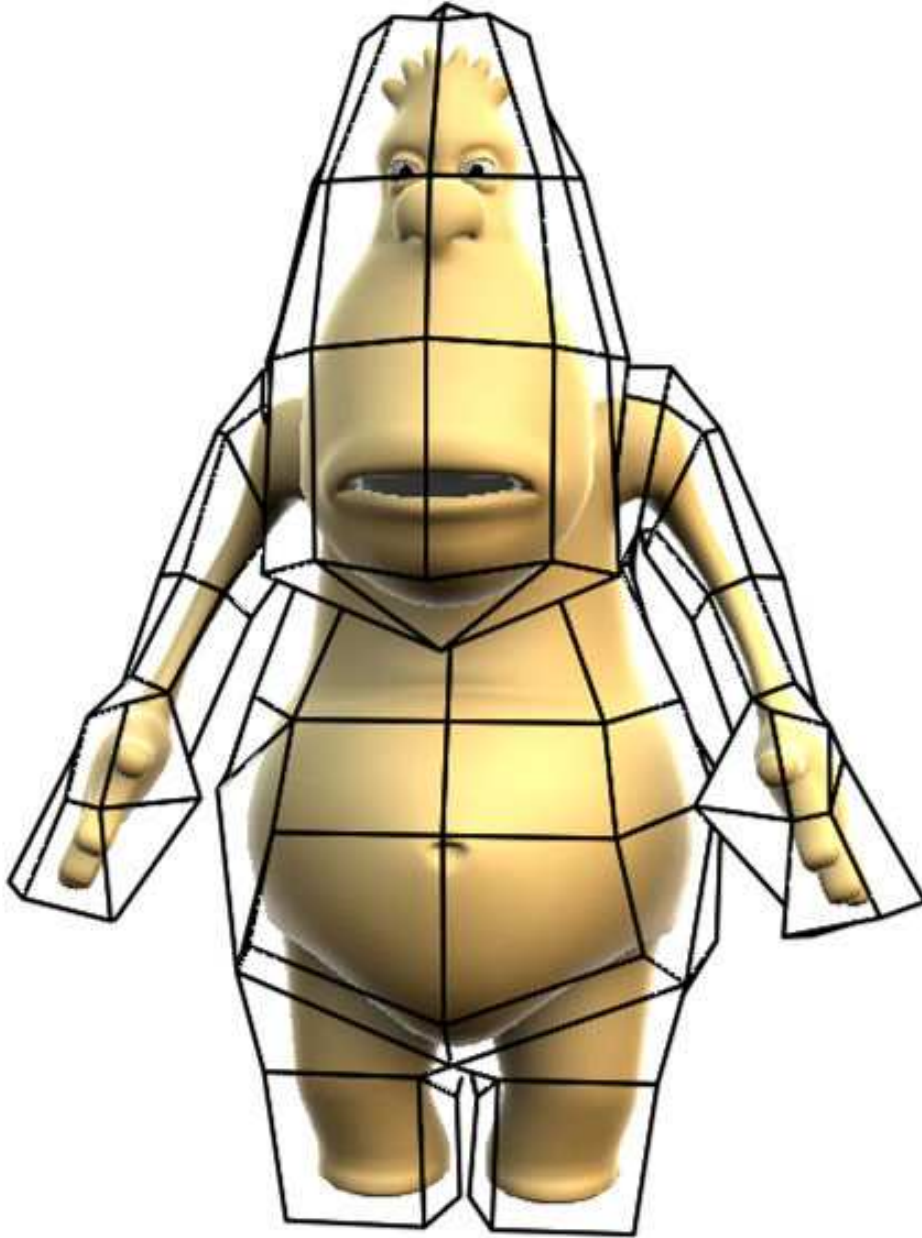


Cagedeformer ver. 1.0

User Manual



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1. Introduction

Cagedeformer is a plugin that allows to perform complex deformations of one or more polygon objects. The deformation is performed "indirectly", through a second polygonal object called "cage" that must be constructed by the user. The plugin acts as a cinema 4d's standard deformer, and keeps all the characteristics of this type of plugin.

2. Quick example of use

2.1. Setting the scene

The scene involves the use of at least two objects: the object to deform and the cage.
First of all, create the object to deform, by inserting a cone and then shaping it polygonal by using "Make Object Editable" function.



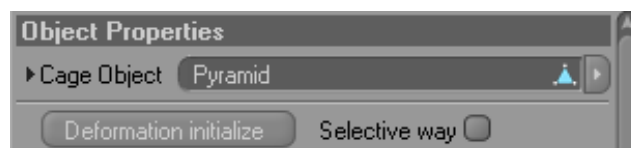
At this point insert a pyramid, by enlarging the dimensions until the cone fits properly inside, and then make it editable too.
Finally insert the cagedeformer and put it as the son of the cone. The result will be a structure like the one described in picture 2.1.



Pic. 2.1

2.2. Deformation initialization

Select the Cagedeformer plugin, then drag the pyramid object inside the box called "cage object".
This action shows the plugging which is the object to be used as a cage. Then press the button "Deformation initialize".



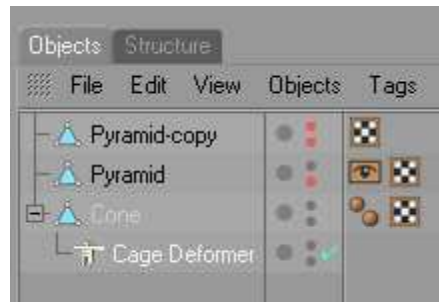
This procedure should be performed the first time an object is linked to the cagedeformer, or whenever the structure of the object to be deformed, or the structure of the cage object, is changed.

When pressing the initialization button, the cage object, if necessary, is triangulated and automatically displayed in "wired" mode. This helps the User to see both the polygon cage's structure and the deformed object's structure.

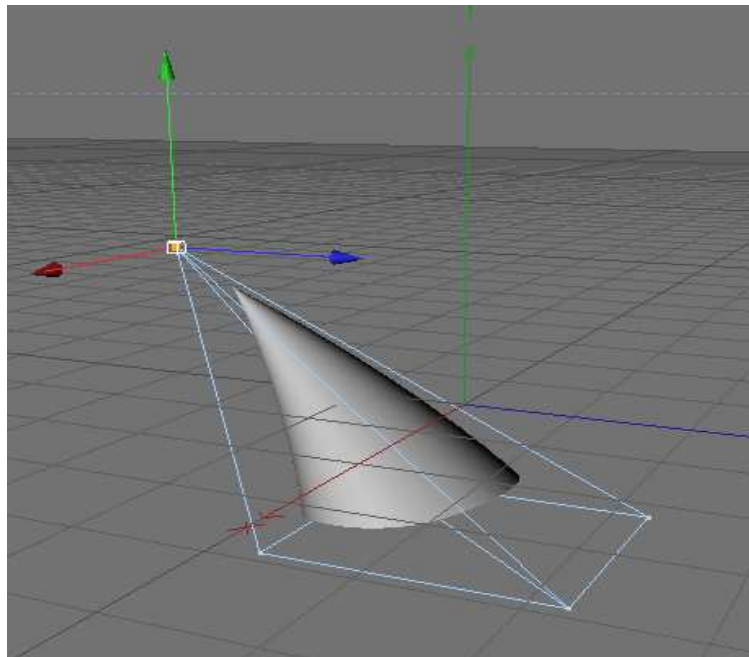
In case triangulation is necessary, the program created a backup copy of the original cage model.

The scene should now look like the one in picture 2.2.

pic. 2.2

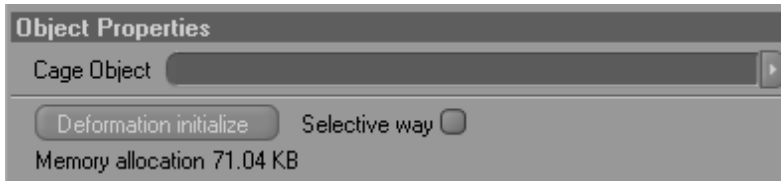


At this point, by moving the pyramid object's faces or points, the cone object deformation should be obtained.



3. Menus and functions

3.1. Object



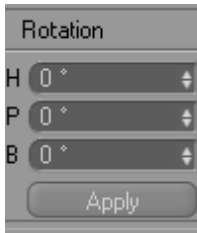
This menu contains the basic settings of the plugin.

3.1.1. Cage Object

The Cage Object box specifies which object has to be used as a cage.

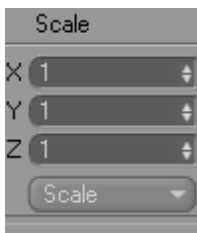
The cage object could be any type of polygonal model, but must meet the following restrictions:

- **Rotation limits:** the object must have a null rotation matrix



Tips: In case the cage has to be turned, this can be done by turning all its points or faces. This procedure in fact, compared to the Model tool mode, does not change the rotation matrix.

- **Scale limits:** the cage object must have a matrix scale equal to 1.



Tips: in this case, if the cage must be scaled, use model tool.

- **Structure limits:** the cage object must contain all items to be deformed, unless the "selective method" or a Tag Restriction is used (these two methods are described in the next pages). Moreover, the cage object must be a closed polygon and have all the normals externally aligned.

In case any of these limitations is not respected, the deformation results will be affected by serious calculation errors and will give unpredictable results.

3.1.2. Selective Way

This option enables a different method to calculate the deformation parameters. By default (Selective Way box unchecked) the plugin considers all points of the object to be deformed included into the cage; if this is false, errors will occur during the deformation. Using the selective method, an additional procedure is enabled: it checks if a point is inside the cage; if not, the point is excluded from the deformation.

This procedure extends a bit the initialization phase's time, but at the same time allows more efficient use of memory because it doesn't allocate anything for points outside the cage.

Tips: due to a limitation in monitoring the collisions of the CINEMA 4D SDK, it can happen that points exactly perpendicular to the cage face's edges are in the wrong place considered like outside (it can happen especially on the axis of symmetry of construction of the cage). To work around this limitation you may want to slightly alter the cage and eliminate this correspondence.

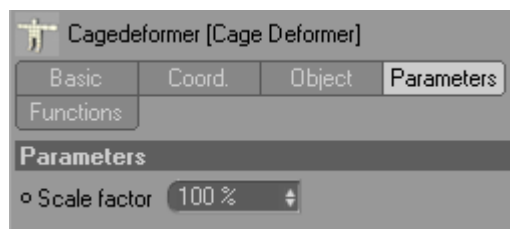
3.1.3. Deformation initialize

This button starts the calculation process of the deformation parameters. A connection between the cage and the objects to be deformed is built up. After that, any modification of the cage will match a modification of linked objects.

Below the button the amount of used memory is showed. The required memory depends on these main factors: the number of points of the object to be deformed, the number of points and faces of the cage object. In case of deformations of very complex models, it is recommended to use very light cages or partial cages by using the selective way (see 3.1.1).

At the bottom left side of the program window, the evolution of the initialization procedure is showed. To abort press the ESC key.

3.2. Parameters



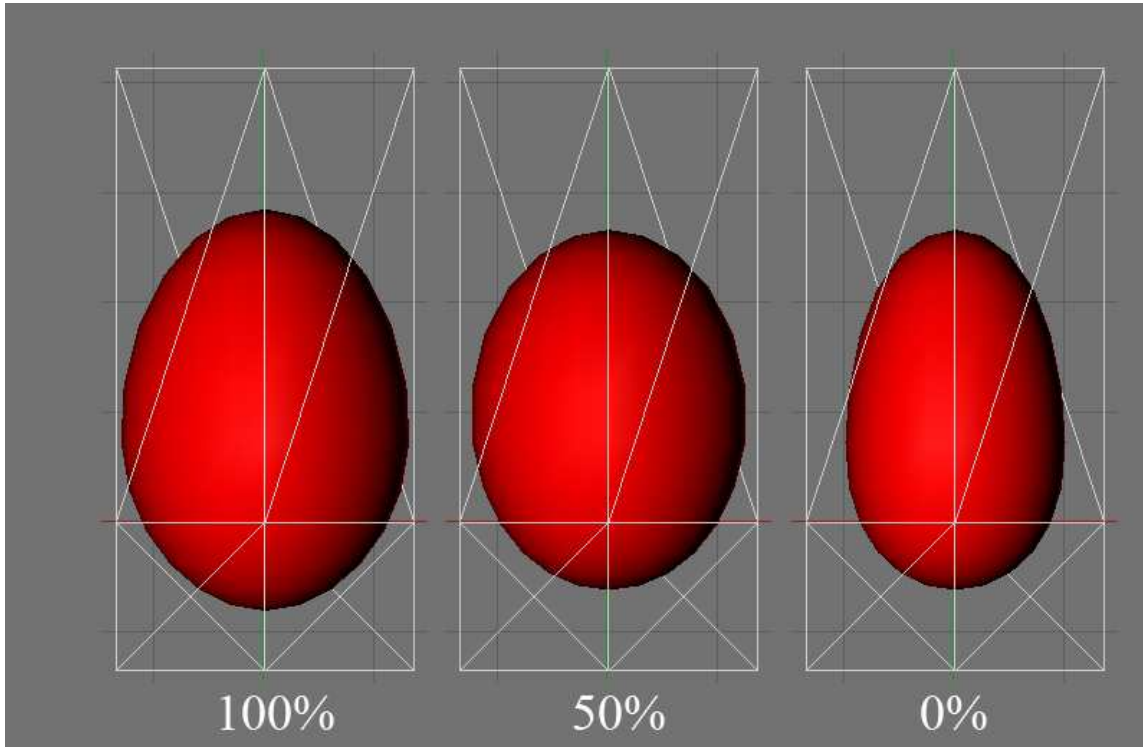
The Parameters box contains only one item called scale-factor. This is the only plugin's animation parameter, which defines the way in which the program recalculates the deformation volumes according to the new positions of the cage's faces.

The default value is 100% and states that the program will use a method that is subject to the deformation of the cage's proportions area. This mode gives the most realistic results.

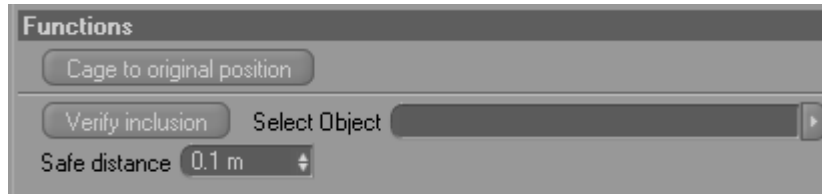
On the contrary, a value of 0% completely ignores the cage's surface proportions area, and assigns the weights constantly.

Values ranging instead from 0% .. <100% introduce distortions that have intermediate weight.

In the figure below an example of the use of three different "scale factor" parameter's values on the deformation of a sphere.



3.3 Functions



In the "Functions" box there are some functions which are not basic for the plugin use, but could be useful in some circumstances.

3.3.1 Cage to original position

This button brings the points of the cage back to the original position.

3.3.2 Verify inclusion

This command is very useful in case it is difficult to understand if the constructed cage is valid or not.

Insert the object, on which the function has to be used, in the "Select Object" box. Then click "Verify inclusion" button to start the process.

The process consists of two different steps: the first one to check if all points of the selected object are contained in the cage object. If so, the procedure moves to the next step, otherwise it stops and a Tag selection - in which the items outside the cage are displayed - is created.

The second step checks that all points have a distance from the cage at least equal to the value entered in the "safe distance" box. At the end of the step the plugin creates a tag selection that highlights the too close points. If the cage meets the requirements, no tag selections is created!

The closeness of the points to the cage is a very important parameter, because if the points are too close to the cage, they tend to create problems during calculation and it would be better to avoid it.

4. Usage Guidelines

- The deformation calculation procedure is always the result of rounding and approximations. Therefore sometimes it's possible to get errors in the deformation process which cause a noise on the surface of the deformed polygon. A good way to avoid such a problem is to use cages as simple as possible and with surfaces enough distant from the polygons to be deformed.
- The plug-in is a Cinema 4D's standard deformer, therefore contains all properties of such a type of structures. A tag restriction can be used to limit the effect of the deformer. This technique could be successfully applied also to the selective deformation (see par. 3.1.2), making the transition between the deformed and the non-deformed zone be softer.

Sample scene with tag restriction

