the point.
3. Release the mouse button.

- ***Moving a breakpoint along the ramp***

1. Click and hold the mouse button on the round handle of the breakpoint you want to move.
2. Move the cursor along the ramp.
3. Release the mouse button at the desired position.

- ***The filter***

Reminder: You can define an interaction between the current layer and the underneath layer. The "**operator**" defines the nature of the influence of the current layer on the layer below. The operation is made on one **channel;** you can tune the amount with the **balance**.

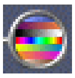
The filter defines the **balance for each break point of the colormap**.
It is displayed as a second, monochrome colormap, sharing the same break points as the main colormap (same position, same type).
A break point with a white color on the filter colormap means that the characteristics of this break point will be important when the operation is processed.
Example: We do not want one of the colors of the colormap to be affected by the operation. We set its filter at zero: a black color is displayed on the monochrome colormap at the position of the break point of this color.

To modify the balance of a color of the ramp:

1. Click and hold the mouse button on the filter ramp just below the breakpoint you want to tune. AMAPI 3D displays the "filter" slider corresponding to the point.
2. Move the cursor to set the balance. Moving to the left tends toward black, moving to the right tends toward white.
3. Release the mouse button when you have the desired result.

⚠ Of course, the "Replace" operator and will not be affected by the balance setting.

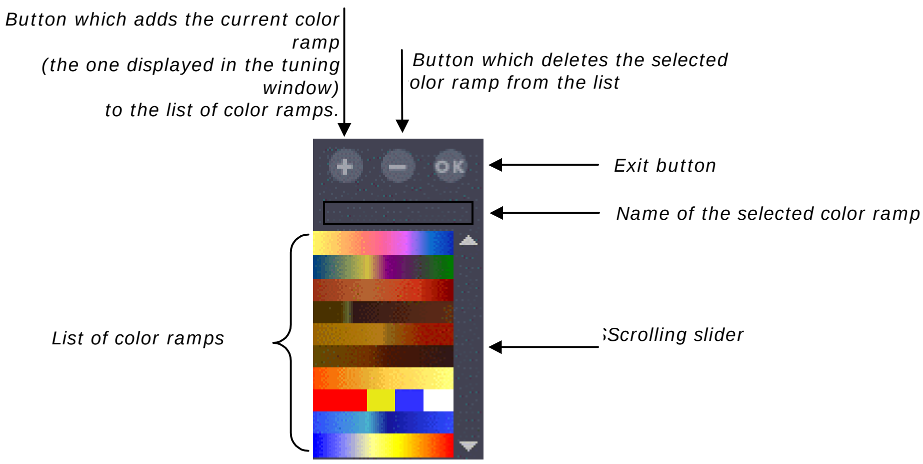
- ***The list of the color ramps***



AMAPI 3D displays a list of the color ramps which can eventually be used by you to set a new color ramp. If you want to add new color ramps, you can. Click on the icon depicting the ramps list to display it.

⚠ When the list of the color ramps is open, it is not possible to modify the current list of the color ramps. To do this you must close the list by clicking on the OK button.

Browse the list of the color ramps:



Selecting a ramp from the list
To select a ramp from the list, just click on its name. The name will appear in the editing window.

Selecting a ramp from the list to tune it
Browse the list. If needed, use the scrolling slider or select a ramp to see its name. When you have made your choice, you can either:
⇒ Double-click on the selected ramp.
Or
⇒ Click on the "OK" button.

Add the current ramp to the list
When you are satisfied with the ramp you are tuning (the one displayed in the tuning window), you can save it to use it again in another scene. Just:
1. Click on the "+" button.
2. AMAPI 3D will ask you to specify a name for this ramp. Then it will be added to the list.

Deleting a ramp from the list
If you think a ramp is no longer useful, you can delete it, as follows:
1. Select the ramp to be deleted from the list (see how above).
2. Click on the "-" button, and the ramp is deleted.

8.3.10 Image mapping

Mapping is the projection of an image on an object's surface. There are different types of mapping depending on the way the image is projected and on the interaction between the projection and the object's surface.
Other parameters can be also set: scale, repetition, orientation, etc…).

- Creating an image mapping


You can create a 3D texture 3D like what we saw in chapter "The upper layers" on page 371.
Make sure that the texture layer to be tuned is the current layer (see chapter "Current layer concept" on page 371).

♦ ***The different types of mapping***

There are different types of mapping depending on the way the image is projected and on the interaction between the projection and the object's surface.
AMAPI 3D displays a list of available mapping types.

1. Click on the box corresponding to the mapping types. The mapping types list is displayed:
   - Sphere
   - Cylinder
   - Plane
   - Cube
   - Circle
   - Ball
   - Reflection
   - ….
2. Drag the cursor onto the one you want, and click again to validate your selection.

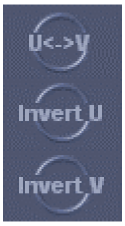
♦ ***Interactions between the current layer and the layer below***

You can define an interaction between the current layer and the layer below. For more information, see chapter "Interactions between the current layer and the underneath layer" on page 372.

- Image repetition

You may want to repeat an image a certain number of times, horizontally or vertically.
You can set the value using the slider or by directly entering the value in the appropriate data window on the right hand side of the slider

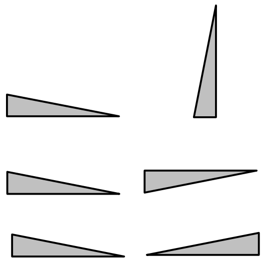
- U and V image mirror



Swaps the U and V

Image mirroring in U

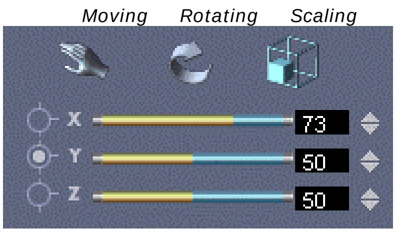
Image mirroring in V



- Moving, rotating and scaling an image

The image will be applied according to the mapping type you choose. You can see the result in the preview window.
You can choose between two setting methods ("Remote" or "Interactive").

♦ ***Remote***



You can move the image on the current object, and rotate or scale it, too.
Click on the icon corresponding to the operation you want to do. This will be done along the orthogonal plane nearest to the current view plane. You may need to use the navigation arrows to view the scene from a different angle (see chapter Navigation" on page 91).
You can set the values with the sliders or by directly entering a value (x,y,z) in the appropriate data window on the right hand side of the sliders.
To increase or decrease several values at the same time, check the boxes on the left of the sliders before using them.

♦ ***Interactive***

With this method, you will work directly in the preview window. Depending of the mapping type, a control box will be displayed on the current object. It will allow you to move, rotate or scale the picture against the object.
Two ways are available to switch the preview window from the « rendering display » to the « control box display » (and the reverse).

1st method : Drag the cursor to the preview window and :
PC : click on the right hand mouse button
Mac : press and hold the Option key and click,

2nd method : click on the  icon on the right hand of the preview window.

Move the image
If you put the cursor inside the control box, it will be changed to a hand to indicat that you can move the image over the object.
Usage:

1. Click and hold the mouse button to take the image.
2. Move the cursor (the image follows it).
3. Release the mouse button when you have the desired result.

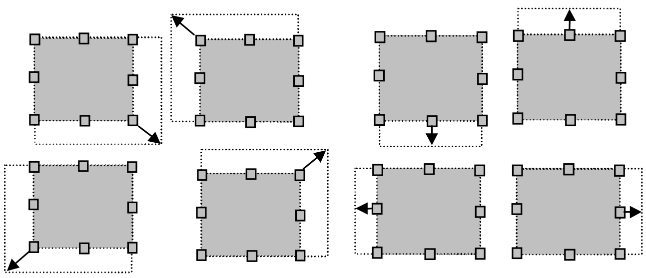
Rotate the image
If you put the cursor outside the control box, it will indicate that you can rotate the image over the object.
Usage:

1. Click and hold the mouse button.
2. Move the cursor to rotate the image.
3. Release the mouse button when you have the desired result.

Scale the image
If you put the cursor over one of the height handles of the control box, it will be changed to a double arrow to indicate the direction of the scaling.

Whole (uniform) scaling: The handles on the corners allow you to change the image scaling.

Axis (non-uniform) scaling: The handles on the edges allow you to change the image scaling along one axis at a time



Usage:

1. Click and hold the mouse button to grab a handle.
2. Move the cursor to scale the image.
3. Release the mouse button when you have the desired result.

8.3.11 2D texture mapping

A 2D texture algorithmically describes the structure of a pattern in two dimensions*.* *Some parameters can be also set: scale, perturbation, grain, etc…) and you can control its colormap.*

You may need to define both the texture parameters and the mapping parameters. This explains why you will need to refer to various other chapters to learn about these two kinds of settings.

- Creating a 2D texture


You can create a 2D texture like we saw in chapter “The upper layers” on page 371. Make sure that the texture layer to be tuned is the current layer (see chapter “Current layer concept” on page 371).

♦ ***Basic textures***

A 2D texture layer is built from a primary texture. AMAPI 3D displays a list of primary textures from which you can select the one most appropriate for your project. The default primary texture selected by AMAPI 3D is the first one in the list.

1. Click in the box corresponding to the texture. The list of the available primary 3D textures is displayed.
   - Wood
   - Marble
   - Checker
   - Grid
   - Brick
   - Radial
   - Smooth radial
   - Ramp
   - Smooth ramp
   - Noise
2. Drag the cursor onto your choice, then click again to validate it.

♦ ***The different types of mapping***

There are different types of mapping depending on the way the image is projected and on the interaction between the projection and the object's surface.
AMAPI 3D displays a list of the available mapping types.

1. Click on the box corresponding to the mapping types. The mapping types list is displayed:
   - Sphere
   - Cylinder
   - Plane
   - Cube
   - Circle
   - Ball
   - Reflection
   - …
2. Drag the cursor onto the one you want, then click again to validate your selection.

♦ ***Interactions between the current layer and the layer below***

You can specify an interaction between the current layer and the layer below. For more information, see chapter "Interactions between the current layer and the underneath layer" on page 372.

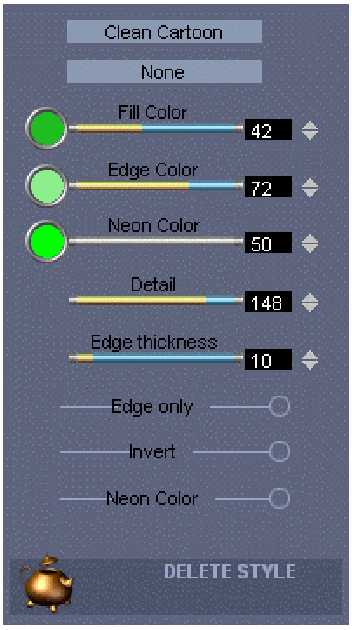
❑ Setting the parameters defining the algorithms

You can set the following parameters: proportion, perturbation, grain, orientation, and density. See chapter "Setting the parameters defining the algorithm" on page 375.
You can tune the color ramp assigned to the 2D texture layer. See chapter "Editing the color ramp" on page 378.

❑ Moving, rotating, and scaling a 2D texture

See chapter "Moving, rotating and scaling an image" on page 383.

8.3.12 Style



***A STYLE** differs from a material because it is a drawing style. It is not defined by layers of textures. It is characterized by:*

- *contour line*
- *a fill color.*

You access it with the button:

- Selecting a style

Choose the desired style from the ones listed (Cartoon, Techno, etc.).
1. Click on the name of the current style. The list of available styles appears.
2. Drag the cursor onto the one you want, then click again to validate your selection.

- Selecting a shading type

You can choose a shading type for your style. The default is none, which will generate solid colors. If you want your style to have shading, choose from the available shading types (2 shades, 4 shades, saturated, soft, rainbow, and zebra) as follows:
1. Click on the name of the current shading. The list of available shading types appears.
2. Drag the cursor onto the one you want, then click again to validate your selection.

- Fill color

Proceed as follow to modify the fill color:
1. You can choose between two interfaces to select the color: the triangle of colors or the standard dialog box (for details see chaper "Diffuse color" on page 367).
2. You can now set the luminance of the color using the corresponding slider.

You can choose to not display the fill color by clicking in the "Contour only" box.

- Contour color

Proceed as follows to modify the color of the contour:
1. You can choose between two interfaces to select the color: the triangle of colors or the standard dialog box (for details see chaper "Diffuse color" on page 367).
2. You can now set the luminance of the color using the corresponding slider.

- Neon color

You can activate (or deactivate) the "Neon" mode (see below for details).
To modify the neon color:
1. You can choose between two interfaces to select the color: the triangle of colors or the standard dialog box (for details see chaper "Diffuse color" on page 367).
2. You can now set the luminance of the color using the corresponding slider.

- Detail

The "Detail" option displays additional internal lines. These lines correspond to edges of the object; they are made visible only if the angle defined by the two adjacent facets is greater than a specific value. The corresponding slider will modify this angle value and thus make more edges visible or not.

- Edge thickness

Use the slider to increase or decrease the edge thickness.

- Contour only

Check the "Contour only" box to display only the contour lines (to not display the fill color).

- Invert

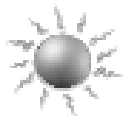
To invert the contour line color and the fill color, check this box.

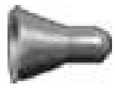
- Neon

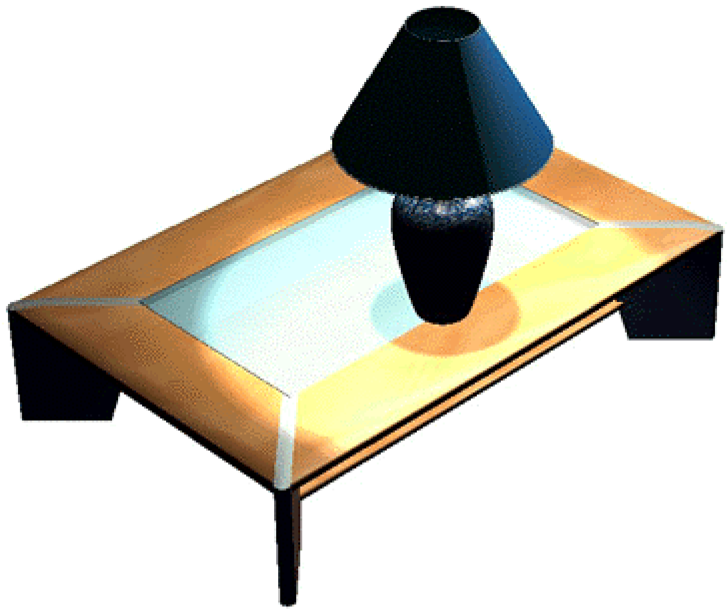
Check the "Neon" box to display to activate the Neon option.

8.4 The lights

Lighting is the propagation of rays of light originating from a natural or an artificial light source. There are three kinds of light sources: a sun, a light bulb, or a spotlight. Light source tool icons are grouped in the "Animation & Rendering" palette.
A control window displays in real time a preview of the effect of the lighting. You can see the final results by rendering the scene or an area of the scene. (See chapter "Render scene" on page 398.)





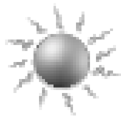


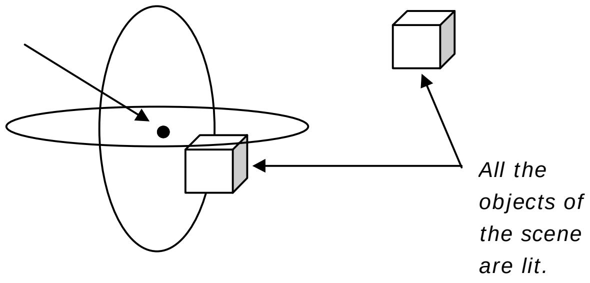
8.4.1 Creating a light source

Any light source created will be automatically associated with a specific layer of lights. (See chapter "Classification by layer" on page 121).

Sun

A sun produces what is sometimes called directional lighting. A sun can generate colored light.





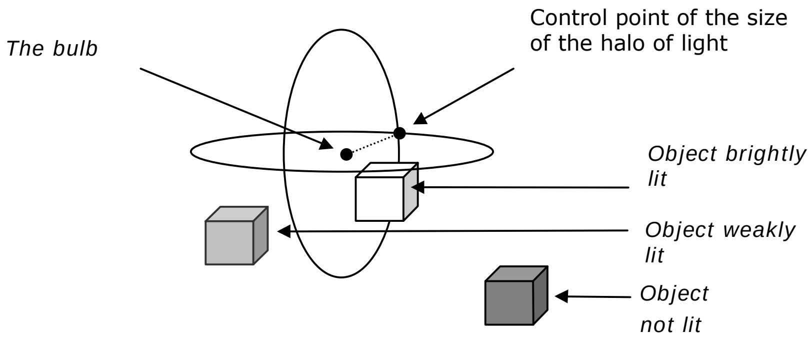
Creation of a sun:

1. Select a "Sun" light in the "Rendering" pulldown menu or click on the corresponding light icon in the "Animation & Rendering" tools palette to create a sun.
2. The light source follows the cursor's movements.
3. Position the lighting at the selected location and click.

You can create as many suns as you want; there is no limit on their number.

❑ Bulb

A bulb is a point light source producing a halo of light whose size and color is user-defined.
Within the halo, the light gets dimmer (i.e., attenuates) as one is further away from the light source.



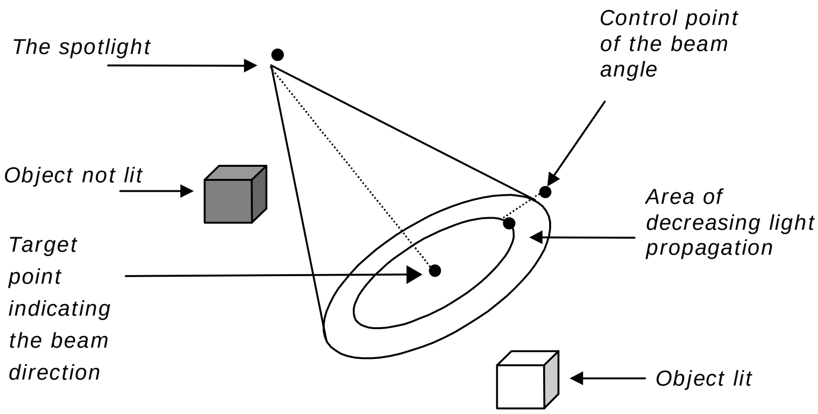
Creation of a bulb:

1. Select a "Bulb" light in the "Rendering" pulldown menu or click on the corresponding light icon in the "Animation & Rendering" tools palette to create a bulb light.
2. The light source follows the cursor's movements.
3. Position the lighting at the selected location and click.
4. You can set the halo size by moving the cursor.
5. Click when satisfied.

There is no limit to the number of bulbs you can create.

❑ Spotlight

A spotlight is a discrete light source generating a directed light beam.
You can specify the beam direction, the light beam radius, its area of propagation, and its color. You can have it cast shadows.



Creation of a spotlight:

1. Select a “Spot” light in the “Rendering” pulldown menu or click on the corresponding light icon in the “Animation & Rendering” tools palette to create a light.
2. Click to define the target point of the spotlight.
3. Drag the cursor to set the position of the spotlight and click when satisfied.
4. There is no limit to the number of spotlights you can create.

8.4.2 Setting the lights

❑ Using the information box

If you double-click on a light source, you will open a dialog box which displays information about the seledted light. You can use the dialog box to change some of the light parameters, which will vary depending on the light type. You can even change the light type.

♦ ***Change the light source name***

You can rename the current light. To do this, click on the light name in the Data Window and enter a new name.

♦ ***Change the light source type***

You can change the light source type of the current light. To do this, scroll the dialog to see the available types (sun, bulb, or spotlight) and click on the type you want.

♦ ***Parameters specific to the bulb and the spotlight***

Radius (for a bulb):
The light is uniformly spread around the bulb light. To modify the size of the halo, click in the data area and enter a radius.
This adjustment can be made graphically too (See chapter “A bulb” on page 395).
Angle (for a spotlight):
To modify the angle, click in the data area and enter a value.
This adjustment can be made graphically too (See chapter “A spotlight” on page 395).

♦ ***Activating a light***

You can switch a light on or off by checking (or unchecking) the “Active” check box.

♦ ***Color***

To specify a light color:
1. Place the cursor over the light source, and double click.
2. A dialog box appears. Click on the color area.
3. Another dialog box is opened to allow you to select the new color.
4. Click on “OK” to validate the color, or on “Cancel” to leave without changing the color.
5. Now you will be back in the first dialog box. Click on “OK” to validate the color, or on “Cancel” to leave without changing the color.

♦ *Shadow*

Type and quality of the shadow:
You can ask lit objects to cast a shadow. You have three choices:

<table>
<tr><th colspan="2">Shadow type</th><th>Shadow quality</th></tr>
<tr><td>No shadow</td><td></td><td></td></tr>
<tr><td>Z-buffered shadow (default)</td><td>The priority is speed over quality.</td><td rowspan="2">AMAPI 3D allows you to set the shadow quality. It corresponds to the fineness of the grain:
0 = large grain
10 = very thin grain
The finer the grain, the longer the calculation time.</td></tr>
<tr><td>Ray-traced shadow</td><td>The priority is quality over speedy.
The ray-traced shadows will look very nice!</td></tr>
</table>

Attenuation:
A shadow is a darkening of the color of the object where the shadow is cast. The "Attenuation" slider allows you to tune this effect.
0= No shadow attenuation. The obscuring area is uniformly dark.
50= The color of the object is somewhat darkened throughout the shadow.
100= The attenuation is maximum, the area is not darkened at all. There is no shadow.

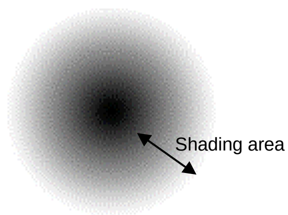
Noise:
Noise allows you to add random shading in the shadow (see paragraph "Shading area").
If you add little or no noise, you may see strange regular patterns (aliasing, big squares...) in the shaded area. Increasing the noise will break up these patterns and will produce a more visually pleasing effect.

Shading area:
The "Shading area" slider allows you to control the amount of shading in the shadowed area.

0= No softness. The shading area is uniformly dark.

100= The softness is maximum in the shadowed area.

A ray-traced shaded shadow gives very realistic results, but it takes a long time to calculate.



Graphically

♦ ***A bulb***

The light is uniformly spread around the bulb light. You can modify the size of the halo. You can interactively modify the halo radius using the "Stretch" tool from the modeling tools palette (see chapter « Stretch » on page 268
This tuning can be done via the Information dialog box (See chapter "Parameters specific to the bulb and the spot" on page 393).

♦ ***A spotlight***

Specifying the direction of the beam of light:
Specify the direction of the beam of light using the « Stretch » tool in the Modeling palette (See chapter « Stretch » on page 268).

Specifying the beam's angle:
Specify the angle of the beam of light using the « Stretch » tool in the Modeling palette (See chapter « Stretch » on page 268).
This setting may be made through the information dialog box (See chapter « Parameters specific to the bulb and the spot» on page 393).

Specifying the area of decreasing light propagation:
Use the « Stretch » tool in the Modeling palette to interactively define the area of decreasing light propagation (See chapter « Stretch » on page 268).

8.5 The cameras

Click on the Camera tool icon of the "Animation & Rendering" tools palette to create a camera.

8.5.1 Definitions

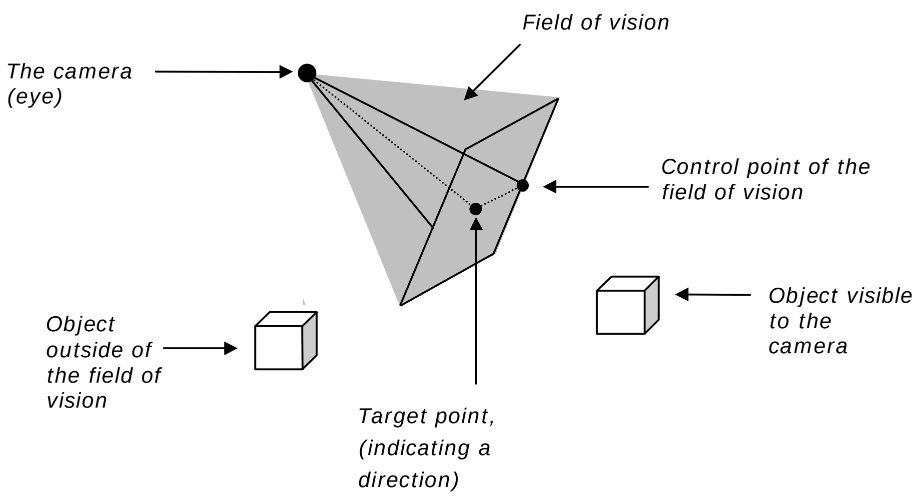
POINT OF VIEW: Position of the eye looking at a scene. It is defined by the position of the eye, a Target Point defining the eye direction, and a field of vision.

The **EYE** is the point from which the scene is seen.

The **TARGET POINT** is the point towards which the eye is oriented.

The **FIELD OF VISION** is the area covered by the eye looking toward the Target point.

A **CAMERA** is the instrument used to set the point of view.



8.5.2 Creating and positioning a camera

When a camera is created, it is automatically associated with a layer (see chapter "Classification by layer" on page 121) specific to cameras and points of view (see chapter "Point of view" on page 134).

- Creation of a camera

1. You create a camera either with the "New camera" command of the Rendering pulldown menu or by clicking on the corresponding icon in the "Animation & Rendering" tools palette.
2. Click to define the point targeted by the camera.
3. Move the cursor to set the camera position and click when satisfied.

You can create an unlimited number of cameras.

- Moving a camera

You can select and move a camera as you would an object.

8.5.3 Setup of the cameras

Double clicking on a camera opens a dialog box displaying the settings used to define the camera setup.

- Changing the camera name

Click on the current camera name and enter a new name.

- Defining the characteristics of the camera

♦ ***Set the camera direction***

Use the "Stretch" tool of the Modeling palette to set the camera direction (see chapter "Stretch" on page 268).

♦ ***Specify the field of vision***

Use the "Stretch" tool of the Modeling palette to define the field of vision of the camera (see chapter "Stretch" on page 268).

8.6 Render scene

***RENDERING** is a process of computing and displaying a scene. The computations are based on pre-defined algorithms that take into account: the geometry of the objects (modeling), the materials applied to those objects (metal, marble, wood, etc.), the lighting, the point of view and, finally, the interaction that all those elements may have between them (shadows, reflections, etc.).*
If no material is assigned to an object, AMAPI 3D will use a default color. Default lighting values will be used as well, if none were specified.

8.6.1 Rendering the scene

Usage:

1. **Selecting the "Render Scene" tool.**
   There are three ways to select this tool:
   - In the "Render" pulldown menu, select the "Render now" command.
   - Click on the "Render Selection" tool icon, in the "Animation & Rendering" tools palette.
   - Or, with no tool selected, press the "Return" key.

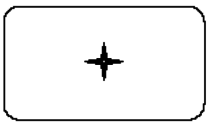
   The display is immediately rendered. The time taken to render the scene will vary depending on the complexity of the scene.

2. **Interrupting the rendering**
   To interrupt the rendering, press the "Esc" key or click on the "Cancel" icon in the Assistant Palette.

8.6.2 Rendering an area

Usage:

1. **Select the "Render Selection" tool.**
   Access the tool through the "Render Selection" command of the Render pulldown menu.
   A white rectangle used to define the area of the scene to render is displayed.

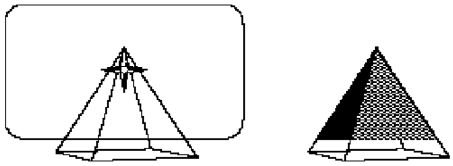


2. **Position the center of the rectangle.**
   Drag the cursor and click to set the center of the rectangle at the center of the area of the scene you want to render.
   .

3. Set the size of the rectangle.
Drag the cursor to modify the rectangle's size.

4. Validate the selection and start the rendering.
Click on the mouse button once the rectangle is the correct size.

AMAPI 3D renders the defined area of the scene.



5. Go back to step 2 to render another area of the scene.

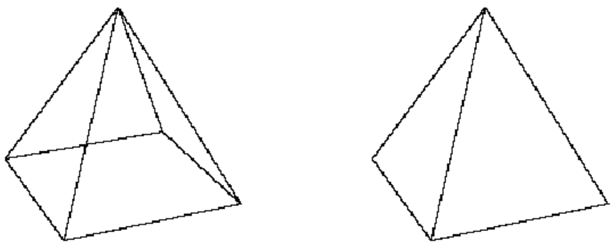
6. Ending the tool action.
Put the tool aside (depending on the chosen interface) to end the tool action. See chapter "How do you end a tool action?" on page 158.

8.7 Saving an image

This command of the "Render" pulldown menu saves the image as a file on the hard drive. You can choose the type of file format (PICT, BMP, JPEG or TGA), the file name, and where you want to save this file.

8.8 Hidden lines

"Hidden Lines" renders the scene in wireframe but displays only the edges that would be visible to the user's eye (totally or partially) if the facets where not transparent.
This type of display can be very time consuming for complex scenes. Its main advantage is to give a realistic representation of the models.



9 Animation

The AMAPI 3D Animation module is accessed via the menu bar.
You may access the « Rendering-Animation » module, either :

- *By clicking on the*  *icon in the« Mode » area of the assistant palette.*
- *By pressing the Space bar.*

This allows you to toggle between the « Modeling » mode and the « Rendering-Animation » mode..

Then, click on the Animation icon : 

AMAPI 3D recommends that you use the viewers to simultaneously control what is seen by each camera. See chapter "Viewer" on page 94.

9.1 Animation Parameters

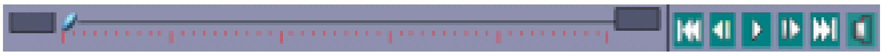
You can set:

- The size of the generated video image in pixels.
- The number of images per second.
- The image compression factor (between 1 and 100).
- The export format.

9.2 The Animation Editor

You access the Animation Editor by selecting "Animation Editor" in the "Animation" menu.
The Animation Editor is divided into three parts that allow you to:

- *Create an animation on a recording tape.*
- *Edit a path.*
- *See an animation.*



9.2.1 Edit an animation on a recording tape

The recording tape appears as a graduated ruler.
You will print the animation of an object or a group of objects on it.
At each step, you will link a picture of the object as it is at a given moment (position and appearance).

❑ Frame concepts: keyframe and intermediate frame

- ***A frame:***

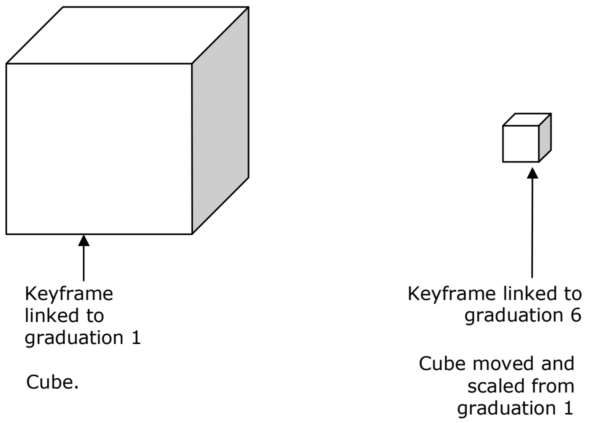
A frame represents the object to be animated at a given moment (position and appearance).
In an animation, the frames are sequenced. A frame is linked to a graduation of the recording tape.
There are two kinds of frames:
- The keyframes (marked in green)
- The intermediate frames

If the tape is still blank, there are no frames linked to any of the graduations.

By default, there are 99 frames per animation.
An editable counter at the right side of the graduated ruler indicates the maximum number of frames.
To modify this number:
⇒ Click on the editable zone.
⇒ Enter a number.
⇒ Press the Return key to validate.

- ***A keyframe:***

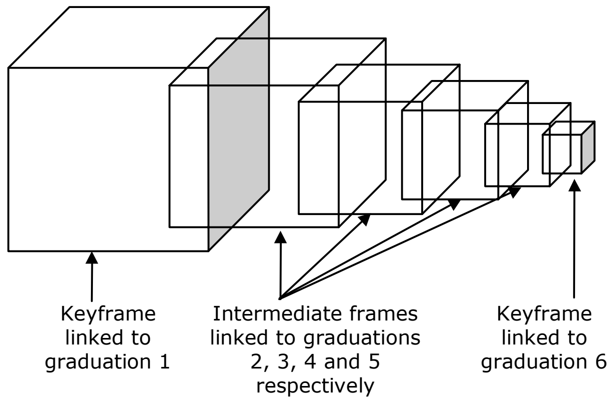
A keyframe is a frame that contains all of the information concerning the movement and deformation applied to the object from the previous keyframe.



You can Create, Copy, Paste, Reproduce and Delete a keyframe.

- ***An intermediate frame:***

  Between two consecutive keyframes, AMAPI 3D automatically generates what we call the intermediate frames.
  AMAPI 3D generates the same number of intermediate frames as the number of graduations between two consecutive keyframes.



  You cannot Copy, Paste or Delete an intermediate frame.
  However, you can convert an intermediate frame into a keyframe.

❑ To go to a specific graduation of the tape

Several methods are available. Choose the one you want:

- ***1st method: Enter the number corresponding to the desired graduation.***

  Click on the editable zone.
  Enter a number.
  Press the Return key to validate.
  The cursor is automatically positioned at this graduation.
  AMAPI 3D immediately displays the frame linked to this graduation.

- ***2nd method: Move the graduated ruler cursor.***

  By moving the cursor of the graduated ruler, you can position the scene at the desired graduation.
  You can watch the animation playing while you move the cursor.

- ***3rd method: Click on the graduated ruler.***

  Click on the graduated ruler at the desired graduation.
  The cursor is automatically positioned at this graduation.
  AMAPI 3D immediately displays the frame linked to this graduation.

- ***4th method: Use the commands that allow you to play the animation.***

  See “Play an animation” on page 409.

❑ Create an animation

To link a keyframe to a graduation of the tape, you must do the following:

♦ ***Create or modify a keyframe:***

1. Go to the desired graduation:
To be positioned on the desired graduation, please refer to the above paragraph: "To go to a specific graduation of the tape".
There are several possible scenarios:

- If you ask for a graduation greater than the last keyframe of the tape, AMAPI 3D will display the last keyframe of the tape.
- **If you ask for a graduation already linked to a keyframe,** AMAPI 3D will display this keyframe. In this case you will modify this keyframe.
- **If you ask for a graduation already linked to an intermediate frame,** AMAPI 3D will display this intermediate frame. In this case you will replace this intermediate frame by a keyframe.

2. Move and / or deform the object to be animated:
Now that the cursor is positioned on the desired graduation of the ruler, move or deform the object to be animated.
To do this, you can use any of the following tools:

- Move
- Rotate
- Scale
- Deform
- Mold
- Stretch
- Bend

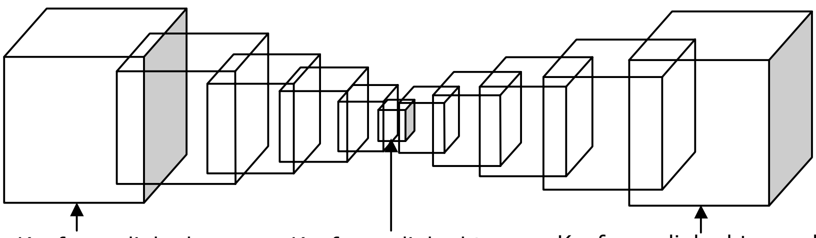
⚠ The frame becomes a keyframe only if you use a tool on the object. If you don't use a tool:

- If the graduation was not linked to a frame, it remains without a linked frame.
- If the graduation was linked to a frame, that frame will still remain linked to this graduation.

⚠ If you went to step 2 without doing step 1, there is the risk that your new keyframe will be linked to the wrong graduation.

♦ ***Copy-paste a keyframe:***

With this tool you will copy a frame linked to a graduation so that you can link a copy of it to another graduation.



You can use this tool to make sure that an object is not altered between two graduations.

Usage:

1. **Get positioned on the graduation corresponding to the keyframe to be copied:**
   To be positioned on the desired graduation, please refer to the paragraph: "To go to a specific graduation of the tape".

2. **Copy the keyframe:**
   ⇒ PC: Press and hold the right mouse button. Mac: Press and hold the Option key and press and hold the mouse button
   ⇒ Position the cursor on "Copy".
   ⇒ Release the mouse button.

3. **Get positioned on the graduation where you want to paste the copied keyframe:**
   Go to the desired graduation by using the technique described in step 1.

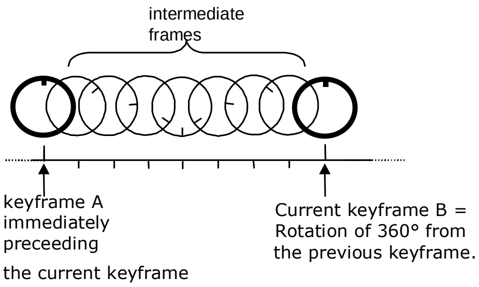
4. **Paste the keyframe.**
   ⇒ PC: Press and hold the right mouse button. Mac: Press and hold the Option key and press and hold the mouse button
   ⇒ Position the cursor on "Paste".
   ⇒ Release the mouse button.
   The pasted frame becomes linked to the current graduation.

5. **Eventually transform the new keyframe.**
   If you want, you can move or transform the object to be animated.
   To do this, you can use the following tools:
   - Move
   - Rotate
   - Scale
   - Deform
   - Mold
   - Stretch
   - Bend

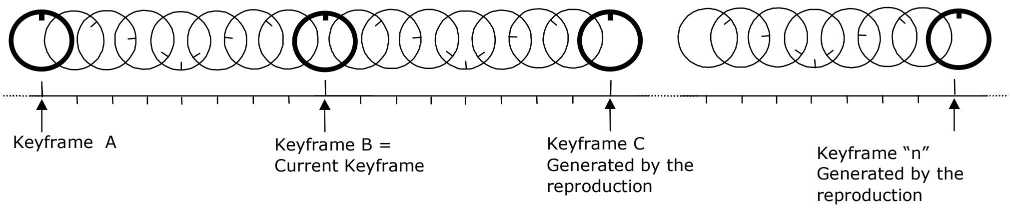
♦ ***Reproduce an action:***

This tool is used to take an action that was made between two consecutive keyframes, and apply it to the rest of the graduations until the end of the tape.
Here, "action" means all of the movements and deformations applied to an object between the two keyframes.

Example:
You can use this features to apply a rotation to a wheel until the end of the animation.
Assume that you have recorded the rotation movement between keyframe A and keyframe B, and AMAPI 3D has generated the intermediate frames.



Using this feature, with one click, you can reproduce this action until the end of the animation:



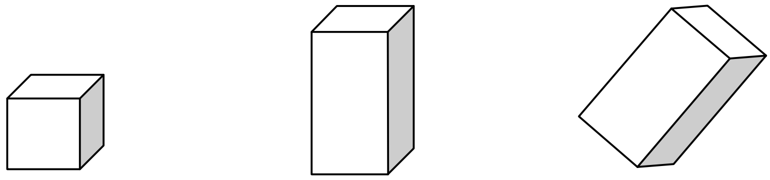
usage:

1. **Get positioned on the graduation corresponding to the end-of-action keyframe.**
   To get positioned at the desired graduation, refer to the paragraph: "To go to a specific graduation of the tape".
   The keyframe linked to this graduation becomes the current keyframe.

2. **Reproduce the current keyframe action.**
   ⇒ PC: Press and hold the right mouse button. Mac: Press and hold the Option key and press and hold the mouse button.
   ⇒ Position the cursor on "Reproduce".
   ⇒ Release the mouse button.
   AMAPI 3D reproduces this action until the end of the animation.

- ***Delete a keyframe***

Example:
Animation recorded with three keyframes:



Keyframe on graduation 1

Keyframe on graduation 5 (Vertical scaling of the object from graduation 1)

Keyframe on graduation 10 (Rotation of the object from graduation 5)

After deleting the keyframe linked to graduation 5, we get the following animation:

Keyframe on graduation 1

Keyframe on graduation 10 (Rotation of the object from graduation 1)

Usage:

1. **Get positioned on the graduation corresponding to the keyframe to be deleted.**
   To get positioned on the desired graduation, refer to the paragraph: “To go to a specific graduation of the tape”.

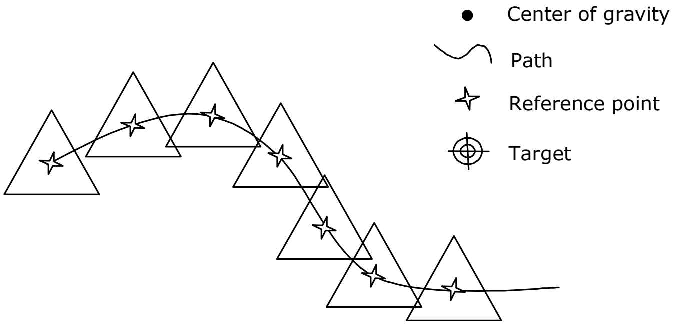
2. **Deleting the keyframe.**
   ⇒ PC: Press and hold the right mouse button. Mac: Press and hold the Option key and press and hold the mouse button.
   ⇒ Position the cursor on “Reproduce”.
   ⇒ Release the mouse button.

Delete the animation of an object

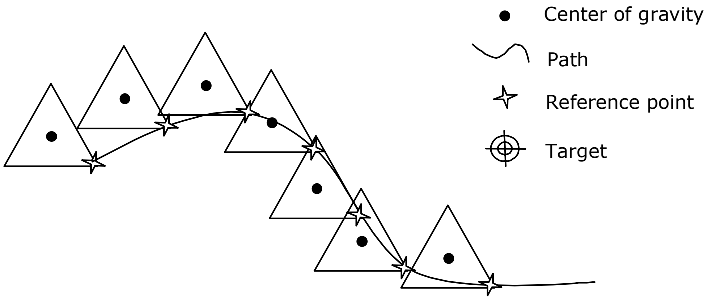
⇒ Click on the Information icon of the Control Panel.
⇒ Click on “Delete the animation information”.
⇒ Click on the OK button.

9.2.2 Edit the path

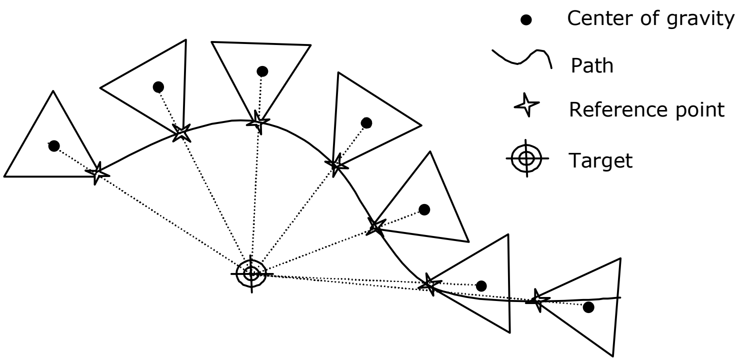
***A path** describes the trajectory of an object.*
***The reference point** is the point of the object that will be in contact with the path at all times.*
***The target** is the point that your object will aim for along the trajectory.*



***Example 1**: Displacement of an object along a path. Here the reference point is coincident with the center of gravity.*



***Example 2**: Displacement of an object along a path. This time the reference point is no longer the center of gravity.*



***Example 3**: Displacement of an object along a path. Here, the reference point is no longer the center of gravity. The object is oriented toward a target along the trajectory.*

There are two ways to draw a path:

- Use a drawing made with the Drawing tool in the Construction palette.
- Use the Path Drawing tool in the Animation palette.

  In this case, you can only draw polylines.

Usage:

1. **Select the object to be animated.**
   Click on the object to be animated so that it becomes the current object.

2. **Select the Path tool.**
   In the menu, click on: Animation / Assign a path.

3. **Optional: Select the reference point.**
   Take the reference point selection accessory (See chapter "The selection accessories" on page 104) and click on a point of the object.

4. **Optional: Select the target point.**
   Take the point selection accessory (See chapter "The selection accessories" on page 104) and click on a point of the scene.
   If you don't select a target point, the object will maintain its orientation along the whole trajectory.

5. **Select or draw the path:**
   There are two possible cases:
   - **You have already drawn a path with the Drawing tool in the Construction palette:**
     Click with the object selection accessory cursor on this path to apply it and go to the next step.

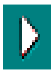
   - **You have not drawn a path yet and you want to do it:**
     ⇒ Click anywhere to drop the object selection accessory and get the point selection accessory **.**
     ⇒ Click to set the starting point of the path.
     ⇒ Click to draw the polyline.
     ⇒ When you are done drawing the polyline, press the Return key.

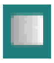
6. **Put the tool aside as usual.**

9.2.3 Play an animation

 Go to the first frame

 Go to the previous frame

 Play the animation from the current frame

 Stop on a frame

 Go to the next frame

 Go to the last frame

 This button works in toggle mode and is a “flag” to indicate if the animation is playing in loop mode or not.

9.3 Open an animation file

This command from the Animation Menu opens an existing animation file.
The “Open” dialog window allows you to select a file.

9.4 Recording an animation (Save to file)

This command from the Animation Menu records the current animation. It allows you to:

- ♦ *Give the animation file a name or change its name.*
- ♦ *Record an animation file in a user-specified folder.*

10 3Space Dynamics

More than to export:

- *3D geometry (see chapter "Objects" on page 151)*
- *3D rendered scenes: with cameras, lights, and textures (see chapter "Rendering" on page 351).*

3D animated scenes: with pre-programmed dynamics.

AMAPI 3D offers a brand new, high performance technology** which is particularly suitable for communicating on the Internet today: **3Space dynamics.

*The 3Space technology is an outstanding solution which allows you to put **3D interactive dynamics** into your HTML documents, making them more user-friendly and able to communicate more efficiently and effectively.*
You will be surprised by the ease with which you can use this technology and discover it is no less than a new way of communicating, to be added to the existing ways (text, images, animated GIF, Java applets, Flash effects, and so on.)

*The goal of 3Space dynamics is to **reproduce, in a realistic way, the natural laws of physics** (gravity, damping, collisions,…) based on the properties you assign to each object (mass, stiffness, roughness…), the action it executes at time "t" (translation, rotation…), and its parameters (orientation, speed…).*
An object will react to user interactions (mouse click, mouse over,…) depending on the behavior (reaction to an event) you have assigned to it.
The user can manipulate the scene with the mouse or the keyboard arrows – if you have allowed this behavior when building the scene.

10.1 Introducing the 3Space technology

10.1.1 The 3Space technology components

- The document

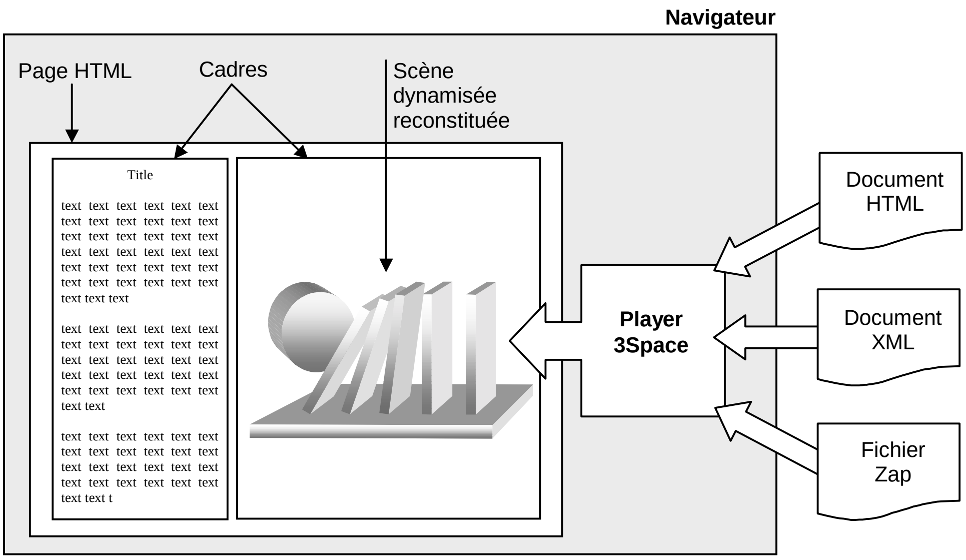
The 3Space document is an XML file describing the scene and the dynamics of a scene. It contains:
A reference to the Zap file which contains the geometry of the objects of the scene.
The properties of each object (mass, stiffness,…)
The behavior of each object. It is defined by a set of physical actions created by a user event (mouse click, mouse over, …) or by a timer.
The environment description (limits of the world, gravity,…).

- The Zap format

Zap is an extremely compact file format (.z3d) which contains the geometry of all the objects in a scene, their materials, and the lights.
It is based on the object construction history and stores only the data needed for the Player (see chapter "The Player" below) to rebuild the 3D geometry.

- The Player

The 3Space Player is a browser plug-in able to read 3Space documents and reconstruct a scene and its dynamics.
In other words: the 3Space Player reads the 3Space file that defines the scene, reads the Zap file corresponding to the objects, and reconstructs the geometry of each object. It renders the scene, runs the dynamics, and responds interactively to user events (mouse click, mouse over, …).



10.1.2 3Space dynamics and AMAPI 3D

AMAPI 3D 3Space dynamics

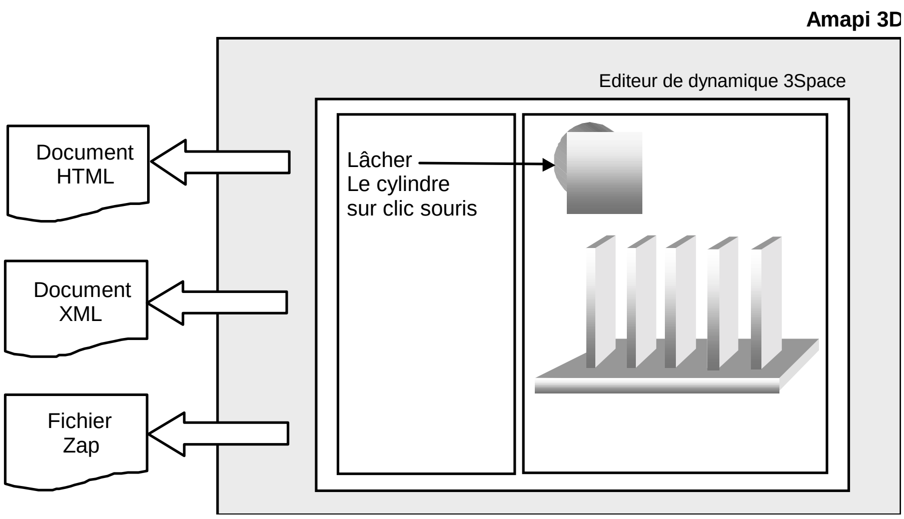
AMAPI 3D includes a 3Space Dynamics Editor which allows you to:

1. **Define:**
   - A world (its boundaries, gravity, …). For more information see chapter "The world" on page 419.
   - The properties of each object in the scene (mass, stiffness,…) For more information see chapter "Object properties" on page 421.
   - The behavior of each object. It is defined by a set of tunable physical actions created (or not) by a user event (mouse click, mouse over,…). For more information see chapter "Behavior" on page 423.

2. **Control:**
   The integrated 3Space player allows you to preview the dynamic effects. For more information see chapter "Control the "dynamized" scene" on page 432.

3. **Save:**
   Saving the scene as a 3Space file performs the following actions:
   - Saving the XML document that describes the scene.
   - Saving the objects (3D geometry and materials) in the Zap format (.z3d).
   - Saving the HTML page that instantiates the scene and the 3Space player.

   For more information see chapter "Saving the "dynamized" scene" on page 432.



Recommendations

To achieve a very compact and very attractive 3Space scene, we strongly suggest the following:

♦ *Modeling*

- Use NURBS surfaces as much as possible.

- If you use polyhedral objects, proceed as follow:
  - Create objects with the minimum number of polygons.
  - If necessary, use Bezier, Doo, Catmull or Loop smoothing algorithms to improve the final appearance.
  - Use the Decimation tool to simplify the geometry. Then use Loop smoothing (triangular facets) to get a good appearance.

- For compactness, the Zap file stores the construction history of each object. It is very important to:
  - Build the objects using the tools which generate Dynamic Geometry (Extrusion, Sweep, Double Sweep, Coons Surfaces, Smoothing …) whenever possible.
  - Retain the Dynamic Geometry properties by avoiding the use of tools which delete these properties (See chapter "Summary of the effects of each tool on D.G." on page 163).

  If you follow these recommendations, you can get files generated with polyhedral objects that are as compact as NURBS objects.

- Note that the unit of the 3Space world is the meter. We suggest you work using meters or centimeters. (Do not use the unit "none"). (see chapter "Preferences /Units" on page 441).

- Make sure no two objects in the scene intersect. If they do, these objects will not move when the scene is played.

♦ *Groups*

A group is treated as a single element. You will set its properties and its behavior as if it were only one object.
If you later decide to ungroup it, each object will inherit the properties and the behavior of the former group. This can be useful, for example, to create a set of similar objects, like marbles, dominoes…)

♦ *Masked objects, hidden objects*

A masked object is an object whose geometry is invisible in the un-"dynamized" scene (See chapter "Hide-Unhide" on page 138).

A hidden object is an object whose geometry is invisible in the "dynamized" scene.
It's important to understand that an object is a part of the scene, whether it is visible or not. That is to say, it has gravitational properties (if it's not fixed), it can collide with other objects (if it has a collision box), and it reacts to events depending on the behavior you assigned to it.
You must delete hidden objects that you don't need for the scene.

The 3Space Dynamics Editor will treat masked objects as follows:
- All non-masked objects of the scene will be visible (not hidden) at the start of the "dynamized" scene.
- All masked objects will be hidden at the start of the "dynamized" scene.

It displays the visible (not hidden) objects only.

Sometimes you may need to **hide some objects when the scene initially opens and then show them later.** In this case, you can proceed as follows:
1. Model all the objects of the scene (the ones that are initially hidden as well as the others).
2. Hide the objects that will be visible when the scene opens.
3. Open the 3Space Dynamics Editor.
4. Set the properties and the behavior of the objects that will be hidden when the scene opens.
5. Exit the 3Space Dynamics Editor.
6. Hide the objects that will be invisible when the scene opens.
7. Unhide the objects that will be visible when the scene opens.
8. Open the 3Space Dynamics Editor.
9. Set the properties and the behavior of the objects that will be visible when the scene opens.
10. Save the "dynamized" scene.
11. Exit the 3Space Dynamics Editor.

The 3Space Dynamics Editor display window displays hidden objects only for these cases:
- Show (an object)
- Replace (object geometry)

♦ ***Rendering***

3Space uses OpenGL acceleration mode with the following parameters:

Lights:

- Sun
- Bulb
- Spotlight

Materials:

Uniform Zero level layer:
- Ambient color
- Diffuse color
- Shininess (falloff and specularity)
- Transparency
- Reflexion

The first upper layer:
- 2D texture
- Image mapping (plane, sphere, and cylinder)
- The “color” channel
- The “mix” and “replace” operators

Paramètres de rendu :

- Image de fond
- Environnement

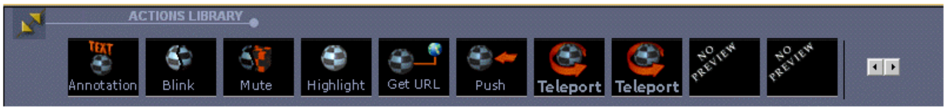
10.2 The 3Space Dynamics Editor

To open the 3Space Dynamics Editor, select it on the menu bar at the top of the screen.

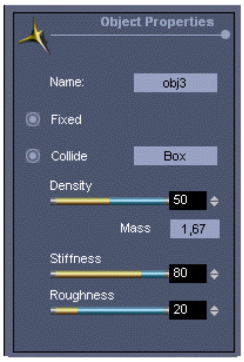
You will be able to open the 3Space Dynamics Editor only if there is at least one object in the scene.

10.2.1 Architecture of the editor

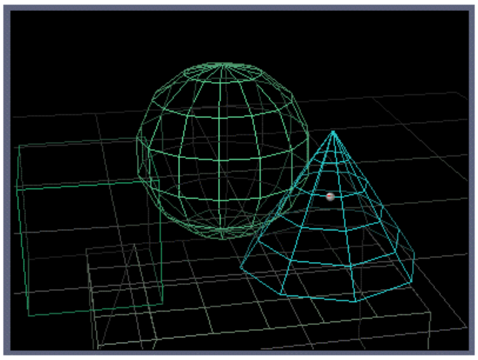
Gallery of actions



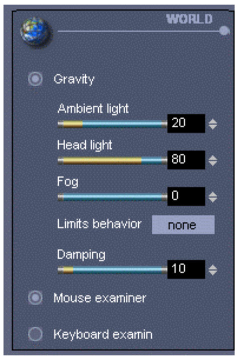
Object proprerties



Display window



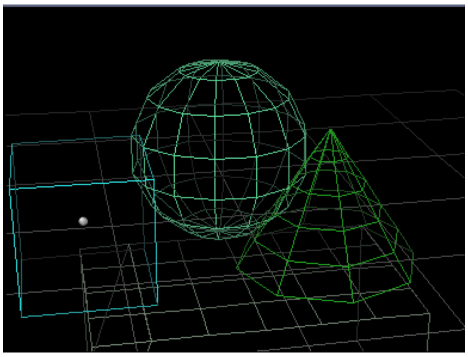
World properties



Behaviors

Command bar

10.2.2 The display window



The central area is for:

The scene to be dynamized display like it is displayed at its opening.
The 3Space Dynamics Editor display window is not only used to show the visible objects of the scene. You will also use it to:

- Specify the initial point of view of the scene (i.e., the one that will be used when the scene is first opened in the player).
- Identify the objects.
- Select an object.
- Set a coordinat

Display of hidden objects.
The 3Space Dynamics Editor display window displays hidden objects only in the following cases:

- Show (an object)
- Replace (an object's geometry)

It is used to:

- Identify hidden objects.
- Select the object concerned by the action.

Specify the initial point of view when opening the scene in the player

The initial point of view when the 3Space scene is opened is the point view in effect in the display window when you saved the 3Space scene.
You can use the navigation arrows to view the scene from a different angle before selecting the point of view. (see chapter "Navigation" on page 91).

Select an object

While editing the scene, you may need to choose an object or a group. Just click on the object to select it.
You can use the navigation arrows to view the scene from a different angle before selecting the object (see chapter "Navigation" on page 91).

Set a coordinate

While editing the scene, you may need to select a point in space (See chapter "Set a coordinate" on page 429).

10.2.3 Concept of current object

❑ Current object

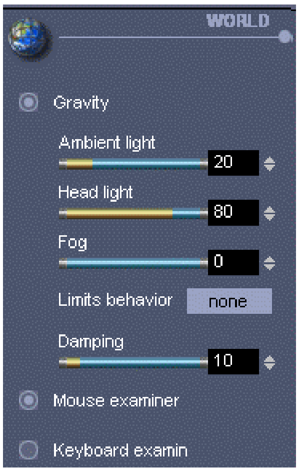
The current object is the object of the scene for which you are setting the properties and the behavior.
In the display window, the current object is colored blue.
One editor area is used for setting the properties of the current object. In this area, the name of the current object is displayed.
A second area is used for setting the behavior of the current object.

❑ Changing the current object

You can change the current object at any time.
Two methods are available:

- **1st method (selecting in the scene)**
  Click directly on the object in the display window. Before selecting the object, you can use the navigation arrows to view the scene from a different angle before selecting the object (see chapter Navigation” on page 91).
- **2nd method (selection by name)**
  1. In the area describing the object properties, click on the name of the current object. The list of the objects of the scene will be displayed.
  2. Drag the cursor onto the name of the object you want, then click again to select it.

10.2.4 The world



A set of parameters will allow you to describe the environment of the scene.

- Gravity

  If this box is checked, all objects in the scene are subject to gravity.

  If this box is not checked, the world is in a condition of weightlessness. All objects in the scene, whether they are fixed or not, are weightless.

  It is possible to make a specific object weightless by setting the "fixed" property (see chapter "Fixe" on page 421).

- Ambient light

  The ambient light is the light given out by each object.
  In the complete dark, only ambient light is used. If the ambient parameter is set to none, the object is not visible.
  You can adjust the ambient light by using the appropriate slider or by entering a value in the Data Window at the right hand of the slider.

- Default light

  The default light is similar to a headlamp worn by the observer. You can adjust the headlamp using the appropriate slider or by entering a value in the Data Window at the right hand of the slider.

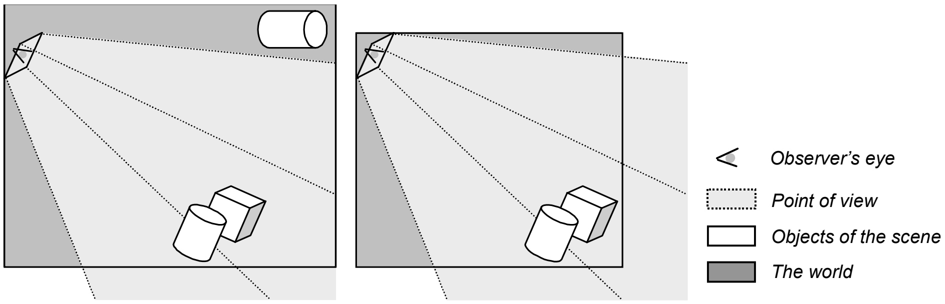
- Fog

  A slider allows you to adjust the amount of fog in the scene.
  You can adjust the fog value using the appropriate slider or by entering a value in the Data Window at the right hand of the slider.

  Be careful to not use a black background color (because the objects will disappear).

Behavior within the limits of the world

The world is a 3D space inside which the objects are moving.
It includes:
- The visible objects of the scene
- The point of view (See chapter "Point of view (Eye – Target point)" on page 134).



You can choose the behavior of each object when it reaches the limits of the world:
- **None**
  The object is not concerned by this event.
- **Collision**
  When an object runs into the limits of the world, this is treated as a collision. The object will bounce off these limits in accordance with its physical properties (mass, stiffness…).
- **Kill object**
  When the object's center of gravity runs into the limits of the world, the object will be destroyed. The object will disappear.
- **Cycle**
  When an object runs into the limits of the world through one of the sides of the screen, it will reappear on the opposite side. The same thing happens with the top and the bottom.

The selection will be made in the behavior selection area: the behavior's list will appear. Drag the cursor, then click on your choice.

Damping force

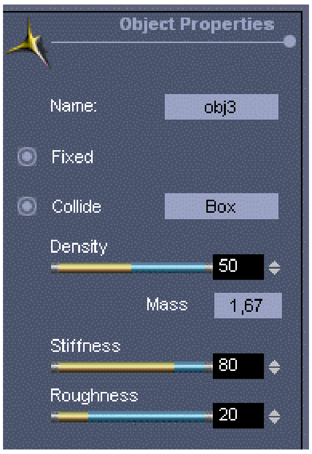
Use the damping force attenuation percentage, for example, to simulate air resistance.
- If the percentage is zero, forces will be constant.
- If the percentage is not zero, all forces in the scene will be affected by the damping effect:
  Examples: The amplitude of a swinging pendulum will gradually decrease. The speed of an object will decrease.

You can adjust the damping force using the appropriate slider or by entering a value in the Data Window at the right hand of the slider.

Camera

Mouse examiner: If this box is checked, you will use the mouse for navigating in the Player.
Keyboard examiner: If this box is checked, you will use the keyboard for navigating in the Player.

10.2.5 Object properties



AMAPI 3D displays the properties of the current object. To set the properties of an object, first make sure sure it is the current object. For more information see chapter "Concept of current object" on page 418.

- Name

AMAPI 3D displays the properties of the current object. To tune the object properties, ensure it is the current one.
For more information see chapter "Concept of current object" on page 418.

- Fixed

If this box is checked, the current object is not moveable:
It will not move if another object collides with it.
It will not be affected by any forces, not even the force of gravity.
(see chapter "Gravity" on page 419).

If this box is not checked, the current object is moveable:
It will react to collisions.
It will react to forces.
How it reacts will depend on whether gravity is on (see chapter "Gravity" on page 419):
If gravity is on: the current object, and the other moveable objects in the scene are subject to gravitational forces.
If gravity is not on: the current object, and the other moveable objects in the scene are not subject to gravitational forces.

- Collision volume

The goal of 3Space dynamics is to reproduce the laws of physics, as seen in nature, as realistically as possible.
In the real world, objects react to a collision when there is contact between the surfaces. To reproduce this is possible, but requires signficant computational resources if the geometries are complex.
Altough 3Space displays the geometric shape of the object, for maximum efficiency it computes collisions based on simple shapes surrounding the object by default: this shape is the "collision volume."

If the "collision volume" box is checked, you can choose from several collision volumes:

Collision volume	Collision calculation
Sphere (surrounding volume)	Very optimized
Box (surrounding volume)	Very optimized
Simplified geometry (calculated per decimation)	Optimized
Full geometry	Not optimized

If the "collision volume" box is not checked, the current object will not have a collision volume. It will not react to any collision:
It will not detect any obstacles (it will pass through them) and it will not be detected by the other objects of the scene (they will pass through it).

- Density

The "density" parameter controls the specific mass of the current object. The unit is the g/cm^2 (gram per square centimeter). You can set the density of the current object by using the appropriate slider or entering a value in the Data Window at the right hand of the slider.

- Mass

The unit of mass of an object is the Kg (Kilogram). It is automatically computed from the density and the volume of the current object.

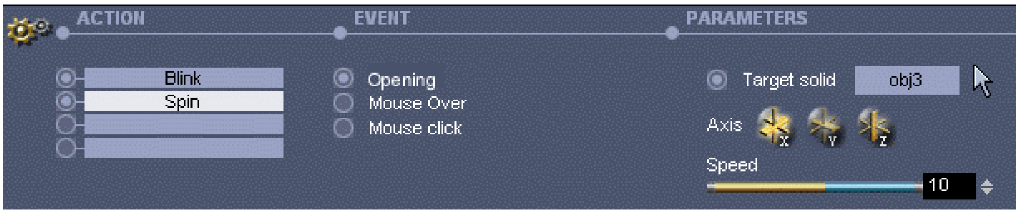
- Stiffness

The stiffness simulates the energy restitution after a collision between objects. Like in the real world, the greater the stiffness, the less energy will be lost.
In a collision, each object will react depending its mass, roughness, links with the other objects, forces…
You can set the stiffness of the current object using the appropriate slider or by entering a value in the Data Window at the right hand of the slider.

- Roughness

Roughness simulates an uneven (rough) surface. Like in the real world, it affects the sliding friction between objects.
For example, consider object "A" laid on a fixed object "B". When we push on"A", there is sliding friction:
If "A" and "B" are both polished (roughness=0): "A" will move at a constant speed.
If "A" or/and "B" have roughness, the 3Space player will take this into account. The greater the roughness, the faster "A" will decelerate.
You can set the roughness of the current object by using the appropriate slider or entering a value in the Data Window at the right hand of the slider.

10.2.6 Behaviors



❑ Definitions

♦ ***Event***

The event will set up an action. There are three types of events:
- ♦ Opening: The action is performed when the scene is opened (default).
- ♦ Mouse over: The action is performed while the mouse cursor is over the object; it ends as soon as the mouse cursor is no longer over the object.
- ♦ Mouse click: The action is performed when the object is clicked.

♦ ***Action***

An action is an instruction to be executed. There are several types of instructions:
- ♦ Motion (rotation, moving…)
- ♦ Force (drag…)
- ♦ Status change (blinking, highlight…)
- ♦ Geometry (geometry change…)
- ♦ Link (spring …)
- ♦ Camera (zoom)
- ♦ Others (annotation ….)

AMAPI 3D provides a gallery of actions which you can customize.

♦ ***Customizable Action***

A customizable action has parameters you can set and event types you can chose from. It is associated with an object.
Example: Blink every 2 milliseconds on mouse over.

♦ ***Behavior***

The behavior of an object is the list of customized actions associated with it.
Example: The sphere rotates on the Y axis when the scene opens, it blinks every 2 milliseconds, and displays "Hello!" on mouse over.

♦ ***Trigger object***

When a specified event occurs on the trigger object, the action is launched. (Put another way, the trigger object is the object upon which the event must occur in order to launch the action.)

♦ ***Target object***

The target object is the object on which the action will be done.
There are two cases:

- The trigger object and the target object are the same (default).
  Example: If you click on object "A", it will blink.
- The trigger object is different from the target object.
  Example: If you click on the object "A" (trigger), the object "B" (target) will blink.
  In this case, the event should not be "Opening" (there is no reason to do this).

Assign a behavior to an object

To assign a behavior to an object:

1 Select the trigger object as the current object.
2 Choose an action in the gallery.
3 Customize it:
  - Set a trigger event.
  - Set the parameters of the action.
4 Return to step 2 to add another action, if needed (4 maximum).

♦ ***Select the object for which you want to define the behavior***

AMAPI 3D displays the behavior of the current object. To specify the behavior of an object, first make sure it is the current object. For more information see chapter "Concept of current object" on page 418.

♦ ***Choose an action in the gallery***

The gallery has an area where you can specify the actions to be assigned to an object.
Up to four actions may be assigned to an object.
AMAPI 3D provides a customizable actions gallery. For more information see chapter "Customize an action" on page 425.

To ADD an action:

1. Click on an empty box to display the list of the possible actions allowed by AMAPI 3D.
2. Drag the cursor onto the chosen action.
3. Click to validate it.

To SELECT the current action:
The current action is the one you are customizing. It is displayed with a light background. Click on the box corresponding to this action. AMAPI 3D will display its parameters and its events.

To REPLACE an action from the list:

1. Make sure that it is the current action (see above).
2. Click on the box corresponding to the action to be replaced. Amapi displays the list of possible actions.
3. Drag the cursor onto a new action.
4. Click to validate it.

To DELETE an action from the list:

1. Make sure that it is the current action (see above).
2. Click on box corresponding to the action to be deleted. Amapi displays the list of possible actions.
3. Drag the cursor onto the “NONE” action.
4. Click to validate it.

To Enable / Disable an action:

 If this item is checked, the action is enabled.

 If this item is not checked, the action is disabled.

♦ *Customize an action*

You customize each action by setting a trigger event and some parameters.
The customization area displays the parameters that apply to the current action. To change the current action, see on page 424.

Set a trigger event

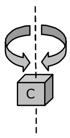
There are several possibilities:

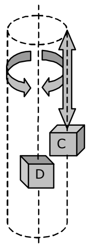
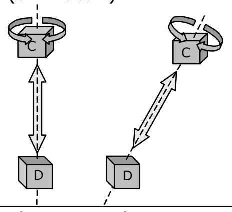
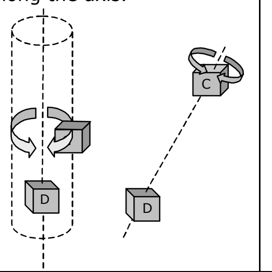
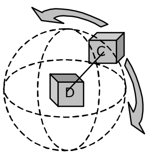
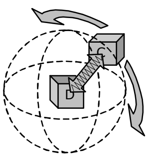
- **Opening:** The action is performed when the scene is initially opened (default).
- **Mouse over:** The action is performed when the mouse cursor is over the object and ends as soon as the the mouse cursor is no longer over it.
  Example: The object burns when the mouse cursor is over it; the flames disappear as soon as the mouse cursor moves off of it.
- **Mouse click:** The action is done when the object is clicked.
  Example: The object burns when it is clicked. It will not be possible to stop the flames.

Set the parameters of the actions

You can set parameters for each action from the gallery.

Action		Parameters		
Name	**Description**	**Title**	**Description**	**Default**
Annotate	Display a line of text just above the target object	**Target**	Object on which the action will be done. (see "Select an object" on page 429)	Current object
		Text	Enter the text to be displayed.	"Enter here"
		Size	Slider controls the string length relative to the the object's bounding box. 0= Text not visible 50= Same width as bounding box 100= The text is two times wider than the bounding box	50
Blink	Displays and erases the target object at regular intervals	**Target**	Object on which the action will be done. (see "Select an object" on page 429)	Current object
		Interval	Interval period of time in milliseconds	32
Highlight	Adds a highlight effect to the target object	**Target**	Object on which the action will be done. (see "Select an object" on page 429)	Current object
		Intensity	0= No effect 100= Maximum highlight	50
Drop	Disable the "Fixed" property of the target object.	**Target**	Object on which the action will be done. (see "Select an object" on page 429)	Current object
Shoot	Creates a directional force on the geometric center of the target object No effect on a fixed object	**Target**	Object on which the action will be done.	Current object
		Direction	♦ Along the X axis ♦ Along the Y axis ♦ Along the Z axis ♦ Auto (Along the camera-object axis)	Auto
		Intensity	0= No force 100= Maximum force	15
Teleport	Instantly moves the target object	**Target**	Object on which the action will be done. (see "Select an object" on page 429)	Current object
		Position	The geometric center coordinates of the target object at the destination position (voir « Set a coordinate" on page 429)	(0,0,0)

Action		Parameters		
Name	**Description**	**Title**	**Description**	**Default**
Move	Linear movement (translation) of the target object	**Target**	Object on which the action will be done. (see “Select an object” on page 429)	Current object
		Position	The geometric center coordinates of the target object at the destination position (voir ” Set a coordinate” on page 429)	(0,0,0)
		Speed	The slider tunes the action speed: 0= No movement 100= Very fast movement.	50
Spin 	Gives a rotation movement to the target object along an axis through its geometric center No effect on a fixed object. Best used in a world without gravity	**Target**	Object on which the action will be done. (see “Select an object” on page 429)	Current object
		Axis	X, Y, or Z	X
		Speed	Rotations per minute	10
Show	Unhide a hidden object.	**Target**	A hidden object to be displayed (see “Select an object” on page 429)	Current object
Hide	Hides the target object. It will not be subject to forces and events.	**Target**	Object on which the action will be done. (see “Select an object” on page 429)	Current object
Replace	Replaces the geometry of the target object with the geometry of the replacing object (The properties and behavior of the target object are retained.)	**Target**	Object on which the action will be done. (see “Select an object” on page 429)	Current object
		Replacing object	The replacing object (a hidden object in the scene) (see “Select an object” on page 429)	
Burn	Simulates the burning of the target object.	**Target**	Object on which the action will be done. (see “Select an object” on page 429)	Current object
		Intensity	Controls the flame’s intensity	25
Loads a web page	Displays the page you requested	**Address**	URL of the page to be loaded.	TGS Site
		Frame	Name of the frame where to load the page.	Current page

Action		Parameters		
Name	**Description**	**Title**	**Description**	**Default**
Cylindrical link 	The target object can move on the surface of a cylinder whose central axis passes through the geometric center of the trigger object. The object may both rotate around the axis and move along the axis. The axial link is a specific case of the cylindrical link: The target object is on one of the axes x, y, or z. (or "Auto") 	**Target**	Object on which the action will be done. (see "Select an object" on page 429)	Current object
		Axis	♦ Select the orientation axis: ♦ X ♦ Y ♦ Z ♦ Auto (along the trigger- target object axis)	Auto
		Translation Constraint	Check this box to not allow the object to move along the axis. 	Disabled
Spherical link 	The target object can move on the surface of a sphere. The center of the sphere is the geometric center of the trigger object. Remark: If one of the two object is fixed, we get a pendulum.	**Target**	The target object is linked with the trigger object. Object on which the action will be done. (see "Select an object" on page 429)	Current object
Spring link 	The spring link is a spherical link where the two objects are linked by a spring.	**Target**	The target object is linked with the trigger object. Object on which the action will be done. (see "Select an object" on page 429)	Current object
		Force	Set the speed which the spring will recover its initial shape.	50
		Damping	Set the weakening of the spring force.	20

Action		Parameters		
Name	**Description**	**Title**	**Description**	**Default**
Zoom	Brings the camera nearer the target object	**Target**	Object on which the action will be done. (see "Select an object" below)	Current object
		Magnification	This slider allows you to adjust the Camera - target object distance. 0%= The camera doesn't move 50%= The camera draw nearer the target object by the half of the initial camera - target object 100%= The camera is in the center of the target object.	50
		Speed	The slider controls the action speed: 0= No movement (no zoom) 100= Very fast movement (fast zoom).	20

❖ **Select an object**

When customizing an action, you may need to select an object.
There are two ways to do this:

Select from the list:

1. Check the box corresponding to the object to be selected (target or replacing). Amapi displays the name of the default object on the right hand of this box.
2. Click on this name to display the list of objects (or groups).
3. Drag the cursor onto the chosen object's name, then click again to validate.

Graphical selection:

1. Check the box corresponding to the object to be selected (target or replacing). Amapi displays the name of the default object on the right hand of this box.
2. Click on the icon which is the right of the name of the default object. Then click on the object to be selected in the display window. Don't hesitate to use the navigation arrows to adjust the view so that you can set the coordinates in the three dimensions (see chapter "Navigation" on page 91).

❖ **Set a coordinate**

When customizing an action, you may need to specify a point in space. There are two ways to do this:

Entering the coordinates with the keyboard:

- By using the TAB key 

1. Use the TAB key to access the next coordinate (the first coordinate, if this is the first time you press this key).
2. Enter a new value.
3. To enter the next value (if needed), return to step 1.
4. Press the "Enter" key to validate all the values.

- By clicking in the data display area

1. Click in the data display area of the coordinate to be modified.
2. Enter a new value.
3. Use the TAB key to access the next coordinate and return to step 2.
   Or
   Press the "Enter" key to validate all the values.

Graphically:

Click on the  icon which is to the right of the coordinate ault object. Then click on the new position in the display window. Don't hesitate to use the navigation arrows to adjust the view so that you can set the coordinates in three dimensions (see chapter "Navigation" on page 91).

10.2.7 The gallery of actions

The catalog of actions is a gallery displaying all the AMAPI 3D actions that can be customized.

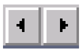
- Browsing the gallery

AMAPI 3D provides several ways to browse its catalog.

♦ ***Browse a page***

A thumbnail depicts each action; its name is displayed.
For more information see chapter "Customize an action" on page 425.

♦ ***Scrolling the pages***


When you scroll through the catalog pages, you will replace the complete line of thumbnails with the thumbnails from the next or the previous page.
Click on the right hand arrow to go to the next page and on the left hand arrow to go to the previous page.

- Add an action to the behavior of the current object

You can choose between two methods to add an action to the behavior of an object:

1st method: Directly in the list of the actions assigned to the behavior of the current object (see chapter "Choose an action in the gallery" on page 424.

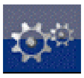
2nd method: By dragging an action from the gallery onto the object you have chosen in the scene display area.
Assign an action to an object or a group:
1. Browse the gallery to choose an action.
2. Place the cursor on the thumbnail depicting this action, then press and hold the mouse button.
3. Drag the cursor into the scene display area and place it over the desired object.
4. Release the mouse button.

10.2.8 The Command bar

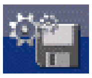
- Information

 Click on this icon to get information.

- Control the "dynamized" scene

 By clicking on this icon, you can preview the effects of the scene in the browser, then return to the 3Space Dynamics Editor.

- Saving the "dynamized" scene

 When you save the 3Space scene, the following items are saved:

- An XML document describing the dynamics of the scene (See chapter « The document » on page 411).
- A Zap (.Z3d) format file containing the 3D geometry and textures (See chapter « The Zap format » on page 411).
- An HTML page that instantiates the scene and the 3Space player.

These three files will have the same name and will be saved in the same folder. You can:

- Name these files or change their names.
- Choose the folder where you will save these three files.

How to save?

1. Click on the "Save" icon to get the dialog window (if the file was already saved, it will ask you to save it with the same name in the same folder).
2. Change the folder if you don't want to use the one that Amapi suggests.
3. Change the name of the files to be saved.
4. Press Enter or click on the Save button.

- Leave

 Click on this button to leave the 3Space Dynamics Editor.

11 Window

The "Window" menu manages the open AMAPI 3D documents.

11.1 Open a new window

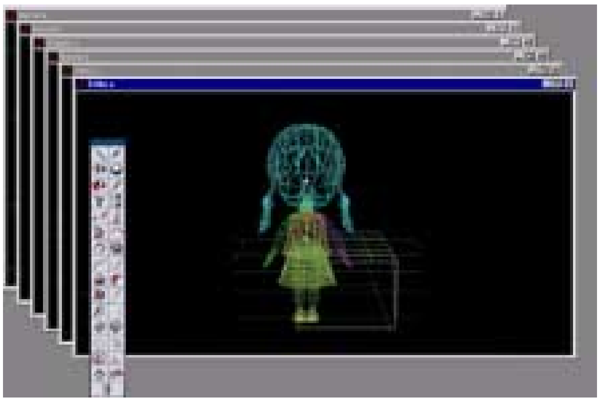
This command allows you to create a new window containing an empty document.

11.2 Close all

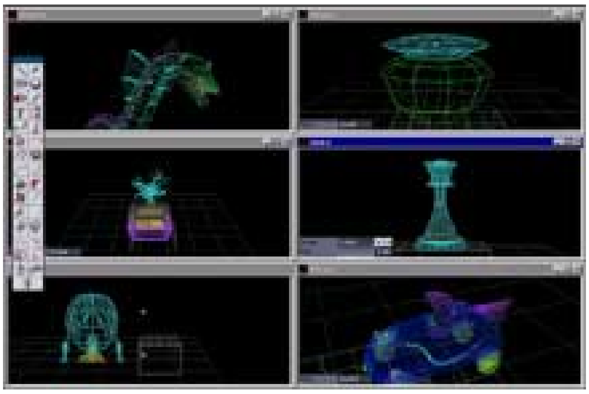
This command closes all the open AMAPI 3D documents.

11.3 Cascade

This command displays all the open AMAPI 3D documents, one on top of another.
You will then be able to resize and position them.
Click on the window of the document you wish to work on.
If you double click on a window, it will be displayed full-screen size, hiding the others.



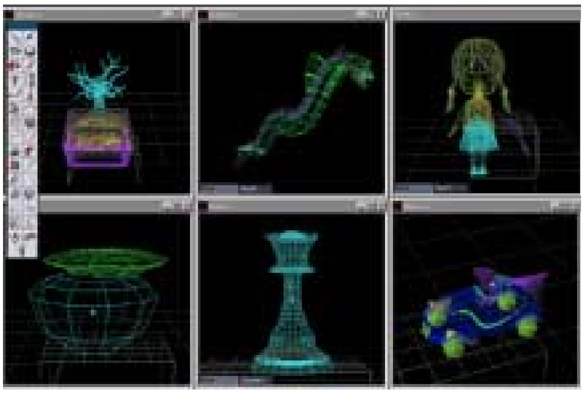
11.4 Tile windows horizontally



This command displays all the open AMAPI 3D documents, side by side, such that the windows are wider than they are tall.
You will then be able to resize and position them.
Click on the window of the document you wish to work on.
If you double click on a window, it will be displayed full-screen size, hiding the others.

11.5 Tile windows vertically

This command displays all the open AMAPI 3D documents, side by side, such that the windows are taller than they are wide.
You will then be able to resize and position them.
Click on the window of the document you wish to work on.
If you double click on a window, it will be displayed full-screen size, hiding the others.



11.6 Document

The Window menu displays a detailed list of all the open AMAPI 3D documents. You can designate one of them as the current document, as follows: holding down the mouse button, move the cursor downward until you highlight the name of the document you wish to work on, then release the mouse button.

12 Preferences

You can customize AMAPI 3D according to your needs.

12.1 Interface

This menu allows you to customize the AMAPI 3D interface, i.e., the way that you communicate with your software. As you master AMAPI 3D, you will adapt it to your needs and capabilities.

12.1.1 Dialogs

❑ Language

Use this command to specify the language used for displaying messages.

To date, you can choose from the following languages:
- English
- French

Highlight the desired language and release the mouse button (left button on PC).

❑ Tool palettes

AMAPI 3D supports three tool palettes:
- Construction
- Modeling
- Assembly

You can choose between two interfaces:

♦ *“Workshop“ (the classical AMAPI 3D interface):*

○ Standard ⊗ Workshop

Construction Palette *Modeling Palette* *Assembly Palette*

This interface was ergonomically designed so as to allow the user’s movements to follow as closely as possible the natural movement of a designer at the drawing table, or a sculptor in his / her workshop.
The floating tool palettes are displayed on the top right side of the scene. Within a palette, each tool is represented by an icon.

❖ **How do you select a tool?**

1.Before using a tool, make sure that the current (selected) object is the one you want to work on (see chapter “Current object concept” on page 166).

2. Click on the icon depicting the tool you want to use.

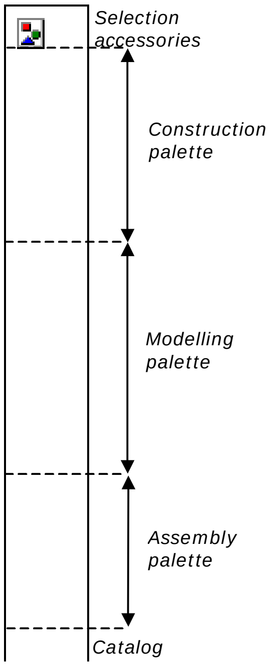
❖ **How do you switch tool palettes?**

To switch tool palettes, if you have chosen the Workshop interface, move the cursor out of the scene by the right hand side of the screen and then back into the scene.

❖ **How do you end the action of a tool?**

There are two ways to do this:
Validate the action:
⇒ In the Assistant Palette: Click on the “OK” button.
or
⇒ Through the keyboard: Press the Return key.
Validating an action puts the tool aside: the cursor switches back to the object selection accessory , which allows you to select another element or tool.
Put the tool aside:
Move the cursor out of the scene through the right hand side of the screen to put the tool aside (to drop it) and move it back into the scene. You will then be able to select another element or tool.

♦ ***“The Standard Interface”***



⊗ Standard ○ Workshop

The advantage of this interface is that it is familiar to most users**.**
The three tool palettes are grouped into a single palette displayed at the left-hand side of the screen. You can position it anywhere you want in the scene.

A black arrow indicates tools that unfold.

❖ **How do you select a tool?**

1. Before using a tool, make sure that the current (selected) object is the one you want to work on (see chapter “Current object concept” on page 166).
2. Click on the icon depicting the tool.

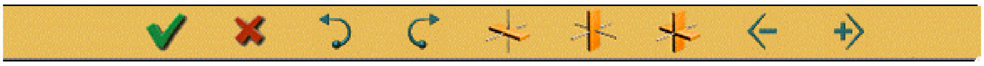
❖ **How do you change tool palette?**

Using this interface, the three tool palettes are constantly displayed. Therefore, you do not need to change palettes.

❖ **How do you end the action of a tool?**

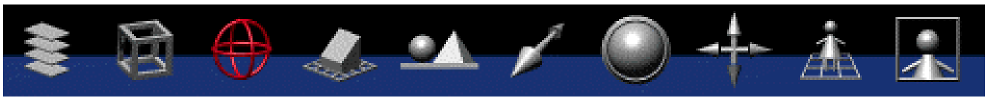
There are two ways to do this:
Validating the action:
⇒ In the Assistant Palette: Click on the “OK” button.
or
⇒ Through the keyboard: Press the Return key.
Validating the action causes the tool to be dropped. The cursor switches back to the object selection accessory , allowing the user to select another element.
Putting the tool aside:
Selecting another tool automatically drops the previous tool.
⇒ Select another tool in the Tools Palette to continue working on the current palette.
Or
⇒ Select a construction tool to build a new object.

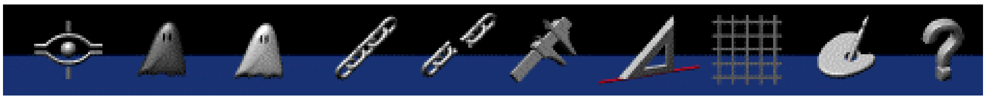
❑ The Assistant Palette



The Assistant Palette has been specifically designed to give you information and guide you through your first projects with AMAPI 3D. It will help you get acquainted with AMAPI 3D quickly. Once you are familiar with it, you can turn off the Assistant Palette, which will give you a larger work space. (See chapter " Assistant Palette" on page 98) Just deactivate the palette if you don't want it displayed.

❑ Control Panel





The Control Panel displayed at the bottom of the screen provides modeling support features. These features will help you get the most from your AMAPI 3D software. (See chapter " Control Panel" on page 111.)
You can choose between three types of interface for the Control Panel:

- ***Control Panel always displayed at the bottom of the screen:***

  ⊗ Activated ○ Automatically hidden

- ***Control Panel automatically hidden:***
  The advantage of this interface is that it frees up work space since the Control Panel is displayed only when you ask it to be. Just move the cursor to the bottom of the screen to have it appear. The Control Panel will disappear as soon as the cursor is back in the scene.

  ⊗ Activated ⊗ Automatically hidden

- ***Control Panel always hidden:***
  This choice frees the most work space. However, you will have to use hotkeys to access the Control Panel tools (see chapter "Shortcuts" on page 88.)

  ○ Activated ○ Automatically hidden

12.1.2 Work Space

- Bounding box

This option is used to display objects as a bounding box when you move them or the scene around. This option speeds up navigation in the working scene.

- Table ("Workbench")

In the center of an empty scene is a table on top of a grid.
You build your model on the table and use the grid and the table as visual references to locate yourself in space.
However, you may want to hide the grid or the table.
Click on this command to hide the table. Click again to have it re-appear.

⚠ Caution, you must restart AMAPI 3D for your choice to take effect.

- Grid

In the center of an empty scene is a table on top of a grid.
You build your model on the table and use the grid and the table as visual references to locate yourself in space.
However, you may want to hide the grid or the table.
Click on this command to hide the grid. Click again to have it re-appear.

⚠ Caution, you must restart AMAPI 3D for your choice to take effect.

- Background image

To add realism to your work, AMAPI 3D allows you to display your models on top of a background image.

⇒ Check the "Background image" box.
⇒ Follow the instructions in the dialog box to specify the file containing the background image.

- Rotation speed

This command is used to set the speed at which the user's eye rotates around the scene.
You will just need to set a value between 1 and 10.
A value of 1 is the slowest speed and a value of 10 the fastest.

12.1.3 Display mode (for objects)

This command opens a dialog box for specifying how you want the current scene to be displayed. Select the desired display mode from the list of choices:

- Basic Wireframe
- Lit Wireframe
- Flat Solid
- Smooth Shading
- Smooth Solid

Shaded mode increases the intuitiveness and the realism of the models.
Wireframe mode is better suited for tasks requiring precision.

12.1.4 Size of the points

- Points defining a curve

  Move the Slider to increase the displayed size of the points.

- Selected points

  Move the Slider to increase the displayed size of the points.

12.2 Units

Units:
You can specify the units you want to work in: millimeters (mm), centimeters (cm), meters (m), inches (fractions), numerical inches, pixels (screen units), or none (virtual units).

Depth:
You can specify the number of places after the decimal point to be displayed.

Angular:
You can also specify the units of angular values (degrees or radians).

Absolute or Relative mode:

- In absolute mode, coordinates are measured relative to the origin, which is by default the center of the workbench.
- In relative mode, coordinates are measured relative to the last point created. (You can specify a different origin for Absolute mode).

Origin:
You can change the origin of the absolute coordinate system to somewhere other than the center of the table (if you selected this mode).

- Click on the "Fixed" button,
- AMAPI 3D displays the point selection accessory . Use it to assign a point of the scene.

Or:

- Enter the origin coordinates (x,y,z) in the editable areas of the Data Window.

Scale:
You can change the working scale:

- Enter a percentage of scaling in the Data Window (default: 100%).
- Or, click on the icon depicting a sub-menu and select from the choices provided.
- Or click on the "Set it" button, then select two existing points with the point selection accessory **.** The distance between the two points becomes "1 unit" of the current unit.

Automatic Positioning of the axes:
You can **automatically position the origin of the axes (graduated rules)** used with the "3D Primitives" or the "Draw" tool.
If you select this option, the origin of the axes will be automatically positioned on the target point of the scene (see chapter "Point of view (Eye – Target point)" on page 134).
If you do not select this option, some tools will require you to set the origin manually. During this extra step, the origin of the axes will follow the cursor. Move the cursor to the desired location and click.

12.3 Import-Export

You can specify how AMAPI 3D will handle in and out communications with other applications.

- You can, of course, select the desired file format from the list of choices. **AMAPI 3D automatically adds the correct file extension to the file name.**
- **Extension:** Specifies the default suffix added to exported files.
- **Switch axes**: Not all 3D software packages use the same orientation for X, Y, and Z. This option allows you to modify the spatial orientation of imported or exported objects. If you notice that the models you import from or export to another application do not have the correct spatial orientation, use this feature to put things back into place.
- **Scale factor**: These values represent the scale (increase or decrease) applied to scenes when reading / writing files in the specified file format. This ensures the consistency of dimensions between AMAPI 3D and other software applications.
- **Clean**: You may want to delete coplanar facets when reading large or complex files. This option will merge all coplanar faces in imported files. This is particularly useful when reading file formats that triangulate facets.
- **Smoothing / smoothing angle**: You may choose to export your models automatically smoothed and set the smoothing angle yourself. This may facilitate communication with other rendering programs.
- **Rendering pre-calculation** (AMAPI 3D format only): The rendering image calculation is made in two times. The first time needs a quite long calculation, and the second one is faster.
  AMAPI 3D allows you to save the first pass result with the file. The next file saving will be quicker.

  The file saving "with Rendering pre-calculation" increases significantly the file size.

12.4 Printer

This command opens a dialog box to specify the printing parameters.

- You can choose "Pri**nt the Measurements**" (see chapter "Measurements" on page 143).
- You can choose to print in "**Backface culling**". If you check this box, AMAPI 3D will print only the edges that would be visible (even partially) to the user's eye if the facets were solid (see chapter "Backface culling" on page 128).
- You can set a **scale factor**.

12.5 Recovery

12.5.1 Automatic backup

This feature saves all the shapes (even hidden) every "n" minutes in a backup file. When activating this option, you can specify the file location and name where the backup file will be automatically stored (click on "default folder").

12.5.2 Undo level

This feature allows you to specify the maximum number of undos you can perform successively.
An undo (see chapter "Undo" on page 85) cancels:
- ♦ Within a tool: The last operation performed by the current tool.
- ♦ Outside a tool: All the operations performed by the last tool used.

Management of the undos is dynamic, meaning that in most cases, it does not consume a great deal of memory (RAM). Nevertheless, do not set a large value for this parameter, especially if your system is short of RAM.
Be aware that some tools require more RAM than others, the Cut tool, for instance.

12.5.3 Crash file

Click on the "Crash File" button to change the file name where the current scene will be saved in case of abnormal termination of the application.

12.6 Constraints

AMAPI 3D allows you to snap the cursor onto an existing point or a specific point on a segment (relative to the nearest end).

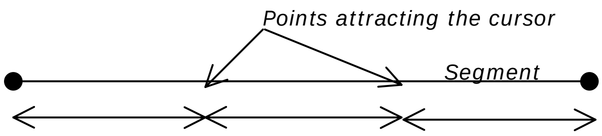
Check the designated box in the "Preferences – Constraints" dialog box to activate / deactivate this feature of the cursor.

- On a point
- On a segment

If you checked the "Snap onto a point" box:
The shift key will have the cursor snap to existing points.

If you checked the "Snap onto a segment" box:
You will need to specify the length of the spacing onto which the cursor will snap.

The shift key not only snaps the cursor onto existing points if you specified it in the Preferences - Constraints, but will also snap the cursor onto user-defined spacing along the segments (spacing relative to the nearest end).



12.7 Macintosh

This command of the Preference menu is used to set parameters for Apple Macintosh computers only.

Display AMAPI 3D as icon on the desktop:
When this feature is activated, an AMAPI 3D logo will be visible at the top left corner of the desktop when you temporarily leave AMAPI 3D. Click on this icon to go back to AMAPI 3D.

QuickDraw display (slower):
To increase the redraw speed, we have implemented our own graphics engine, which replaces the Macintosh graphics manager when using AMAPI 3D. If your system has a graphics accelerator, you may be able to increase the display speed by activating this feature.

Quick allocation:
This option accelerates AMAPI 3D significantly but also increases the RAM requirements. Modify the value of the Macintosh memory allocator. If the "Memory failure" message appears, increase this value slightly.

Print:
You can define the font used for printing as well as its size and style. This option is also available for Illustrator and PICT outputs.

Font:
You can choose the font to be used in the interface and in the dialog boxes.

Practical Exercises

The "Practical Exercises" chapter was specially created to help you build your first models and to answer the questions that are likely to come up as you create your own more complex models. The models presented here are from a variety of different fields, including architecture, interior design, furniture design, packaging, and illustration. The construction of each model has been divided into actions, which have been further subdivided into one or more steps. Each step shows the use of one tool.

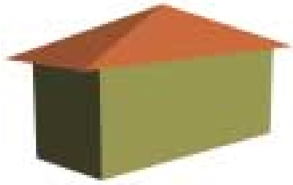
Included with AMAPI 3D is a directory called "Exercises" that contains sample model files for the exercises in this chapter. Each file corresponds to the state of a model before an action. You can go directly to the file that shows the model in the state that will help you with your specific question; you don't have to start from the initial state of the model.
In addition to providing detailed instructions and illustrations, each exercise also tells you which chapter / section in the User's Guide to read for further details. Some exercises also suggest alternate methods for accomplishing the same task. You are encouraged to experiment with and compare the different methods to see which ones are best suited for your needs.

The AMAPI 3D tools are easy to learn and easy to use. You can use them together to create a wealth of beautiful and useful models, limited only by your imagination. The power of AMAPI 3D is yours. Now, put your clever and creative mind to work and create some awesome models!

TGS provides additional practical exercises: visit our Internet web site ***www.tgs.com****.*

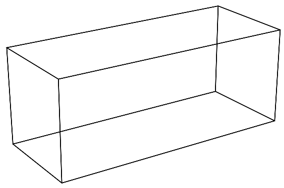
1. A LITTLE HOUSE

This little house is an exercise that will show you how delightfully easy it is to use AMAPI 3D!



The little house's base

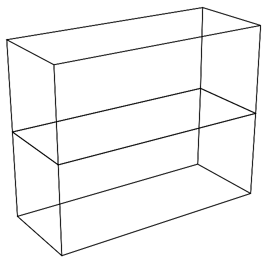
- ❑ **Tool:** Cube
- ❑ **Do this:**
  Draw a 20x20x50 cube. This will be the house's base.
- ❑ **See the detailed explanations in the chapter:**
  "Cube" en page 173.



The little house's roof

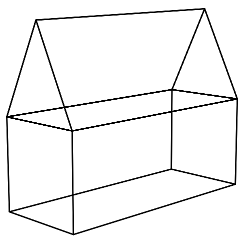
Step 1: Rough sketch

- ❑ **Tool:** Snap (+Control)
- ❑ **Open the model file:** Mt1
- ❑ **Do this:**
  1. We will make a copy of the cube and snap it over the first one, in only one step.
  2. Press and hold the Control key and click on the Snap tool.
  3. Click on the lower left corner of the house.
  4. Then click on the corner just above.
- ❑ **See the detailed explanations in the chapter:**
  "Snap" on page 336.

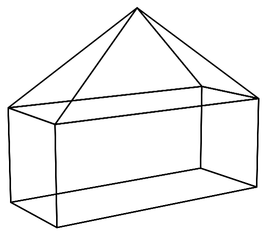


Step 2: Make a roof with two sloping sides

- ❑ **Tool:** Weld
- ❑ **Open the model file:** Mt2
- ❑ **Do this:**
  We will use the weld tool to weld the two left corners together and the two right corners together. The result is a roof with two sloping sides.
- ❑ **See the detailed explanations in the chapter:**
  "Weld" on page 341.



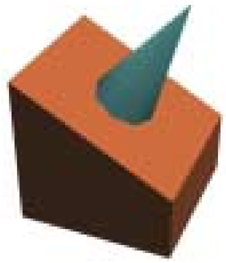
Step 3: Make a roof with four sloping sides



- **Tool:** Weld
- **Open the model file:** Mt3
- **Do this:**
  Weld the two upper corners of the roof together.
  The result is a pyramid.
- **See the detailed explanations in the chapter:**
  "Weld" on page 341.

2. A CONE ON A SLOPING PLANE

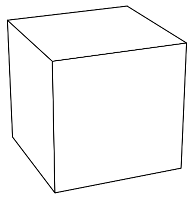
Although this is a very simple model, it demonstrates the steps commonly used to create models with AMAPI 3D:



1. ***BUILD** the construction lines, meshes or basic volumes. Here a cube will be the base for the sloping plane and a circle will be the base for the cone.*
2. ***MODEL** by modifying the construction shapes. Here we will cut the cube to make a sloping plane.*
3. ***ASSEMBLE** the parts to make the final scene. Here we will place the cone on the sloping plane.*

The sloping plane

Step 1: Make a cube



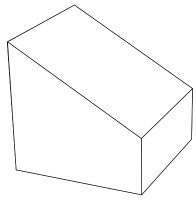
- **Tool:** Cube
- **Do this:**
  We draw a cube.
- **See the detailed explanations in the chapter:**
  "3D Primitives / Cube" en page 173

Step 2: Cut the cube

- **Tool:** Cut
- **Do this:**
  1. Take the Cut tool.
  2. Click to indicate the origin of the action.
  3. Click again to set the pivot point of the cutting angle.
  4. Click to validate.

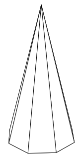
  ⚠ The cut edge is open.
- **See the detailed explanations in the chapter:**
  "Cut" on page 299.

Step 3: Create the sloping plane's face



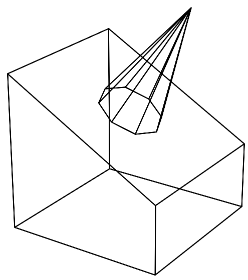
- **Tool:** Surface Extract
- **Do this:**
  Do a manual or automatic extraction of the face.
- **See the detailed explanations in the chapter:**
  "Facet Extraction" en page 206.

The cone



- **Tool:** 3D Primitives / Cone
- **Do this:**
  The "Cone" tool will ask you:
  To draw the base circle of the cone.
  To extrude the circle in the direction of the desired height of the cone.
- **See the detailed explanations in the chapter:**
  "3D Primitives" / "Cone" en page 176.

Put the cone on the sloping plane



- **Tool:** Lay On
- **Open the model file:** Poser
- **Do this:**
  1. Select the Lay On tool (the cone is the current object).
  2. Click the face under the cone.
  3. Now, click on the sloping plane.
  4. The geometric centers of the two faces are against each other. If necessary, you can cancel the operation (PC: CTRL+Z or Mac: Command+Z) and do it again with another face of the cube.
- **See the detailed explanations in the chapter:**
  "Lay On" on page 339.

3. PIPES

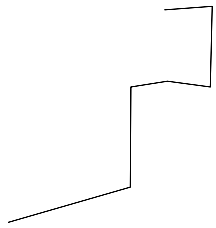
This exercise shows one way to design a pipe:

- *Draw the path.*
- *Make the elbows (with the Chamfer tool).*
- *Give the pipe thickness.*

There are also other quick and easy ways to make pipes!

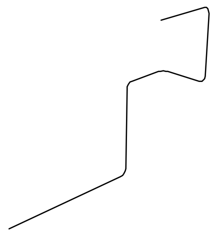
Draw the path

- **Tool:** 2D Drawing tool, Polyline
- **Do this:**
  1. Select the Polyline tool.
  2. Draw a path for the pipes in 3 space. Don't concern yourself with the elbows, just draw the path followed by the pipes.
- **See the detailed explanations in the chapter:** "Drawing / Polyline" on page 194.



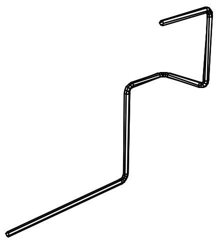
Make the elbows

- **Tool:** Chamfer
- **Open the model file:** Tuyau1
- **Do this:**
  1. Select the Chamfer tool.
  2. Set a value for each elbow (or one for all).
  3. Validate.
- **See the detailed explanations in the chapter:** "Chamfer" en page 290.

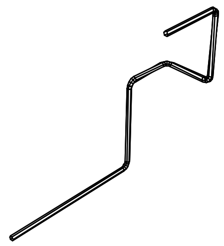


Set the diameter of the pipe

- **Tool:** Thickness
- **Open the model file:** Tuyau2
- **Do this:**
  1. Select the Thickness tool.
  2. Set the thickness to 3.
  3. Set the number of points to 6.
  4. Validate.
- **See the detailed explanations in the chapter:** "Thickness" on page 294.



Apply smoothing



- **Open the model file:** Tuyau3
- **Tool:** Smooth
- **Do this:**
  1. Select the Smooth tool.
  2. Set the smoothing value to 1.
  3. Validate.
- **See the detailed explanations in the chapter:** "Smooth" on page 276.

4. A CHAMPAGNE CAP

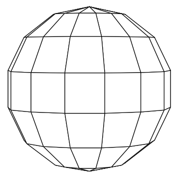
Once again this is a very simple model, and again you will use the basic steps commonly used to create models with AMAPI 3D:

1. ***BUILD** the construction lines, meshes or basic volumes. Here a sphere will be used for the head of the cap and a circle for the body.*
2. ***MODEL** by modifying the construction shapes. Here we will cut and squash the sphere to make the head of the cap.*
3. ***ASSEMBLE** the parts to make the final scene. Here we will assemble the head and the body.*

The cap's head

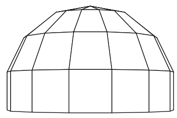
Step 1: Make a sphere

- **Tool:** Sphere
- **Do this:**
  Create a sphere.
- **See the detailed explanations in the chapter:**
  "3D Primitives / Sphere" en page 169.



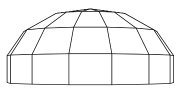
Step 2: Make a half sphere

- **Tool:** Delete Facet
- **Do this:**
  1. With the Delete Facet tool and the Lasso (PC: Click the right button / Mac: Command+click), select the lower half of the sphere.
  2. Validate. It is removed.
- **See the detailed explanations in the chapter:**
  "Delete" on page 272.

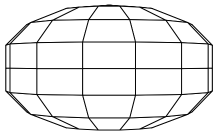


Step 3: Squash the half sphere

- **Tool:** Scale
- **Do this:**
  Take the Scale tool and squash the half sphere slightly, as shown.
- **See the detailed explanations in the chapter:**
  "Scale" en page 332.



Step 4: Mirror the half head



- **Tool:** Symmetry
- **Do this:**
  Mirror the half sphere under itself.
- **See the detailed explanations in the chapter:**
  “Symmetry” on page 323.

Step 5: Weld the two half heads

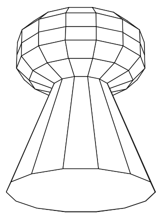
- **Tool:** Weld
- **Do this:**
  Weld the two parts of the head together.
- **See the detailed explanations in the chapter:**
  “Weld” on page 341.

Step 6: Prepare the beginning of the body

- **Tool:** Delete Facet
- **Do this:**
  1. With the Delete Facet tool and the Lasso (PC: Click the right button / Mac: Command+click), select the lower row of facets.
  2. Validate. They are removed.
- **See the detailed explanations in the chapter:**
  “Delete” on page 272.

The cap’s body

Step 1: The cap’s body



- **Tool:** Curve Extract
- **Open the model file:** 3Dline1
- **Do this:**
  Select the Curve Extract tool and validate. A circle is automatically created.
- **See the detailed explanations in the chapter:**
  “Extract Curve” on page 204.

Step 2: The cap’s body (continued)

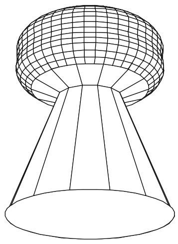
- **Tool:** Extrusion
- **Do this:**
  With the Extrusion tool, build the body and close the bottom.
- **See the detailed explanations in the chapter:**
  “Extrusion” en page 209.

Head and body assembly

- **Tool:** Weld
- **Do this:**
  Weld together the head and the body. The result is a champagne cap!
  For the finishing touch, apply a nice texture.
- **See the detailed explanations in the chapter:**
  "Weld" on page 341.

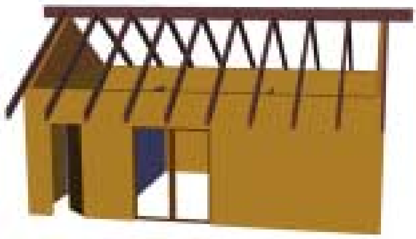
Smoothing the cap

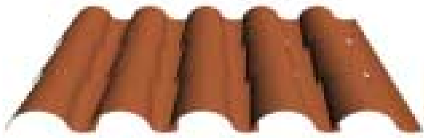
- **Tool:** Smooth (partial smoothing)
- **Open the model file:** 3Dline2
- **Do this:**
  1. To avoid undesired deformations on the body, select only the upper portion of the cap.
  2. Apply a smoothing with a value 3.
- **See the detailed explanations in the chapter:**
  "Smooth" on page 276.



5. A HOUSE

The following model is not warranted by an architect – it was designed for tutorial purposes only <smile>.
To build this house, we will start with the walls, then add the roof.





The carpentry is very simple – there is only a main beam and some rafters. Later, we will see how to design tiles to protect our home against the rain.

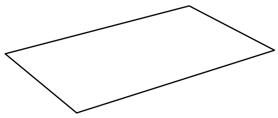
The walls

Step 1: Set the preferences

- **Do this:**
  In the menu Preferences / Units choose centimeters with 2 decimal places (see chapter " Preferences / Units" on page 441).

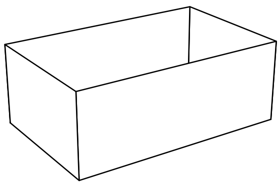
Step 2: Drawing

- **Tool:** Drawing tool, Rectangle
- **Do this:**
  1. Face view, then top view (keys 2, then 5).
  2. With the Rectangle tool, draw a 800x500 cm rectangle.
- **See the detailed explanations in the chapter:**
  "Drawing / Rectangle" on page 191.



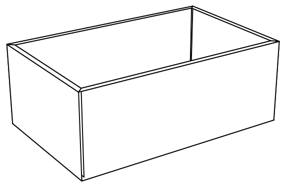
Step 3: Extrude the walls

- **Tool:** Sweep
- **Open the model file:** M01
- **Do this:**
  1. Face view (key 2).
  2. Select the Sweep tool.
  3. With the spacebar, constrain cursor movement to the vertical axis.
  4. Sweep toward the top, to a value of 300 cm.
  5. Don't click the ends (in red) because you don't want to close them.
- **See the detailed explanations in the chapter:**
  "Sweeping" on page 220.
  "Cursor movement and positioning constraints" on page 98.



Step 4: Wall thickness

- **Tool:** Thickness
- **Open the model file:** M02
- **Do this:**
  1. Select the Thickness tool.
  2. Specify a thickness value (20 cm) inside the house. (Press the spacebar if necessary to change the thickness direction.)
- **See the detailed explanations in the chapter:**
  "Thickness" on page 294.
  "Cursor movement and positioning constraints" on page 98.



Step 5: Measurements

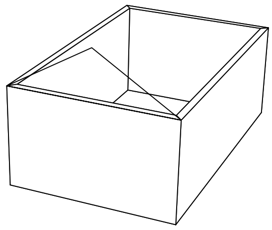
- **Tool:** Measure
- **Open the model file:** M03
- **Do this:**
  1. Select Measures.
  2. Verify that the length of the large wall is 760 cm (interior dimension) and 800 cm (exterior dimension).
  3. Click in the black hole to suppress display of the dimensions.
- **See the detailed explanations in the chapter:**
  "Measurements" on page 143.

The peaks

Step 1: Draw the rectangle of the base

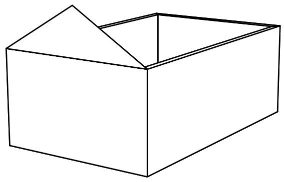
- **Tool:** Drawing tool, Rectangle
- **Open the model file:** M04
- **Do this:**
  1. Side view (key 4).
  2. Select the Rectangle tool.
  3. Apply a constraint using the Shift key on the top left corner of the house.
  4. Draw a rectangle, 500 cm wide by 150 cm high.
- **See the detailed explanations in the chapter:**
  "Drawing / Rectangle" on page 191.
  "Cursor movement and positioning constraints" on page 98.

Step 2: Change the rectangle into a triangle



- ❑ **Tool:** Weld
- ❑ **Open the model file:** M04
- ❑ **Do this:**
  1. Select the Weld tool.
  2. Weld the two top corners of the rectangle. The result is a triangle.
- ❑ **See the detailed explanations in the chapter:** "Weld" on page 341.

Step 3: Make a triangular surface



- ❑ **Tool:** Surface Extract
- ❑ **Open the model file:** M05
- ❑ **Do this:**
  1. Be sure that the triangle is the current object.
  2. Select the Surface Extract tool.
  3. Press the Return key.
  4. Put aside the tool. If you press the Return key, the scene is rendered and you will see the generated face.
- ❑ **See the detailed explanations in the chapter:** "Facet Extraction" en page 206.

Step 4: Give thickness to the peaks

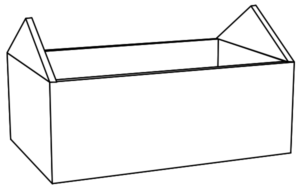
- ❑ **Tool:** Thickness
- ❑ **Open the model file:** M06a
- ❑ **Do this:**
  1. Face view (key 2).
  2. Select the Thickness tool.
  3. The thickness appears on the triangle face.
  4. Enter the value: 20 cm.
  5. If necessary, press the spacebar to change the thickness direction.
- ❑ **See the detailed explanations in the chapter:** "Thickness" on page 294.

Step 5: Make 2nd peak (1st method: Duplicate)

- ❑ **Tool:** Duplicate
- ❑ **Open the model file:** M06b
- ❑ **Do this:**
  1. Face view (key 2).
  2. Select the Duplicate tool.
  3. Apply a horizontal constraint (spacebar) and a move of 780 cm (the house's length – the wall thickness).
- ❑ **See the detailed explanations in the chapter:** "Duplicate" en page 314.
  "Cursor movement and positioning constraints" on page 98.

Step 5a: Make 2nd peak (2nd method: Snap + Control)

- **Tool:** Snap (+ Control)
- **Open the model file:** M06b
- **Do this:**
  1. Face view (key 2).
  2. Hold down the Control key and select the Snap tool. This will make a copy of the current object.
  3. Click a point on the base of the triangle and click the point on the other wall where the copy should be placed.
  4. This makes a copy of the current object and snaps it on to another object.



- **See the detailed explanations in the chapter:**
  “Snap” on page 336.

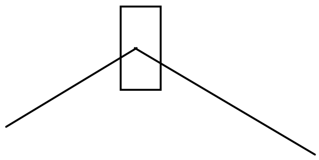
Step 5b: Weld the peaks with the walls

- **Tool:** Weld
- **Open the model file:** M06c
- **Do this:**
  Weld together the walls and the peaks.
- **See the detailed explanations in the chapter:**
  “Weld” on page 341.

The main beam

Step 1: Draw the section

- **Tool:** Drawing tool, Rectangle
- **Open the model file:** M07
- **Do this:**
  1. Side view (key 4).
  2. Select the Rectangle tool.
  3. Draw a rectangle, 15x30 cm.



- **See the detailed explanations in the chapter:**
  “Drawing / Rectangle” on page 191.

Step 2: Place the section on the top of the peak

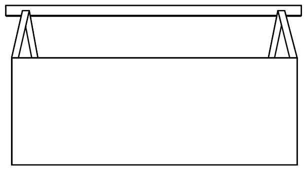
- **Tool:** Snap
- **Open the model file:** M08
- **Do this:**
  1. Side view (key 4).
  2. Select the Snap tool.
  3. Place the center of gravity of the rectangle on the top of the roof (Use the Zoom and Perspective functions if necessary.)
- **See the detailed explanations in the chapter:**
  “Snap” on page 336.
  “The Views” on page 133.
  “Perspective” en page 132.

Step 3: Offset the beam

- **Tool:** Move
- **Open the model file:** M08
- **Do this:**
  1. Face view (key 2).
  2. Select the Move Tool.
  3. Move the rectangle by 50 cm toward the left (-50) with a horizontal axis constraint to avoid any other offsets.
- **See the detailed explanations in the chapter:**
  “Move” on page 330.
  “Cursor movement and positioning constraints” on page 98.

Step 4: Extrude the beam

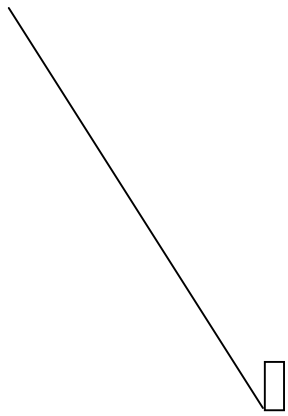
- **Tool:** Sweep
- **Open the model file:** M09
- **Do this:**
  1. Select the Sweep tool.
  2. Extrude the rectangle toward the right with a 900 cm value (with horizontal axis constraint) then click at each end (red) to close the beam.
- **See the detailed explanations in the chapter:**
  “Sweeping” on page 220.
  “Cursor movement and positioning constraints” on page 98.



The rafters

Step 1: Draw the base line

- **Tools: 2D Drawing tool, Polyline**
- **Open the model file:** M10
- **Do this:**
  1. Side view (key 4).
  2. Unhide the triangle that was the base of the peak (Unhide).
  3. Hide the house and the beam to make the scene less cluttered.
  4. Select the 2D Drawing tool, Polyline.
  5. Apply a constraint using the Shift key on the top of the triangle. Draw a line (use polar coordinates) 400 cm long with constraint (Control+Shift and click on the point) on the triangle base (release Control but hold Shift).
  6. Hide the triangle.
- **See the detailed explanations in the chapter:**
  “Drawing / Polyline” on page 194.“Hide-Unhide” en page 138.
  “Cursor movement and positioning constraints” on page 98.

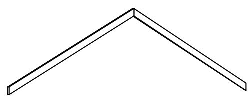


Step 2: Draw the rafter section

- **Tools: Drawing tool, Rectangle**
- **Do this:**
  1. Face view (key 2).
  2. With the Rectangle tool, draw a rectangle, 8x20 cm.
- **See the detailed explanations in the chapter:**
  “Drawing / Rectangle” on page 191.

Step 3: Make a half rafter

- **Tool:** Extrusion
- **Open the model file:** M11
- **Do this:**
  1. Be sure that the segment is the current object.
  2. Select the Extrusion tool.
  3. Click on the rafter’s section.
  4. Then click both ends (red) to close the rafter.
- **See the detailed explanations in the chapter:**
  “Extrusion” en page 209.



Step 4: Place the half rafter

- **Tool:** Snap
- **Do this:**
  1. Unhide the walls.
  2. Select the Snap tool.
  3. Snap the rafter’s base to the peak.
- **See the detailed explanations in the chapter:**
  “Snap” en page 336.
  “Hide-Unhide” en page 138.

Step 5: Mirror the half rafter

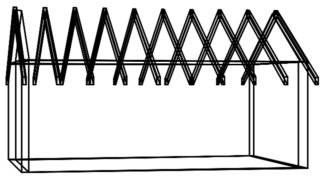
- **Tool:** Symmetry
- **Open the model file:** M11
- **Do this:**
  Do a vertical mirror of this half rafter.
- **See the detailed explanations in the chapter:**
  “Symmetry” on page 323.

Step 6: Weld the two half rafters

- **Tool:** Weld
- **Open the model file:** M11
- **Do this:**
  1. Weld the two half rafters together.
  2. The first pair of rafters is finished.
  3. Unhide the walls.
- **See the detailed explanations in the chapter:**
  “Weld” on page 341.
  “Hide-Unhide” en page 138.

Step 7: The series of rafters

- **Tool:** Duplicate
- **Open the model file:** M13
- **Do this:**
  The length to be covered is: 800 – 8 (thickness of the first rafter) = 792 cm,
  If we add 9 rafters, the gap between them will be 792 / 9 = 88 cm.
  1. Be sure that the first rafter is the current object.
  2. Select the Duplicate tool.
  3. Press the Tab key to enter the numerical values:
  4. Number of objects: 10 + Return.
  5. X axis offset: 88 (Y and Z remain 0) + Return.
  6. Rotation: 0.
  7. Press the Return key to validate. The roof is covered by the rafters.
  8. Unhide the beam.

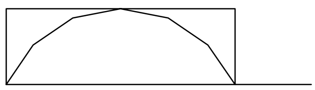


- **See the detailed explanations in the chapter:**
  "Duplicate / Creating multiple copies" on page 315.
  "Hide-Unhide" en page 138.

The tiles

Step 1: Draw the construction curves

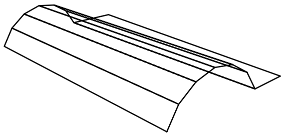
- **Tools: Drawing tool, Rectangle, Arc, Polyline**
- **Do this:**
  You need to draw an arc (inside a 15x5 cm rectangle), followed by a horizontal 5 cm line segment.
  1. With the Rectangle tool, draw a 15x5 cm rectangle.
  2. Draw the arc: Apply a constraint (Shift) on the bottom left corner of the rectangle and click the right mouse button (Mac: Option-Click) to begin the arc. Continue applying a constraint (Shift) and on the middle of the top side of the rectangle, click the right mouse button (Mac: Option-Click) to set the arc tangent to the segment. Set the 3rd point of the arc on the bottom right corner of the rectangle and set the number of points to 7 (to avoid generating too many faces).
  3. Without putting aside the Drawing tool, take the Polyline tool and end the curve with a 5 cm horizontal line segment.



- **See the detailed explanations in the chapter:**
  "Construction / Drawing" on page 185
  "Cursor movement and positioning constraints" on page 98.

Step 2: Make the tile

- **Tool:** Sweep
- **Open the model file:** M16a
- **Do this:**
  1. Take the Sweep tool to extrude the tile section with a 30 cm length.
  2. Hide the rectangle.
- **See the detailed explanations in the chapter:**
  "Sweeping" on page 220.
  "Hide-Unhide" en page 138.



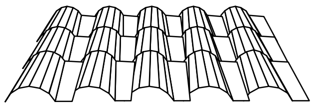
Step 3: Touch up the tile

- **Tool:** Scale
- **Open the model file:** M16b
- **Do this:**
  With the Scaling tool, select the points of the arc (only) at the rear side of the tile and reset the size from 15 to 12 cm.
- **See the detailed explanations in the chapter:**
  "Scale" en page 332.

Step 4: Tile the roof

- **Tool:** Grid and Duplicate
- **Open the model file:** M17
- **Do this:**
  Draw a 5x3 grid of cells to make a quick sample:
  1. Grid tool: Draw a 5x3 cell grid (18x25 cm per cell).
  2. Duplicate tool: Do a Multiple Copy. Make the tile the current object, and click on the grid.
  3. The tiles are copied and arranged as if for a roof.

  To make one side of the roof, draw a 50x16 cell grid (900x400 cm) with 18x25 cm per cell, and make a multiple copy of the tile (800 tiles). This will make a file that is too bulky to be practical.
  For the final rendering, it would be better to use a texture map of a tile pattern, which would yield a much smaller file.
- **See the detailed explanations in the chapter:**
  "3D Primitives / Grid" en page 181.
  "Duplicate" en page 314.



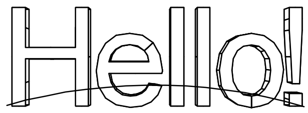
6. HELLO! (3D TEXT)

You will see how easy it is (even a child can do it) to create and model 3D text with AMAPI 3D.

Composing the text

- **Tool:** Text
- **Do this:**
  1. Select the Text tool.
  2. Select the font and the style.
  3. Select the extrusion mode (to make 3D text).
  4. In the text window, type: Hello! (or any text you want) and validate.

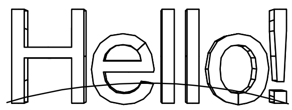
  You've got 3D text!
- **See the detailed explanations in the chapter:** "Text Editor" on page 203.



Modeling the text

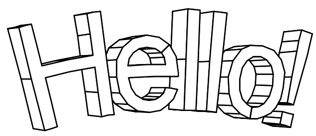
Step 1: Draw a bending curve

- **Tool:** Drawing tool, Interpolated Curve
- **Open the model file:** Hello1
- **Do this:**
  To do it, just draw a 2D curve which will be the bending path.
- **See the detailed explanations in the chapter:** "Interpolated Curve" on page 198.



Step 2: Bending the text

- **Tool:** Bend
- **Do this:**
  Select the text as the current object and click on the curve to bend it.
  WARNING! The only constraint is to be in a front view with the bending curve.
- **See the detailed explanations in the chapter:** "Bend" on page 262.

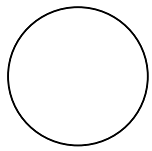


7. A GLASS

This exercise will show you that there may be several different ways to get the desired results with AMAPI 3D.
In this example, we will make a glass from the same curves with two different tools. First, we will use the Extrusion tool. Next, you will see that we can produce the same object using the Sweep tool!

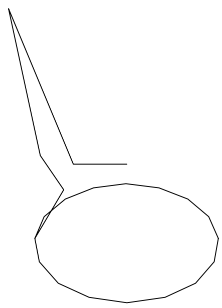
Drawing the construction curves

Step 1: The base



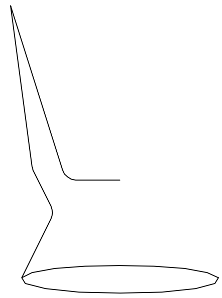
- **Tool:** Drawing tool, Circle
- **Do this:**
  1. Face view, then top view (keys 2 then 5).
  2. Select the Circle tool.
  3. Draw a circle and specify that it have 16 points.
- **See the detailed explanations in the chapter:**
  "Drawing / Circle" on page 189.

Step 2: The profile curve



- **Tool:** Drawing tool, Polyline
- **Do this:**
  1. Select the Polyline tool.
  2. Draw the glass profile. Begin the first point by clicking a point of the circle.
  3. Make sure the last point is vertically aligned with the center of the circle by using the constraints.
- **See the detailed explanations in the chapter:**
  "Drawing / Polyline" on page 194.
  "Cursor movement and positioning constraints" on page 98.

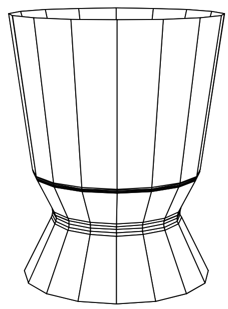
Step 3: Round the angles



- **Tool:** Chamfer
- **Open the model file:** Gobelet1
- **Do this:**
  1. Make sure the profile is the current object.
  2. Select the Chamfer tool.
  3. Click twice on the right hand mouse button (or Command+click on Mac) to get the point selection accessory .
  4. Select the angle to be rounded.
  5. Validate.
  6. Set the chamfer radii.
  7. Validate.
- **See the detailed explanations in the chapter:** “Chamfer” en page 290.

Extruding the glass (2 methods)

Step 1a: (1st method)



- **Tool:** Extrusion
- **Open the model file:** Gobelet2
- **Do this:**
  1. Make sure the circle is the current object.
  2. Select the Extrusion tool.
  3. Click the profile.
  4. Click on the red curve to close the glass bottom.

  The glass is complete.
- **See the detailed explanations in the chapter:** “Extrusion” en page 209.

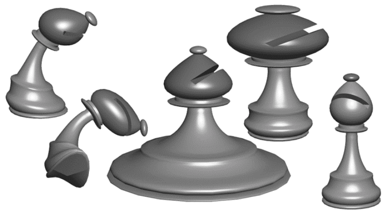
Step 1b: (2nd method)

- **Tool:** Sweep
- **Open the model file:** Gobelet2
- **Do this:**
  1. Make sure the profile is the current object.
  2. Select the Sweep tool.
  3. Click on the circle.
  4. Click on the red curve to close the glass bottom.

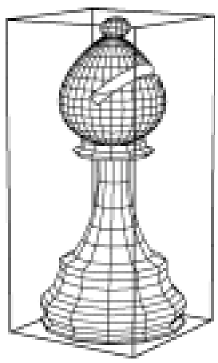
  The glass is done.
- **See the detailed explanations in the chapter:** “Sweeping” on page 220.

8. DEFORMED CHESSMEN

The global Deform tools allow you to create a variety of fantasy-like effects.
In this exercise, you will become familiar with some of the possibilities.
Warning: In order for an object to be deformed nicely, without breaks, it should have a dense wireframe (very smooth).

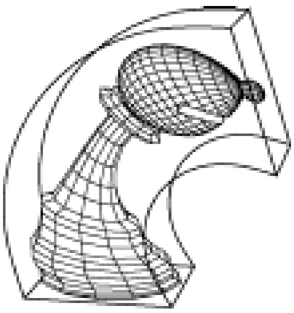


Bend a bishop

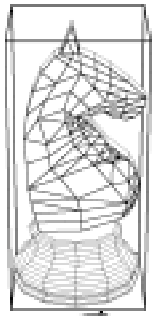


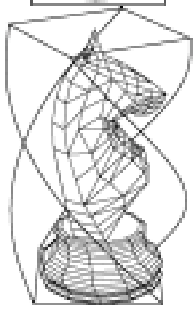
- **Tool:** Deform / Bender
- **Open the model file:** Fou
- **Do this:**
  1. Select the Deform tool. From the displayed palette, select the Bend tool.
  2. The bishop will be surrounded by a yellow box. Two faces are highlighted:they are the control faces. You can select different pairs of control faces by pressing the spacebar.
  3. Since we want to bend the bishop's vertical axis, you will need to highlight the upper and lower faces by pressing the spacebar.
  4. The cursor is changed into pliers. Move it to the upper face and pull it: the object will bend.
  5. Validate and put the tool aside.
  6. If you run into problems, the finished file is: Fou2.

- **See the detailed explanations in the chapter:** "Deform / The global deformers / Bender" on page 246.



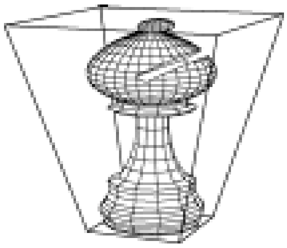
Twist a knight

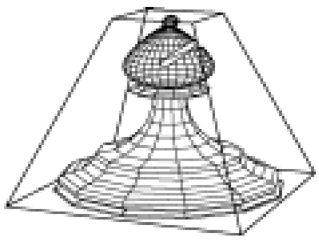




- **Tool:** Deform / Twist
- **Open the model file:** Cavalier
- **Do this:**
  1. Select the Deform tool. From the displayed palette, select the Twist tool.
  2. The knight will be surrounded by a yellow box. Two faces are highlighted: they are the control faces. You can select different pairs of control faces by pressing the spacebar.
  3. Since we want to twist the knight about the vertical axis, you will need to highlight the upper and lower faces by pressing the spacebar.
  4. The cursor is changed into pliers. Move it to the upper face and pull it: the object will twist. Move the pliers to obtain the desired twisting effect.
  5. Validate and put the tool aside.
  6. If you run into problems, the finished file is: Cavalier2.
- **See the detailed explanations in the chapter:** "Deform / The global deformers / Twist" on page 248.

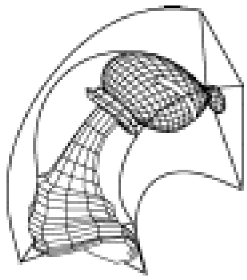
Taper a bishop





- **Tool:** Deform / Taper
- **Open the model file:** Fou
- **Do this:**
  1. Select the Deform tool. In the displayed palette, select the Taper tool.
  2. The bishop will be surrounded by a yellow box. Two faces are highlighted: they are the control faces. You can select different pairs of control faces by pressing the spacebar.
  3. Since we want taper the top and bottom of the bishop, you will need to highlight upper and lower faces by pressing the spacebar.
  4. The cursor is changed into pliers. Move it to the upper face and pull it: the face is stretched wider or narrower, depending on how you move the pliers. Move the pliers to obtain the desired tapering effect.
  5. Validate.
  6. Select this tool again. This time, move the pliers to the lower face, and do the same as before. Now the base that is deformed.
  7. If you run into problems, the finished file is: Fou3.
- **See the detailed explanations in the chapter:** "Deform / The global deformers / Taper" on page 248.

Combine the deformations



- **Tool:** Deform / All global Deformers
- **Do this:**
  You can combine several deformations, one after another. Your model will follow your wishes.
- **See the detailed explanations in the chapter:**
  "Deform / The global deformers" on page 245.

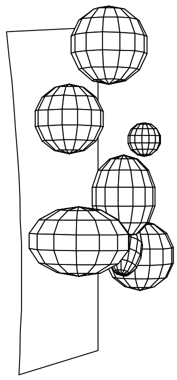
9. A MOUSE ON A PIECE OF CHEESE

This example places an easy-to-draw object, the cheese, and a more complex object, the mouse, together in a scene.
You will quickly realize that anything (or nearly anything) can be made with the AMAPI 3D tools.

The cheese (the recipe...)

Step 1: Shape the cheese

- **Tool:** Extrusion
- **Open the model file:** Fromage
- **Do this:**
  1. Start with the closed curve which is the cheese section and extrude it 4 or 5 cm with the Extrusion tool (and horizontal constraint).
  2. Validate and click on both ends (red) to close the cheese.
- **See the detailed explanations in the chapter:**
  "Extrusion" en page 209.
  "Cursor movement and positioning constraints" on page 98.



Step 2: Create the holes

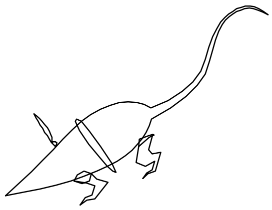
- **Tool:** Boolean
- **Do this:**
  1. Perform a Boolean operation between the block of cheese and the group of spheres.
  2. With the + / - keys you can display the results until you get what you like. You have just made a piece of Gruyere, a famous French cheese!
  3. Now, save the cheese before making the mouse.
- **See the detailed explanations in the chapter:**
  "Cut / Boolean" on page 303.

The mouse

Step 1: The mouse's body

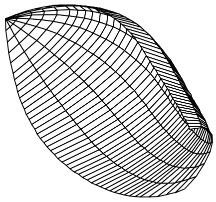
- **Tool:** Double Profile
- **Open the model file:** Souris1
- **Do this:**
  1. Select the circle which corresponds to the section.
  2. Select the Double Profile tool.
  3. Click on the two curves that are the paths of the body shape.

  You now have the body.
- **See the detailed explanations in the chapter:**
  "Sweeping" on page 220.



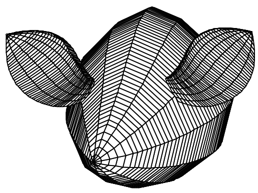
Step 2: An ear

- **Tool:** Double Profile
- **Do this:**
  1. To work more easily, hide the body of the mouse and zoom in on the three curves which define the shape of the ear.
  2. Select the curve which is the base of the ear.
  3. Select the Double Profile tool.
  4. Click on the two curves that are the paths of the ear shape.
- **See the detailed explanations in the chapter:**
  "Hide-Unhide" en page 138.
  "To zoom " on page 133.
  "Sweeping" on page 220.

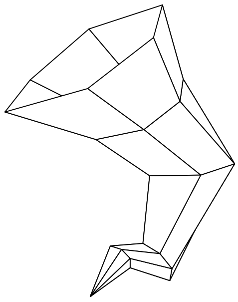


Step 3: The 2nd ear

- **Tool:** Symmetry
- **Do this:**
  1. After making the first ear, unhide the body.
  2. Press the 4 key on the keypad.
  3. The ear is the current object; select the Symmetry tool.
  4. With the right hand button of the mouse, (Option+Click on Mac) click about the center of gravity of the body to set the symmetry point.
  5. Click on the bounding box face near the ear base: the 2nd ear is automatically placed at the right place.
- **See the detailed explanations in the chapter:**
  "Hide-Unhide" en page 138.
  "Symmetry" on page 323.
  "The Views" on page 133

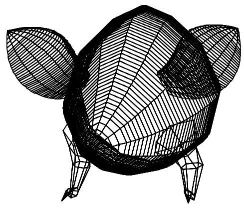


Step 4: A front leg



- **Tool:** Double Profile
- **Do this:**
  To make the mouse's legs, proceed as for the ears:
  1. Select the curve that is the leg section.
  2. Select the Double Profile tool.
  3. Click on the two curves that are the paths of the leg shape.
- **See the detailed explanations in the chapter:**
  "Sweeping" on page 220.

Step 5: The 2nd front leg

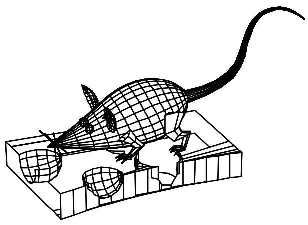


- **Tool:** Symmetry
- **Do this:**
  We always mirror from the body center of the mouse.
  Click on the bounding box face near the front leg's face: the 2nd leg is automatically placed at the right place.
- **See the detailed explanations in the chapter:**
  "Symmetry" on page 323.

Step 6: The rear legs

- **Do this: Repeat the two previous steps for the rear legs.**

The mouse on the cheese



You will notice that the legs have only one toe. You can try to add more toes as shown in the final model... (Souris3).

Next, you should add the eyes and whiskers (Souris2) and give the piece of cheese to the little mouse.

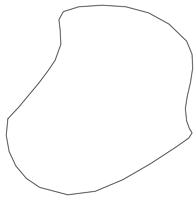
10. POTATO CHIPS

This is another easy exercise, but one that will help you when you are wondering how to make new and unusual shapes.
Today you make potato chips, tomorrow industrial designs and organic shapes…

Potato chips

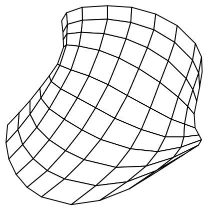
Step 1: Drawing the shape

- ❑ **Tool:** Interpolated Curve
- ❑ **Do this:** Draw a closed curve in 3 dimensions.
- ❑ **See the detailed explanations in the chapter:** "Drawing / Interpolated Curve" on page 198.



Step 2: Generate the surface

- ❑ **Tool:** Hull / Coons
- ❑ **Open the model file:** Coons1
- ❑ **Do this:**
  Select the Hull / Coons tool, click on the curve and the surface is generated.
- ❑ **See the detailed explanations in the chapter:** "Surfaces / Coons Surfaces" en page 239.

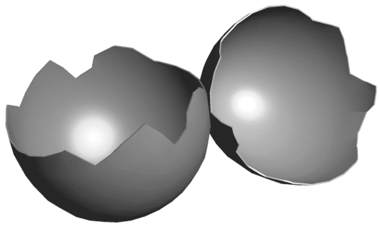


Step 3: Model the shape

- ❑ **Tool:** Mold
- ❑ **Do this:** Use the Mold tool to modify the shape until you have the shape you want.
- ❑ **See the detailed explanations in the chapter:** "Mold" on page 255.

11. A BROKEN EGG

Modeling potato chips, champagne caps, and glasses has made us hungry. Why don't we do some cooking?
The following exercise will allow you to practice using the Cut tool. You can make your egg before cutting it, or go directly to the cutting portion of the exercise.



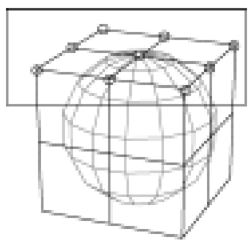
Constructing the egg

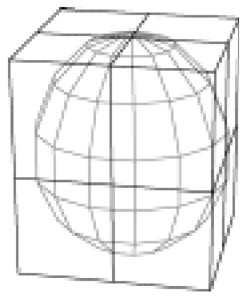
Step 1: Create a sphere

- **Tool:** 3D Primitives / Sphere
- **Do this:**
  Select the Sphere tool and create… a sphere!
- **See the detailed explanations in the chapter:**
  "3D Primitives / Sphere" en page 169.

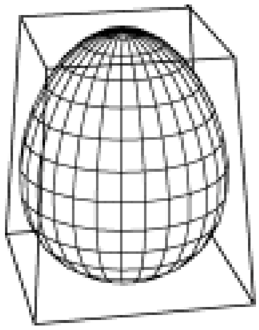
Step 2: Deform the sphere

- **Tool:** Deformer / Stretch
- **Do this:**
  1. Select the Deformer tool.
  2. In the Assistant Palette, click on the group-of-points selection accessory .and select the upper part of the gridded box.
  3. Validate.
  4. From the Deformer tool palette, select the Stretch tool and pull on the top of the sphere.
  5. Validate and put the tool aside.
- **See the detailed explanations in the chapter:**
  "Deformer / The local deformers / Stretch" on page 268.





Step 3: Taper the upper part of the egg



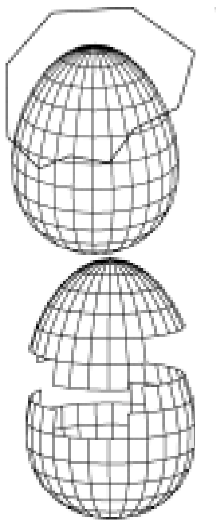
- **Tool:** Deformers / Taper
- **Do this:**
  1. Select the Deformer tool again.
  2. Select the Taper tool.
  3. With the spacebar, toggle until the upper faces are highlighted.
  4. Click on the upper face and move your mouse to taper the top of the egg.
  5. Validate and put the tool aside.
- **See the detailed explanations in the chapter:**
  "Deformer" on page 250.

Step 4: Surface smoothing

- **Tool:** Smooth
- **Do this:**
  1. Select the Smooth tool. From the sub-palette, select Bezier smoothing, and specify smoothing range 2 for the egg.
  2. Validate and put the tool aside.
  3. If you ran into problems, the finished file is: Coquille3.
- **See the detailed explanations in the chapter:**
  "Smooth" on page 276.

Break the egg

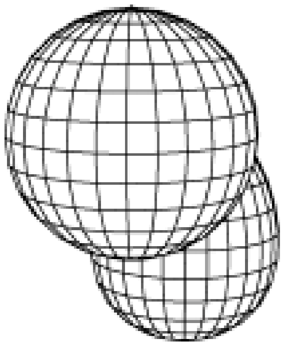
Method 1

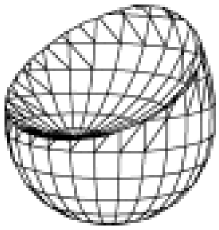


- **Tool:** Cut (Extract)
- **Open the model file:** Coquille3
- **Do this:**
  1. Select the Cut tool.
  2. In the Assistant Palette, click on the group-of-points selection accessory (or right mouse click on PC, ALT+click on Mac).
  3. Surround the part to be cut with the group-of-points selection accessory.
  4. Validate.
  5. Put the tool aside: your object is cut into two parts. You can move one to check it.
- **See the detailed explanations in the chapter:**
  "Cut / Extract" on page 305.
  "Move" on page 330.

Method 2

- ❑ **Tool:** Cut
- ❑ **Open the model file:** Coquille3
- ❑ **Do this:**
  1. Create a sphere that intersects with the egg. The sphere will be the current object.
  2. Select the Cut tool.
  3. Click on the egg. (Note: If the egg is the current object and you click on the sphere, you should get the same results.)
  4. You can see all the additions and subtractions between the two objects by pressing the "+" and "–" keys.
  5. Validate. Put the tool aside: half the egg is left.

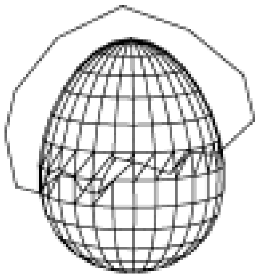




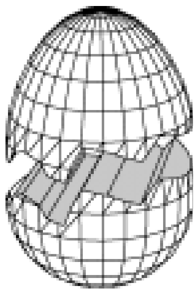
- ❑ **See the detailed explanations in the chapter:** "Cut / Boolean" on page 303.

Method 3

- ❑ **Tool:** Cut
- ❑ **Open the model file:** Coquille3
- ❑ **Do this:**
  1. Select the Cut tool.
  2. Click where you want to start cutting Use the cursor to draw a polyline that will be the cutting line.
  3. Validate and put the tool aside. Your object is cut into two parts. You can move one of the parts to verify it.



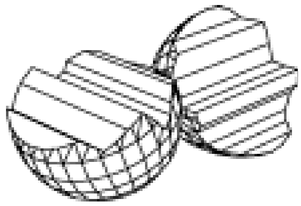
Here is another method you can use: Draw a curve with the drawing tool you want. Make the egg be the current object, then click on the curve. The cut will follow the line. This technique was used for the acoustic baffle.

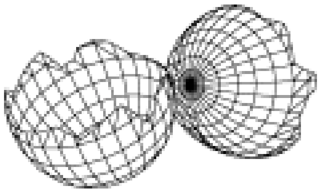


- ❑ **See the detailed explanations in the chapter:** "Cut" on page 299.

Hollow out the egg

- **Tool:** Delete
- **Open the model file:** Coquille4
- **Do this:**
  1. Select the Delete tool.
  2. With this tool, click on the faces which close the inside of the egg.
  3. You will get two empty halves.
  4. Validate and put the tool aside.

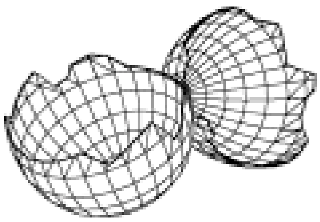




- **See the detailed explanations in the chapter:** "Delete" on page 272.

Give thickness to the egg

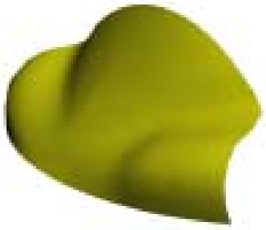
- **Tool:** Thickness
- **Open the model file:** Coquille5
  Select the Thickness tool.
  With the "+" and "–" keys, specify a thickness.
  You can enter a numeric value by pressing the Tab key and entering the value.
  You can add the thickness from the inside or outside of the egg, simply by toggling the spacebar.



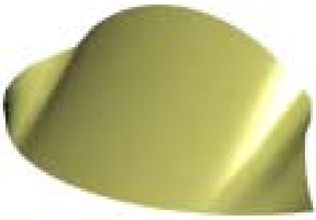
- **See the detailed explanations in the chapter:** "Thickness" on page 294.

12. A WINDSHIELD FOR A MOTOR BIKE

This exercise is designed to allow you to compare the results you can get by starting from the same curves and using two different tools.
You will see that the surface skinning is different depending on the tool used.



1st Method: Coons

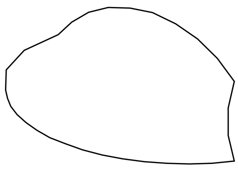


2nd Method: Ruled Surface

Windshield (1st Method: Coons)

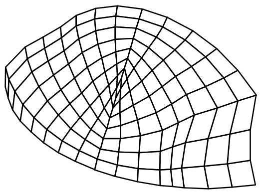
Step 1: Drawing (like method 2)

- ❑ **Tool:** 2D Drawing tool, NURBS
- ❑ **Do this:**
  Two NURBS curves make a closed shape.
- ❑ **See the detailed explanations in the chapter:**
  "Construction / Drawing" on page 185



Step 2: Making the windshield

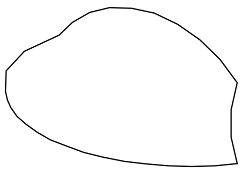
- ❑ **Tool:** Hull / Coons
- ❑ **Open the model file:** Coons2
- ❑ **Do this:**
  Select the Hull / Coons tool. Click on each curve; the surface is generated.
- ❑ **See the detailed explanations in the chapter:**
  "Surfaces / Coons Surfaces" en page 239.



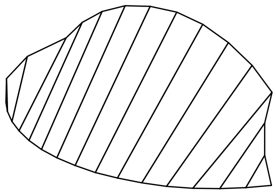
Windshield (2nd Method: Ruled Surface)

Step 1: Drawing (like method 1)

- ❑ **Tool:** Drawing tool, Interpolated Curve
- ❑ **Do this:**
  Two NURBS curves make a closed shape.
- ❑ **See the detailed explanations in the chapter:**
  "Drawing / Interpolated Curve" on page 198.



Step 2: Making the windshield



- **Tool:** Ruled Surface
- **Open the model file:** Coons2
- **Do this:**
  Select the Ruled Surface tool. Click on each curve; the surface is generated.
- **See the detailed explanations in the chapter:**
  "Ruled Surfaces" on page 236.

13. HULL FOR A BOAT (EXAMPLE 1)

This exercise is designed to compare three methods of making a boat hull from the same set of curves. You will see differences depending on the method used because the surface is not skinned the same way; the first hull is the most rounded and the third one is the least.

1st method: Hull

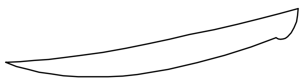
2nd method: Coons

3rd method: Ruled Surface

Boat Hull 1 (1st method: Hull)

Step 1: Construction drawing

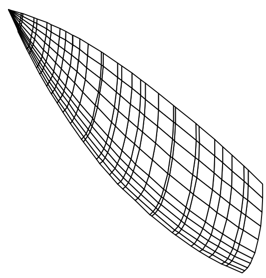
- **Tool:** Drawing tool, Interpolated Curve
- **Do this:**
  Draw 3 NURBS curves, each on a different plane:
  Each curve must have a null dimension (x or y or z = 0) and each one must line on a plane: x,y (z=0), x,z (y=0) & y,z (x=0)
  These curves make a closed shape.
- **See the detailed explanations in the chapter:**
  “Drawing / Interpolated Curve” on page 198.



Step 2: Surface generation

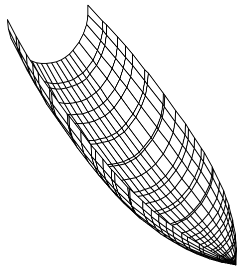
- **Tool:** Hull
- **Open the model file:** Hull1
- **Do this:**
  1. The example model looks like a half boat hull.
  2. With the Hull tool, click first on the vertical curve, then on the two others.

  A mesh is generated.
- **See the detailed explanations in the chapter:**
  “Hull Surfaces” on page 242.



Step 3: Mirror the mesh

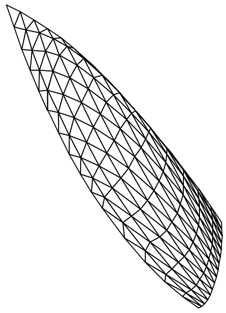
- **Tool:** Symmetry
- **Do this:**
  Mirror the object from the vertical axis. The result is something that looks like a boat hull.
- **See the detailed explanations in the chapter:**
  "Symmetry" on page 323.



Boat Hull 1 (2nd method: Coons)

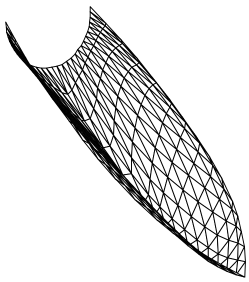
Step 1: Surface generation

- **Tool:** Hull, Coons
- **Open the model file:** Hull1
- **Do this:**
  From the same curves and selecting them in the same order as shown above, but with the Coons Hull tool, the result is a half hull also, but it is less rounded.
- **See the detailed explanations in the chapter:**
  "Surfaces / Coons Surfaces" en page 239.



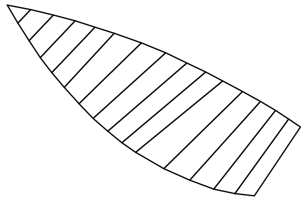
Step 2: Mirror the mesh

- **Tool:** Symmetry
- **Do this:**
  Mirror the object from the vertical axis. The result is something that resembles a boat hull.
- **See the detailed explanations in the chapter:**
  "Symmetry" on page 323.



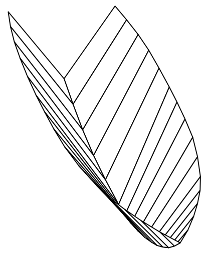
Boat Hull 1 (3rd method: Ruled Surface)

Step 1: Surface generation



- ❑ **Tool:** Ruled Surface
- ❑ **Open the model file:** Hull1
- ❑ **Do this:**
  Using only the two horizontal curves, and clicking the two ends not joined (delete the vertical curve), we still get a half hull, but tighter than with the two previous methods.
- ❑ **See the detailed explanations in the chapter:**
  “Ruled Surfaces” on page 236.

Step 2: Mirror the mesh



- ❑ **Tool:** Symmetry
- ❑ **Do this:**
  Mirror the object from the vertical axis. The result is something that resembles a boat hull.
- ❑ **See the detailed explanations in the chapter:**
  “Symmetry” on page 323.

14. HULL FOR A BOAT (EXAMPLE 2)

This exercise is designed to compare three ways to make a boat hull from the same curves, this time with a rounded rear side.

Note the different results depending the method used.

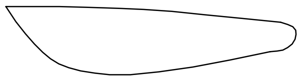
2nd method: Coons

3rd method: Ruled Surface

Boat Hull 2 (1st method: Hull)

Step 1: Surface generation

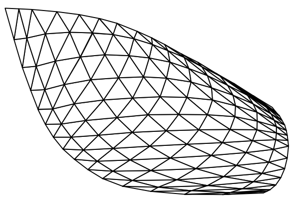
- **Tool:** Hull
- **Open the model file:** Hull2
- **Do this:**
  This tool cannot be used, because two out of the three curves have no null dimension, i.e., they are 3D curves.
- **See the detailed explanations in the chapter:**
  "Hull Surfaces" on page 242.



Boat Hull 2 (2nd method: Coons)

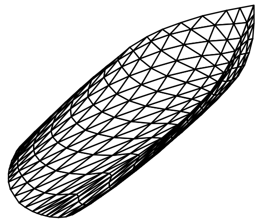
Step 1: Surface generation

- **Tool:** Hull / Coons
- **Open the model file:** Hull2
- **Do this:**
  With the Coons Hull tool, click first on the vertical rear curve, then on the two others. The result is a mesh.
- **See the detailed explanations in the chapter:**
  "Surfaces / Coons Surfaces" en page 239.



Step 2: Mirror the mesh

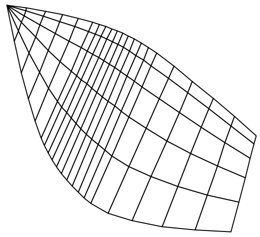
- **Tool:** Symmetry
- **Do this:**
  Mirror the object from the vertical axis. The result is something that resembles a boat hull.
- **See the detailed explanations in the chapter:**
  "Symmetry" on page 323.



Boat Hull 2 (3rd method: Ruled Surface)

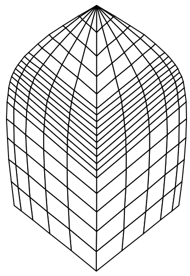
Step 1: Surface generation

- **Tool:** Ruled Surface
- **Open the model file:** Hull2
- **Do this:**
  Using only the two horizontal curves, and clicking the two ends not joined (delete the vertical curve), we still get a half hull, but tighter than with the two previous methods.
- **See the detailed explanations in the chapter:**
  "Ruled Surfaces" on page 236.



Step 2: Mirror the mesh

- **Tool:** Symmetry
- **Do this:**
  Mirror the object from the vertical axis. The result is something that resembles a boat hull.
  We can see that the skin is "tighter" than with the previous methods.
- **See the detailed explanations in the chapter:**
  "Symmetry" on page 323.



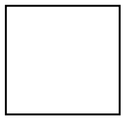
15. A TILED FLOOR

This exercise is a perfect illustration of the use of Boolean operations between 2D curves. Boolean operation can come in handy for making wall or floor tile, and many other things too!

Create geometric shapes

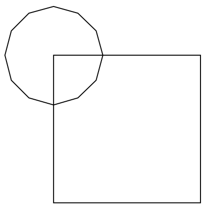
Step 1: Draw the tile

- **Tool:** Drawing Tool, Rectangle
- **Do this:**
  Draw a 15x15cm square.
- **See the detailed explanations in the chapter:**
  "Drawing / Rectangle" on page 191.



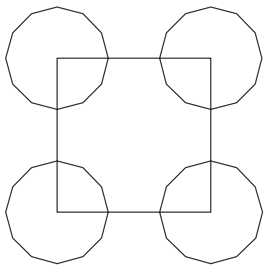
Step 2: Design a pattern

- **Tool:** Drawing Tool, Circle
- **Do this:**
  Inside the square, you can draw geometric patterns which can be tangent or secant with the corners or the sides of the square.
  In this example, draw a circle with its center on the top left corner of the square.
- **See the detailed explanations in the chapter:**
  "Drawing / Circle" on page 189.



Step 3: Pattern repetition

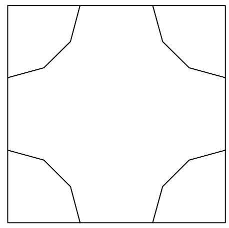
- **Tool:** Duplicate
- **Open the model file:** C01
- **Do this:**
  The circle is the current object. Multiple Copy it to each corner of the square.
- **See the detailed explanations in the chapter:**
  "Duplicate" en page 314.



Step 4: Integrate the pattern to the tile (part 1)

- **Tool:** Boolean
- **Open the model file:** C02
- **Do this:**
  Make a Boolean operation between the square and the group of circles:
  1. Be sure the square is the current object.
  2. Select the Boolean tools and click on the group of circles.
  3. Use the + / - keys to display the different combinations. Validate the correct one (cross shape) and save it (cross)

  WARNING!: To get the two sets of curves you must perform the Boolean operation twice from the C02 file and save a new file each time with a different name.
- **See the detailed explanations in the chapter:**
  "Cut / Boolean" on page 303.

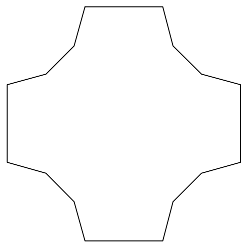


Step 5: Integrate the pattern to the tile (part 2)

- **Tool:** Boolean
- **Open the model file:** C02
- **Do this:**
  1. Do the same operation as above, but this time validate the four quarter-circle shapes.
  2. Merge with the file saved previously (cross).
- **See the detailed explanations in the chapter:**
  "Cut / Boolean" on page 303.

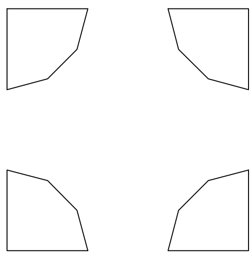
Step 6: Tile surface generation

- **Tool:** Surface Extract
- **Open the model file:** C03
- **Do this:**
  Select a curve (cross) or a group of curves, take the Surface Extract tool, and validate (Return). The surface is automatically generated.
- **See the detailed explanations in the chapter:**
  "Facet Extraction" en page 206.



Step 7: Color

- **Tool:** Material Editor
- **Open the model file:** C04 C05
- **Do this:**
  You can apply a color or a texture on each part of the tile pattern
- **See the detailed explanations in the chapter:**
  "Editing materials" on page 148.

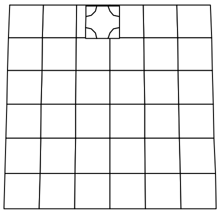


Step 8: The tile is finished

- **Tool:** Group
- **Open the model file:** C04 C05
- **Do this:** Group together to make a tile.
- **See the detailed explanations in the chapter:** "Group-Ungroup" on page 140.

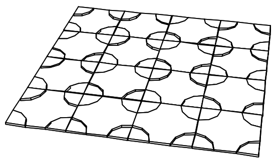
Generating the tile floor

Step 1: Draw a construction grid



- **Tool:** Grid
- **Open the model file:** C06
- **Do this:**
  1. Face view, then top view (key 2, then 5).
  2. Draw a 6x6 cell grid (15x15 cm per cell).
- **See the detailed explanations in the chapter:** "3D Primitives / Grid" en page 181.

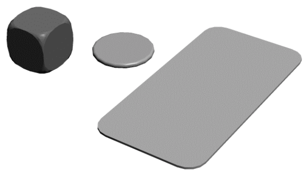
Step 2: Repeat the tile on the grid



- **Tool:** Duplicate
- **Open the model file:** C06a
  Now, Multiple Copy the tile on the grid.
  You can try the same operations with other patterns: see C08 to C13.
- **See the detailed explanations in the chapter:** "Duplicate / Multiple copies along a path or on the facets of an object" on page 318.

16. A PLAYING CARD, A DIE AND A TOKEN

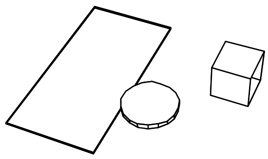
These playing accessories will allow us to learn about three kinds of chamfers (bevels).
We will start from very simple objects. The die is a cube, as is the playing card (but with different proportions). The token is a circle that has been extruded to produce a cylinder.



Basic construction

- ❑ **Tool:** 3D Primitives / Cube
- ❑ **Do this:**
  We will start from very simple objects:

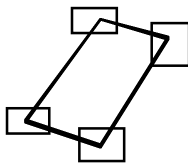
♦ The die is a cube.
♦ The playing card is also a cube, but its proportions have been changed with the Scale tool.
♦ The token is a cylinder.

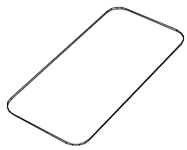


- ❑ **See the detailed explanations in the chapter:**
  “3D Primitives / Cube” en page 173.
  “3D Primitives / Cylinder” en page 175.
  “Scale” en page 332.

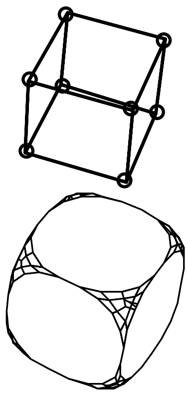
Chamfer the playing card

- ❑ **Tool:** Chamfer
- ❑ **Open the model file:** Carte1
- ❑ **Do this:**
  1. Make the card the current object. Then select the Chamfer tool. Select the  icon.
  2. With the group-of-points selection accessory , successively surround the four corners of the card.
  3. With the “+” and “–” keys, set the desired chamfer radius.
  4. Validate and put the tool aside.
- ❑ **See the detailed explanations in the chapter:**
  “Chamfer” en page 290.





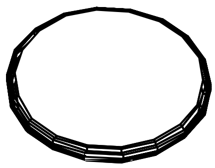
Chamfer the die



- ❑ **Tool:** Chamfer
- ❑ **Open the model file:** Carte1
- ❑ **Do this:**
  1. Make the cube the current object. Select the Chamfer tool. Select the  icon.
  2. With the point selection accessory , click on each corner of the cube.
  3. With the “+” and “–” keys, set the desired chamfer radius.
  4. Validate and put the tool aside.
- ❑ **See the detailed explanations in the chapter:**
  “Chamfer” en page 290.

Chamfer the token

- ❑ **Tool:** Chamfer
- ❑ **Open the model file:** Carte1
- ❑ **Do this:**
  1. Make the token the current object. Set the side view (key 4) to see the edge of the token. Set orthographic viewing (using the Control Panel) to see the token as shown in the picture; this will make the next step easier.
  2. Select the Chamfer tool.
  3. With the group-of-points selection accessory , first surround the upper face of the token and validate. Then, surround the lower face of the token and validate.
  4. With the “+” and “–” keys, set the desired chamfer radius.
  5. Validate and put the tool aside.
  6. Set perspective viewing (using the Control Panel).
- ❑ **See the detailed explanations in the chapter:**
  “Chamfer” en page 290.
  “Perspective” en page 132.



17. A CHAIR

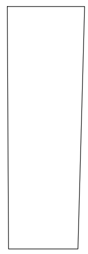
The interesting part of building this chair is that you get to use two powerful tools: the Stretch tool and the Model tool.

You will appreciate knowing how to use these tools when you are making your own complex models.

The seat

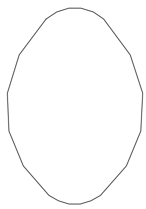
Step 1: Base construction drawing (1)

- **Tool:** Drawing tool, Rectangle
- **Do this:**
  1. Face view (key 2).
  2. Draw a 30x110 rectangle.
- **See the detailed explanations in the chapter:** "Drawing / Rectangle" on page 191.



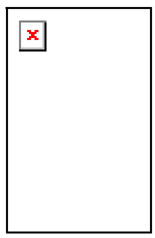
Step 2: Base construction drawing (2)

- **Tool:** Smooth
- **Open the model file:** Faut01
- **Do this:** Apply a smoothing value of 5.
- **See the detailed explanations in the chapter:** "Smooth" on page 276.

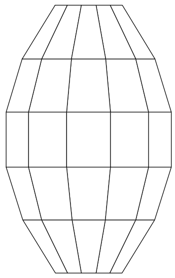


Step 3: Flatten the upper and lower edges

- **Tool:** Scale
- **Open the model file:** Faut02
- **Do this:** Flatten the upper and lower edges of the seat:
  1. Select the points of the upper edge.
  2. Set the value 0 on the Y axis.
  3. Select the points of the lower edge.
  4. Set the value 0 on the Y axis.
- **See the detailed explanations in the chapter:** "Scale" en page 332.

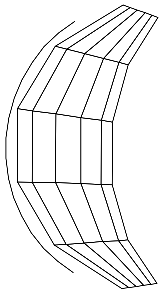


Step 4: Generate a mesh



- **Tool:** Hull Coons
- **Open the model file:** Faut03
- **Do this:** With the Coons tool, generate a mesh.
- **See the detailed explanations in the chapter:**
  “Surfaces / Coons Surfaces” en page 239.

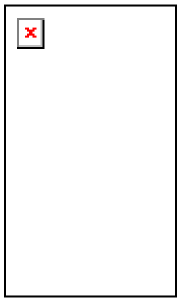
Step 5: Give a 3D shape to the seat



- **Tool:** Bend
- **Open the model file:** Faut03b
- **Do this:**
  1. Side view (key 4).
  2. Select the Bend tool.
  3. Draw a bending curve which will be the seat profile.
  4. Validate.

  The mesh is modified following the curve.
- **See the detailed explanations in the chapter:**
  “Bend” on page 262.

Step 6: Adjust the back

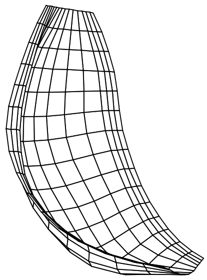


- **Tool:** Stretch
- **Open the model file:** Faut04
- **Do this:**
  1. Select the points of the upper edge of the back.
  2. Select the Stretch tool.
  3. Set the points upright.
  4. Validate.

  The upper part of the back is set upright.
- **See the detailed explanations in the chapter:**
  “Stretch” on page 268

Step 7: Mold the seat

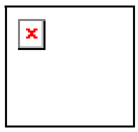
- ❑ **Tool:** Deformer
- ❑ **Open the model file:** Faut05
- ❑ **Do this:**
  1. Select the Deformer tool.
  2. A control box with 3x3x3 control lines appears around the object.
  3. Press the + key twice to get 5x5x5 control lines.One by one, stretch the central points of the control lines, following the external face of the seat.
  4. When the seat is hollowed enough, put the tool aside to see the result.
  5. If it is not satisfactory, select the tool again, set the control lines to 5x5x5 and model some more.
  6. When the seat has a good shape, smooth it with a value of 3, and save it
- ❑ **See the detailed explanations in the chapter:** "Deformers" on page 245.



The foot

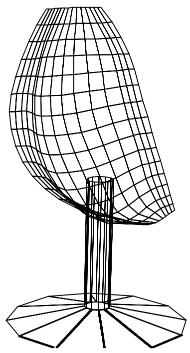
Step 1: Draw the foot section

- ❑ **Tool:** Drawing tool, Circle
- ❑ **Open the model file:** Faut06
- ❑ **Do this:**
  1. Face view (key 2).
  2. Top view (key 5).
  3. Draw a circle with radius = 6 and 12 points.
  4. Use the center of gravity of the seat to set the center of the circle.
- ❑ **See the detailed explanations in the chapter:** "Drawing / Circle" on page 189.



Step 2: Extruding the foot

- ❑ **Tool:** Extrusion
- ❑ **Do this:**
  1. Side view (key 4).
  2. Extrude toward the bottom with a vertical constraint for the first part (cylinder); this part should be long enough for a good height of the seat and a little more, because later we will do a Boolean operation.
  3. Then, remove the constraint and draw the second part of the foot (the base).
- ❑ **See the detailed explanations in the chapter:** "Extrusion" en page 209.



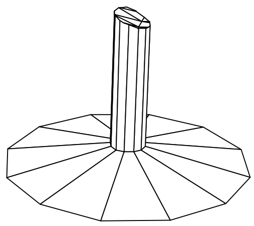
The whole chair

Step 1: Adjust the height of the seat

- ❑ **Tool:** Move
- ❑ **Do this:**
  1. Move the seat toward the top with a vertical constraint to adjust the height of the seat.
  2. Save the model.
- ❑ **See the detailed explanations in the chapter:** “Move” on page 330.

Step 2: Boolean operation between the seat and the foot

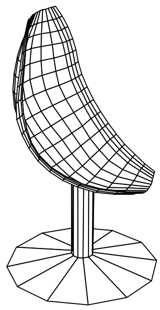
- ❑ **Tool:** Boolean
- ❑ **Open the model file:** Faut07
- ❑ **Do this:**
  1. Perform a Boolean operation between the seat and the foot.
  2. Display the different results with the + / - keys.
  3. Validate the foot only.
  4. Save the model
- ❑ **See the detailed explanations in the chapter:** “Cut / Boolean” on page 303.



Step 3: Texture it!

- ❑ **Tool:** Material Editor
- ❑ **Open the model file:** Faut07 and Faut08
- ❑ **Do this:**
  1. Open the model Faut07.
  2. Suppress the foot.
  3. Open the model Faut08.

  All that’s left to do now is to choose some textures to make a beautiful chair!
- ❑ **See the detailed explanations in the chapter:** “Material Editor” on page 353.



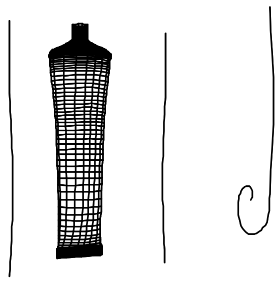
18. A TUBE OF GOO

This exercise doesn't explain how to make a tube of goo… but it does give you practice using the Bend tool.

If you want to try making this model from scratch, use the finished model a guide.

Bend the tube

- **Tool:** Bend
- **Open the model file:** Mayo
- **Do this:**
  Practice bending the tube with the curves given in this example.
  WARNING! The only constraint is that you must be in a view perpendicular to the bending curve.
- **See the detailed explanations in the chapter:**
  "Bend" on page 262.

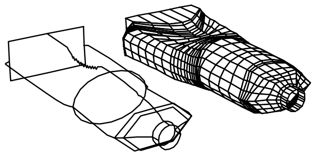


19. A CONTAINER

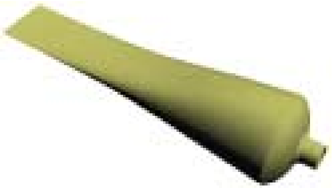
This exercise gives you practice using the Gordon Hull tool.

It doesn't explain how to make this kind of container. However, if you want to try building this model yourself (hint: try drawing a net of curves), having the finished model to look at will be helpful.

- **Tool:** Hull / Gordon
- **Open the model file:** Gordon
- **Do this:**
  Practice using the Gordon Hull tool to generate Gordon surfaces fmrom these curves.
- **See the detailed explanations in the chapter:**
  "Surfaces / Gordon Surfaces" en page 240.



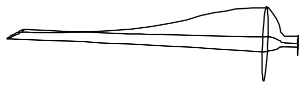
20. A TOOTHPASTE TUBE



This exercise gives you more practice using the Gordon Hull tool.

You can use the finished model as a guide if you decide to try making the toothpaste tube from scratch.

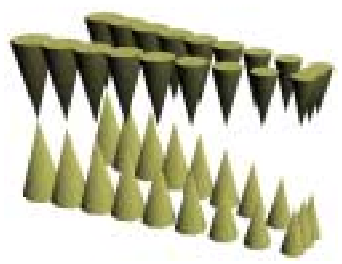
- **Tool:** Surfaces / Gordon
- **Open the model file:** Dentifrice
- **Do this:**
  Practice generating Gordon surfaces from these curves.
- **See the detailed explanations in the chapter:**
  “Surfaces / Gordon Surfaces” en page 240.



21. TEETH

This exercise was designed to illustrate the use of the "multiple copy on faces with variable scale" feature.
The concept is the following:

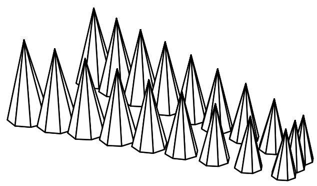
1. *Make the object to be copied. (Here it is a cone, which roughly resembles a tooth.)*
2. *Prepare a surface with different sized faces. The object will be copied on these faces (like the teeth in a jaw?).*
3. *Duplicate and give a size to each object that is proportional to the size of the face onto which the object is copied.*



Half jaw

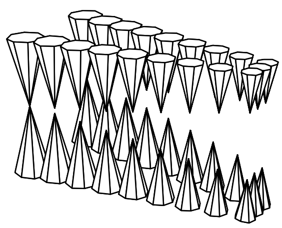
- **Tool:** Duplicate with variable scale
- **Open the model file:** D01
- **Do this:**
  1. The cone is the current object.
  2. Select the Duplicate tool and press the spacebar to be in the multiple copy mode.
  3. Click on the surface with different sized faces.
  4. Then click on the "variable size copy icon".

  With the object selection accessory (+ Click) select the reference face. This face defines the size ratio between the face and the copied object. The reference face is the scale 1 for the object. The other objects will be copied proportional to the size of the face where they are copied.
  You might want to use this tool for making scales (of a fish) or other multiple objects with variable scale.
- **See the detailed explanations in the chapter:** "Duplicate / Multiple copies along a path or on the facets of an object" on page 318.



The jaw

- **Tool:** Symmetry
- **Open the model file:** D02
- **Do this:**
  If you mirror the half jaw…
- **See the detailed explanations in the chapter:** "Symmetry" on page 323.

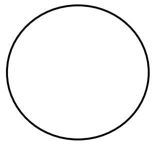


22. INTERSECTING PIPES

This exercise shows the use of the Boolean tool to draw intersecting pipes.

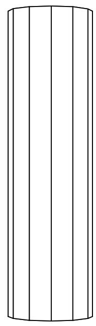
Draw the base (circle)

- **Tool:** 2D Drawing tool, Circle
- **Do this:**
  Face view (2), then top view (5).
  Draw a circle.
- **See the detailed explanations in the chapter:**
  “Drawing / Circle” on page 189.



Make a cylinder

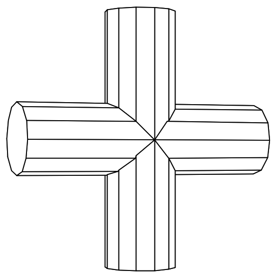
- **Tool:** Extrusion
- **Do this:**
  1. Face view (2).
  2. Extrude the Circle (with a vertical constraint) toward the top.
  3. Then click on the two red faces to close them.
- **See the detailed explanations in the chapter:**
  “Extrusion” en page 209.
  “Cursor movement and positioning constraints” on page 98.



Making the crossing

Step 1: Copy while rotating

- **Tool:** Rotate (+Control)
- **Do this:**
  1. To do the crossing, we simply, while holding the Control key pressed, select the Rotate tool.
  2. Then, click on the center of gravity of the cylinder and rotate 90°.
  3. When leaving the tool, we can see we have made a perpendicular copy of the cylinder.
- **See the detailed explanations in the chapter:**
  “Rotate” on page 326.



Step 2: Finish the crossing

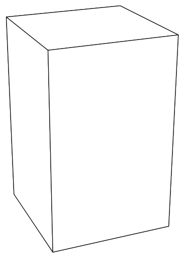
- **Tool:** Boolean
- **Do this:** Now, do a Boolean operation to produce a single object.
- **See the detailed explanations in the chapter:** "Cut / Boolean" on page 303.

23. AN ACOUSTIC BAFFLE

This exercise will show you how you can easily unfold an object (e.g,. to make a template) with AMAPI 3D. You will use the “working plane” facility to punch a true circular hole on a sloping plane.

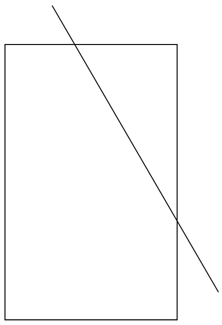
Draw the box

Step 1: The cube



- ❑ **Tool:** Cube
- ❑ **Do this:**
  1. Face view (2).
  2. Select the Cube tool.
  3. Draw a cube with the following dimensions: X=50, Y=80 and Z=50.
- ❑ **See the detailed explanations in the chapter:** “3D Primitives / Cube” en page 173.

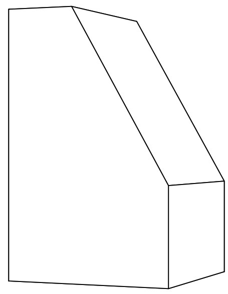
Step 2: The cutting line



- ❑ **Tool:** 2D Drawing tool, Polylines
- ❑ **Open the model file:** Enceinte01
- ❑ **Do this:**
  1. Side view (key 4).
  2. Select the Polyline tool.
  3. Use polar coordinates (PC: Click on the right mouse button, Mac: Hold the Option key pressed and click the mouse button).
  4. Draw a line, with an angle of 60° from the vertical axis. This line will cut the upper face of the cube.
- ❑ **See the detailed explanations in the chapter:** “Drawing / Polyline” on page 194.

Cutting the cube with the line

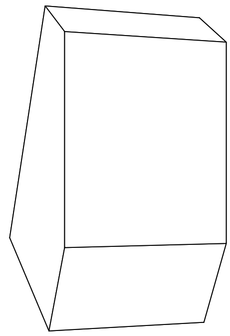
- **Tool:** Cut (Punch)
- **Open the model file:** Enceinte02
- **Do this:**
  1. Side view (key 4).
  2. The cube is the current object.
  3. Select the Cut (Punch) tool.
  4. Click on the cutting line.
  5. The cube is split.
  6. Select and delete the volume with the triangular face.
  7. Now, we get the baffle body.
- **See the detailed explanations in the chapter:** "Cut / Punch" on page 300.



Punch the loudspeaker's hole

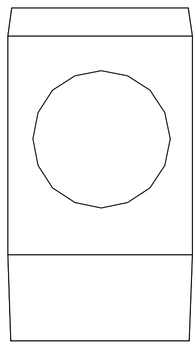
Step 1: Changing the working plane

- **Tool:** Control Panel, Working Plane
- **Open the model file:** Enceinte03
- **Do this:**
  Now, we will change the working plane to drill perpendicular to the face (to avoid drilling an oval hole).
  1. Select the Working Plane tool in the Control Panel.
  2. Click on the sloping plane: AMAPI 3D rotates the baffle so that this plane matches the nearest orthogonal plane.
- **See the detailed explanations in the chapter:** "Working Plane" on page 131.



Step 2: Draw the shape to be punched out

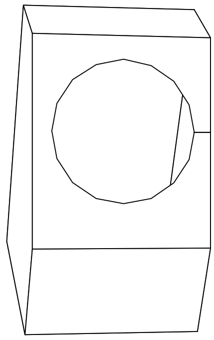
- **Tool:** Drawing tool, Circle
- **Open the model file:** Enceinte04
- **Do this:**
  1. Face view (key 2).
  2. Select the Circle tool.
  3. Draw a circle with 16 points, centered on the front face.
- **See the detailed explanations in the chapter:** "Drawing / Circle" on page 189.



Step 3: Punching

- **Tool:** Punch
- **Open the model file:** Enceinte05
- **Do this:**
  1. Side view (key 4).
  2. The baffle is the current object.
  3. Select the four points of the front face.
  4. Face view (key 2).
  5. Select the Cut (punch) tool.
  6. Click on the Circle: the face is punched.
  7. Select and delete the circular face.

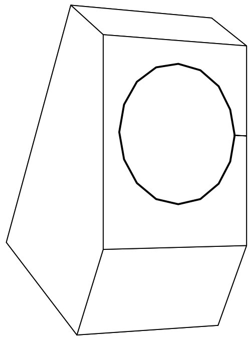
  We have made the hole for the loudspeaker.
- **See the detailed explanations in the chapter:** "Cut / Punch" on page 300.



The loudspeaker

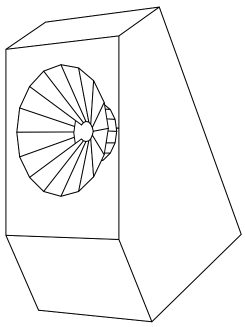
Step 1: Drawing from the loudspeaker's hole

- **Tool:** Curve Extract (Automatic boundaries extract method)
- **Open the model file:** Enceinte06
- **Do this:**
  1. Face view (key 2).
  2. Select the Curve Extract tool.
  3. Validate. The tool uses the Automatic boundaries extract method. A Circle is automatically generated from the punched hole
  4. Put the tool aside.
- **See the detailed explanations in the chapter:** "Extract Curve / Automatic extraction of the contour lines" on page 204.

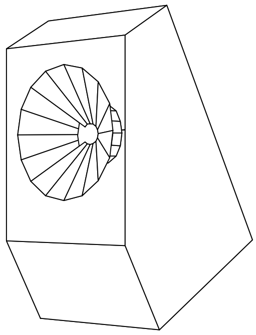


Step 2: Loudspeaker extrusion

- **Tool:** Extrusion
- **Open the model file:** Enceinte07
- **Do this:**
  1. Side view (key 4).
  2. Select the Extrusion tool.
  3. Extrude the loudspeaker profile (cone + cylinder)
  4. Close only the back face.
- **See the detailed explanations in the chapter:** "Extrusion" en page 209.



Step 3: Coming back to the original working plane



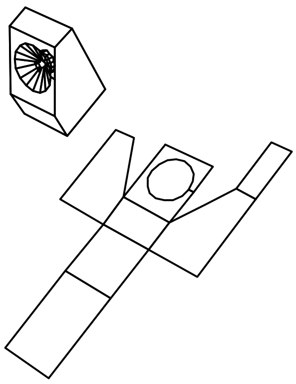
- **Tool:** Control Panel, Working Plane
- **Open the model file:** Enceinte08
- **Do this:**
  Now, we will change the Working Plane to come back to the original working plan.
  Select the Working Plane tool in the Control Panel.
  The baffle is tilted and lies on its base
- **See the detailed explanations in the chapter:**
  "Working Plane" on page 131.

Baffle chamfering

- **Tool:** Chamfer
- **Open the model file:** Enceinte09
- **Do this:**
  We can refine our baffle by rounding the angles:
  1. The baffle is the current object.
  2. Select the Chamfer tool.
  3. Set a small chamfer radius.
  4. Validate.

  The result is an acoustic baffle. If you apply a nice rendering texture, it might look nice in your living room...
- **See the detailed explanations in the chapter:**
  "Chamfer" en page 290.

Unfolding the baffle box



- **Tool:** Unfold
- **Open the model file:** Enceinte09
- **Do this:**
  We could need to have a planar version of our baffle in order to build it. NOTE: Do not unfold a chamfered object.
  We will unfold the chamfered version of the baffle box.
  1. The baffle is the current object.
  2. Select the Unfold tool.
  3. Choose a facet to start the unfolding: for example, the smallest vertical face.
  4. Unfold.

  The result is a template. Now, you can measure the faces, or print to scale, or...
- **See the detailed explanations in the chapter:**
  "Unfold" on page 345.

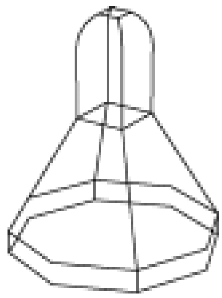
24. SPOTLIGHTS

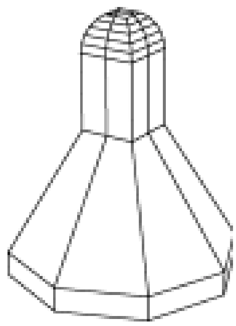
Here we will make a spotlight with one of the more powerful AMAPI 3D tools: the Gordon surfaces.
With Dynamic Geometry, a few clicks will be enough to modify our object and to create some variants.

In this exercise, to save time, we will work from curves already drawn.
Don't forget, if you run into any problem, there are intermediate files for each step in the Exercise folder.

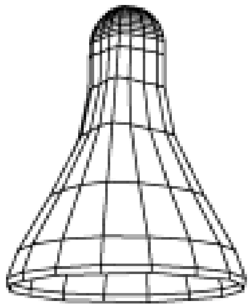
Create the surface

- **Tool:** Surfaces / Gordon Surfaces
- **Open the model file:** Spotb1
  Please note that this model is made from longitude and latitude curves. This is necessary for working with the Gordon Surfaces tool.
- **Do this:**
  1. Select the Gordon Surfaces tool.
  2. First, click on all the longitude curves: they turn red.
  3. Validate.
  4. Then click on the latitude curves: they turn green.
  5. Validate: you will see blue and yellow points. The blue points are the connected ones. The yellow points are not connected (this has been done for this exercise). AMAPI 3D will help you and connect these points itself.
  6. Validate again: the surface is generated.
- **See the detailed explanations in the chapter:**
  "Surfaces / Gordon Surfaces" en page 240.





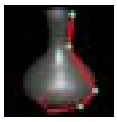
Smoothing

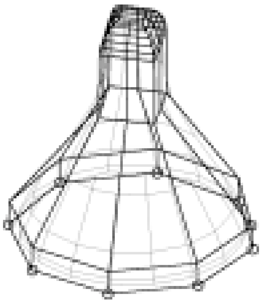


- **Tool:** Smooth
- **Open the model file:** Spotb2
- **Do this:**
  1. Select the Smooth tool.
  2. Select Catmull smoothing.
  3. Validate.
- **See the detailed explanations in the chapter:**
  "Smooth" on page 276.

Deform a spotlight using Dynamic Geometry

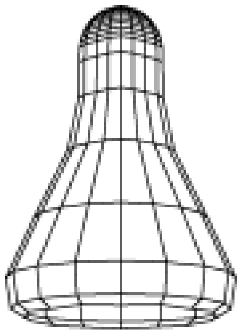
Method 1: Structure deformation





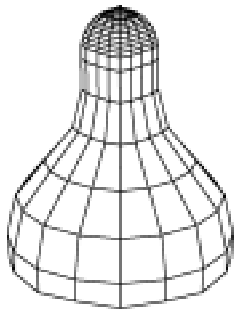
- **Tool:** Stretch
- **Open the model file:** Spotb3
- **Do this:**
  Select the Stretch tool.
  A palette appears: it shows you the three finishing levels on which you may work:
  - The structure (the construction curves)
  - The rough object (extruded object)
  - The smoothed object

  If you click on the first finishing level (bottom icon), you can work on the structure.
  If you click on the level above, you can modify the rough object, BUT you will not come back to the level below. Likewise, if you work on the smoothed object, you will lose the lower levels.
  Before changing to an upper level, save your work in a file, so that, if needed, you can come back to it later.
  Select the structure level (bottom icon).
  In the Assistant Palette, select the point selection accessory and click on the points of the bottom curve of the spotlight (see picture, each point is highlighted).
  Pull these points together.
  Validate. The shape of the spotlight has changed.
  See the result in the Spotb4 file.



- **See the detailed explanations in the chapter:**
  "Dynamic Geometry" on page 155,
  "Stretch" on page 268.

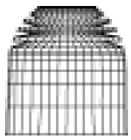
Method 2: Rough object deformation

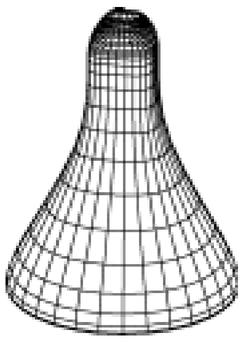


- **Tool:** Stretch
- **Open the model file:** Spotb3
- **Do this:**
  Select the Stretch tool.
  A palette appears: it shows you the three finishing levels on which you may work:
  - The structure (the construction curves)
  - The rough object (extruded object)
  - The smoothed object

  You can modify the rough object, BUT you will not come back to the level below. Likewise, if you work on the smoothed object, you will lose the lower levels.
  Before changing to an upper level, save your work in a file, so that, if needed, you can come back to it later.
  In the Dynamic Geometry palette, select the rough object level.
  In the Assistant Palette, select the point selection accessory and click on the points of the spot bottom curve (see picture, each point is surrounded). These points turn red.
  Press the spacebar once to constrain motion to the vertical axis (green).
  Move these points to the top. Click to stop the moving.
  Validate. The shape of the spotlight has changed
  See the result in the Spotb5 file.
- **See the detailed explanations in the chapter:**
  "Dynamic Geometry" on page 155,
  "Stretch" on page 268.

Method 3: Smoothed object deformation





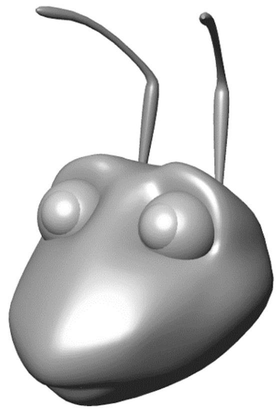
- **Tool:** Scale
- **Open the model file:** Spotb3
- **Do this:**
  Select the Scale tool
  A palette appears: it shows you the three finishing levels on which you may work:
  - The structure (the construction curves)
  - The rough object (extruded object)
  - The smoothed object

  In the Dynamic Geometry palette, select the smoothed object level (top icon).
  With the group-of-points selection accessory , select the points line after line as shown on the picture. You will select four lines of points.
  Use the Scale tool to move these points toward the center.
  Validate. The shape of the spotlight has changed.
  See the result in the Spotb6 file.

- **See the detailed explanations in the chapter:**
  "Dynamic Geometry" on page 155,
  "Scale" en page 332.

25. A LITTLE ANT

In this exercise, you will make a rough wireframe and then use different smoothing methods on your object. You will see that this approach allows you to easily modify your shape.
The tricky part is to arrange the curves at the beginning: it requires some practice to do this, but once you get it, you will be able to design any character with AMAPI 3D.



The first time you do this exercise, we recommend that you use the intermediate files corresponding to each important step. Afterward, you can do it on you own, without help!

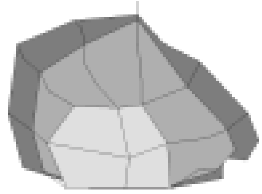
Constructing half of the head

Step 1: Drawing the construction curves

- **Tool:** Drawing / Polyline
- **Do this:**
  1. Select the Polyline tool
  2. Draw three closed curves, as shown in the picture.
  3. Then, turn the scene to slightlyand shift the curves in depth. They will be the vertical “slices” of your model.
  4. Now, turn around your curves with the arrow keys and draw some curves in other planes. They will help you to visualize your object. Don’t forget to press the Shift key to connect your curves together.
  5. Here we have drawn six curves.
  6. Use a Viewer to visualize your curves in space: View menu / New view / Free view.
  7. Remember, this is the hardest step of the exercise. Don’t hesitate to open the file Fourmi1 to use curves that are already drawn.
- **See the detailed explanations in the chapter:**
  “Drawing / Polyline” on page 194.
  “Viewer” on page 94

Side view

Step 2: Creating the surface



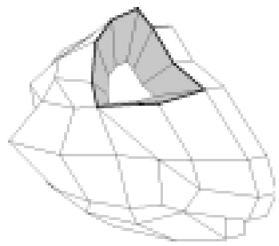
- **Tool:** Facet extraction
- **Open the model file:** Fourmi1
- **Do this:**
  Select the Facet extraction tool.
  You will create your faces one by one by clicking on the construction curves. The best way is to make quadrangular faces.
  Use a Viewer to visualize your curves in space: View menu / New view / Free view.
  If you run into problems, don't hesitate to open the file Fourmi2.
- **See the detailed explanations in the chapter:**
  "Facet Extraction" en page 206.

Step 3: Creating the space between the eyes

- **Tool:** Extrusion, Weld
- **Open the model file:** Fourmi2
- **Do this:**
  Select the Show tool, and click on the first curve you drew (the larger one) to display it on the main screen.
  Select the Extrusion tool and extrude this curve.
  In our picture, the surface generated by the extrusion is grayed.
  Weld the two surfaces together.
  If you run into problems, don't hesitate to open the file Fourmi3.
- **See the detailed explanations in the chapter:**
  "Hide-Unhide" en page 138
  "Extrusion" en page 209.
  "Weld" on page 341.

Step 4: Creating the eye socket

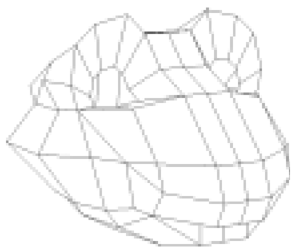
- ❑ **Tool:** Extract curve, Extrusion, Weld
- ❑ **Open the model file:** Fourmi3
- ❑ **Do this:**
  Select the Extract curve tool. The cursor is the group-of-points selection accessory Select the point selection accessory in the Assistant Palette.
  While holding the Shift key pressed, click on each point of the eye contour (bold curve on the picture). Validate. You now have a closed curve that you will extrude to make the eye socket.
  You get a surface (grayed on the picture).
  Weld the two surfaces.
  If you run into problems, don't hesitate to open the file Fourmi4.
- ❑ **See the detailed explanations in the chapter:**
  "Extract Curve" on page 204.
  "Extrusion" on page 209.
  "Weld" on page 341.



Socket extrusion

Modeling the whole head

- ❑ **Tool:** Symmetry
- ❑ **Open the model file:** Fourmi4
- ❑ **Do this:**
  Now, turn around your object with the arrow keys so that the internal face of the model is in front of you.
  Select the Symmetry tool.
  Click on the internal face. The second half of the ant head is automatically created at the right place.
  Weld the two halves. You have finished the rough object. Now we will smooth it!
  If you run into problems, don't hesitate to open the file Fourmi5.
- ❑ **See the detailed explanations in the chapter:**
  "Symmetry" on page 323.
  "Weld" on page 341.



Symmetry

Smoothing

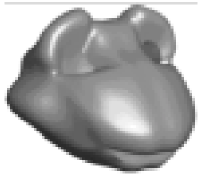
- **Tool:** Smoothing
- **Open the model file:** Fourmi5
- **Do this:**
  1. Select the rough object wireframe.
  2. Select the Smooth tool.
  3. AMAPI 3D allows you to chose from five smoothing methods.
  4. Bézier smoothing is the default. Validate by pressing the Return key to see the effect.
  5. Put the tool aside and launch a rendering by pressing the Return key.
  6. You should see something like the first picture.
  7. Select the Smooth tool again (to try another smoothing method).
  8. Select a different smoothing method.
  9. Modify the smoothing range (optional).
  10. Validate by pressing the Return key.
  11. Put the tool aside.
  12. Launch a rendering by pressing the Return key.
  13. Return to step 7 to try another smoothing method. When you have tried all of them, go to the next step to perform the final smoothing.
  14. Select the Smooth tool again.
  15. Select Catmull smoothing.
  16. With the “+” and “–” keys set the smoothing range to 2.
  17. Validate by pressing the Return key.
- **See the detailed explanations in the chapter:** “Smooth” on page 276.

Bézier Smoothing

Doo Smoothing

Catmull Smoothing

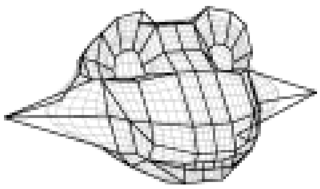
Loop Smoothing



Butterfly Smoothing

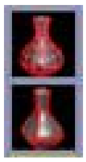
Puff out the cheeks

- **Tool:** Stretch
- **Open the model file:** Fourmi5bis
- **Do this:**
  1. Select the Stretch tool.
  2. The Stretch tool is able to use the Dynamic Geometry properties. Your smoothed object becomes grayed while the rough object appears. By default the rough object is edited and is the control shape for your deformations.
  3. Select the point that corresponds to the cheeks of your ant. Move it away from your model to puff out its cheeks (see illustration). The smoothed object is automatically and dynamically re-computed for any action that you do.
  4. Eventually, move other points.
  5. Put the tool aside and launch a rendering by pressing the Return key.



- **See the detailed explanations in the chapter:**
  "Dynamic Geometry" on page 155.
  "Stretch" on page 268.

Create the nostrils



- **Tool:** Stretch
- **Open the model file:** Fourmi5ter
- **Do this:**
  Select the Stretch tool.
  The Stretch tool is able to use the Dynamic Geometry properties.
  Your smoothed object becomes grayed while the rough object appears. This time we will work on the smoothed object.

  You need to specify this by clicking on the icon corresponding to this finishing level: .
  Warning: You will not be able to come back to the level below, and your object will lose its Dynamic Geometry properties.
  Save your work in a file before doing this, so that, if needed, you can come back to it later.
  Click on the faces corresponding to the place of the nostrils and pull them inside the ant head.
  Put the tool aside.
- **See the detailed explanations in the chapter:**
  "Dynamic Geometry" on page 155,
  "Stretch" on page 268.

Finishing the ant head

- ❑ **Open the model file:** Fourmi7
- ❑ **Do this:**
  Now that the head is finished, use the Fourmi7 model to help you to add eyes and antennas.

Glossary

Absolute (mode) — The position of a point is defined relative to the origin (set by default at the center of the workbench). See also *relative* mode.

Aliasing — Undesirable visual effect (often called “jaggies”) which appears when rendering curves at angles other than 0, 45, or 90 degrees. Also visible on polygon edges, particularly with high contrast scenarios. See also *anti-aliasing*.

Ambient (color) — Color of the object in ambient lighting (without shadows).

Animation — Process used in computer generated images to represent movement.
An animation can be generated and played in real time or played back from recorded images.

Anti-aliasing — Filtering techniques used to reduce or eliminate aliasing effects. See *aliasing*.

Scene Manager — The Scene Manager is a scene management system used to sort objects and to manage the hierarchy of a scene. It will allow you to sort objects by groups and sub-groups, by layers or by the materials applied. Hierarchy management is very useful when working on complex scenes.

Bitmap — A bitmap image is an image which is defined by pixels (as opposed to vectors).

Boolean (operation) — An operation based on logical algebra that can calculate the intersection of two objects, as well as their union, exclusion, and more.

Brightness — Brightness is the property of an object to reflect light. The parameters controlling the brightness are: the specularity, the spread, the falloff, and the filter.
Example: a polished surface has a narrow and intense reflection. A matte surface displays a wide and faint reflection.

Camera — The tool used to set the viewpoint, view direction, and orientation.

Catalog — The AMAPI 3D file manager. AMAPI 3D manages two types of files: scenes and materials.

Coons (surfaces) — A modeling technique involving the Hull tool. Works by interpolation between the control curves which delimit the surface (Hull tool, 4-curve method).

Dialog box	Window that allows the user to ask questions or to choose from options. The user checks the box(s) corresponding to his choice(s).
Diffuse (color)	What the object reflects when lighted by a direct lighting (daylight or artificial light).
Dynamic Geometry	This allows you to edit a surface—not from the surface wireframe—but from the construction curves, which become the control curves of the surface. The surface is automatically regenerated when you edit the curves (like NURBS control polygons).
Extrusion	Modeling process that generates a 3D model from a curve.
Eye	The eye is the point from which the scene is being viewed.
Facet	A 3D model's small flat surfaces delimited by geometric contours (straight lines or curves), usually a triangle or a quadrilateral.
Falloff	Defines the diffusion of reflection along a surface.
Filter	Controls the influence of the color of the lighting on the color of the reflection (defined by the specularity).
Format	Structure of the data used to save a file on the hard drive. There are numerous types of file formats.
Grid	Intersection of lines evenly spaced out in two or three dimensions.
Hidden facets	Facets of a model that would be invisible from the current viewpoint if the facets were not transparent.
Hidden Lines	Edges or lines of a model that would be invisible from the current viewpoint if the facets were not transparent.
Incident light	Light going to the object. The resulting color of the object depends on the incident light and the intrinsic object color.
Interface	Communication facility between the computer and its peripherals or between the user and the software.
Keyframe	A term used in animation. Creating keyframes means that you distort or move your model (move it to different locations, change its scale, bend it, pull points, ...) and that you define when those transformations take place. See also *keyframe editor*.
Keyframe Editor	Editor of keyframes used to create an animation. Between two keyframes, the key-frame editor will, using linear interpolation, compute all the intermediate frames, thus building the animation.

Layer	A layer is a system used to classify objects. The Scene Manager is the tool used to manage this system. Objects can be assigned to a layer.
Layer (2)	A material is defined by a uniform layer and the superposition of higher level layers (textures or mappings).
Lighting	Lighting is the propagation of rays of light originating from a natural or artificial light source.
Luminance	Reflected or emissive light intensity of a surface in an given direction.
Mapping (image)	Mapping of an image (texture map) on a surface (describing a volume or not). There are different types of mapping depending on how the image is projected onto the object, and on the interaction between the projection and the surface of the object. For example, planar, spherical, cylindrical…
Material	A material defines the appearance of a surface. It is defined by one or several layers, which are: the uniform level zero layer and a superposition of higher level layers (which can be textures or mapped images).
Phong	Shading method using normal interpolation for each point of a shape. It doesn't take into account indirect lighting, such as reflection from other objects.
Procedural textures	A procedural texture is the result of a mathematical computation. One can control different parameters defining its structure (scale, perturbation, orientation etc…). Procedural textures involve algorithms instead of images.
Pulldown menu	Menu appearing when the user presses a key or clicks on a button and that disappears once the selection is made.
Ray-tracing	Rendering technique that produces near photo-realistic images by shooting rays from the viewpoint's eye position through each pixel of the scene's image and computing where such rays hit an object's surface. Raytracing can produce images that mimic optical effects such as refection of a polished or chrome (mirror) surface, refraction through glass, and shadows.
Smoothing	Allows the user to control the number and size of facets defining a surface or the number of segments defining a curve. The higher the smoothing value, the smoother the object will look.
Target Point	Point toward which the eye is looking.
Radiance	Determines the light generated by an object's surfaces, independent of any external light source.

Redraw Refreshing the image displayed on screen to eliminate any display artifacts caused by erasing and undrawing.

Reflection Surfaces reflect to some degree the surrounding colors. The reflection determines the ratio between reflected light and incident light (in the case of a lighted surface).
You can set the reflection using the corresponding slider.

Relative (mode) The position of a point is defined relative to the position of the previously entered point. See also *absolute* mode.

Rendering Rendering is the process that computes and displays a scene. Computations are based on pre-defined algorithms that take into account: the geometry of the objects (modeling), the materials applied to those objects (metal, marble, wood, etc.), the lighting, the point of view and, finally, the interaction that all those elements may have between each other (shadows, reflections, etc.).

Scene A scene consists of objects created in a same work space.

Specularity Specifies the color and intensity of the reflection on an object.

Spread Specifies the size of the reflection of a light source on an object.

Style Defines a way to draw an object. It is characterized by a contour (edge) line and a fill color.

Texture (2D and 3D) A 3D TEXTURE describes the structure of a pattern in the three dimensions algorithmically. A object to which such a 3D texture is applied is, in a way, sculpted from this material. We can define some parameters of its structure (scale, perturbation grain, orientation, etc.). It is also possible to set the colormap of a 3D texture.

A 2D TEXTURE describes the structure of a pattern in the two dimensions algorithmically. A 2D texture can be mapped and some parameters describing its structure can be modified (scale, perturbation, grain, orientation, etc.). It is also possible to set the colormap of a 2D texture. 2D textures can also consist of an image instead of an algorithm.

Transparency Surface property defining the quantity of incident light transmitted through the surface of the object.

View point The view point is what is in front of the observer's eye. It is determined by the position of the eye, a target point defining the viewing direction, and the visual field (field of view).

Visual field The region of space that the eye can perceive when looking at the target point.

Window An area on the screen, outlined, where data is displayed.

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