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# **Simplicage**

***Release 1.0***

**Morelewd and Mustard**

**Oct 11, 2022**



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**Simplicage** is a Blender addon to quickly generate physics-ready (through Blender cloth physics) cages for your models.



## MAIN FEATURES

The main features are the following.

- **Generation of physics-ready cages** from mesh and bone selection
- **Generation of collision boxes** from mesh and bone selection
- **Presets system**, with some available by default for most common applications
- **Tool to manage available cages**, and quickly bake them



## REQUIREMENTS

- Blender 3.2 or above (Blender 3.1.x or older versions are not supported)



## CONTENTS

### 3.1 Versions

There are 3 different versions of Simplicage. The features available in each version are summarized in the table.

FEATURES	FREE	LITE	PRO
CAGES FOR CHARACTERS	✓	✓	✓
CLEAN SELECTION	✓	✓	✓
REMESHING	✓	✓	✓
COLLISION BOXES	✓	✓	✓
SINGLE BONE PER CAGE	✓	✓	✓
MULTIPLE BONES PER CAGE		✓	✓
CAGES FOR OBJECTS			✓
PHYSICS PRESETS			✓

#### 3.1.1 Free Version

This version can be used to create fully working physics cages, as well as collision boxes. However, you are limited in creating cages only starting from single bones.

#### 3.1.2 Lite Version

The Lite version provides all the Free version features, with the additional possibility to create cages from a multiple selection of bones. See the documentation part about *Modes* for more informations on this feature.

### 3.1.3 Pro Version

In the Pro version you can create a cage from any vertex group, even if an Armature is not available for the Object you want to create the cage from. See the documentation part about [Modes](#) for more informations on this feature.

## 3.2 Installation

In this section you will be guided in the process of installing/updating Simplicage as an add-on.

### 3.2.1 Install

The installation of the model should be done through the Blender preferences.

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**Note:** Before proceeding with the installation, be sure to install the latest Blender version.

In particular, the addon is compatible with Blender 3.2.x or newest versions. We can not provide any support for installing Simplicage on earlier versions.

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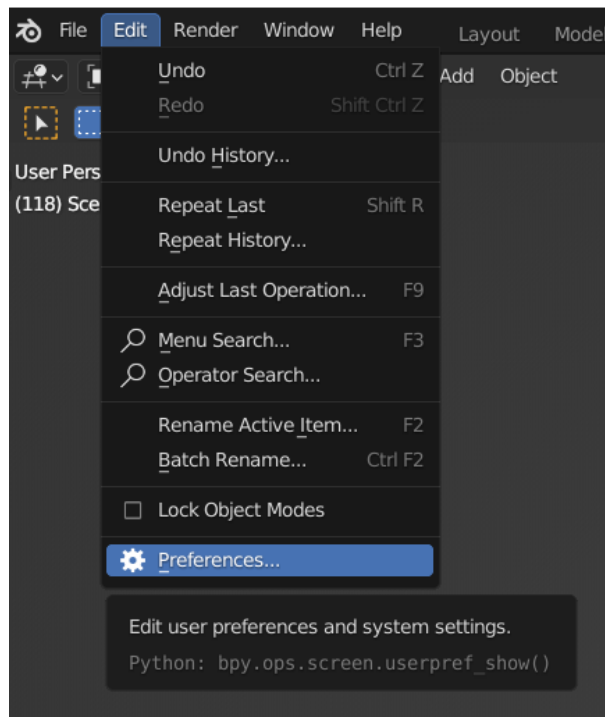
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**Note:** Do not unpack the .zip file before installing the addon. Select directly the file you download.

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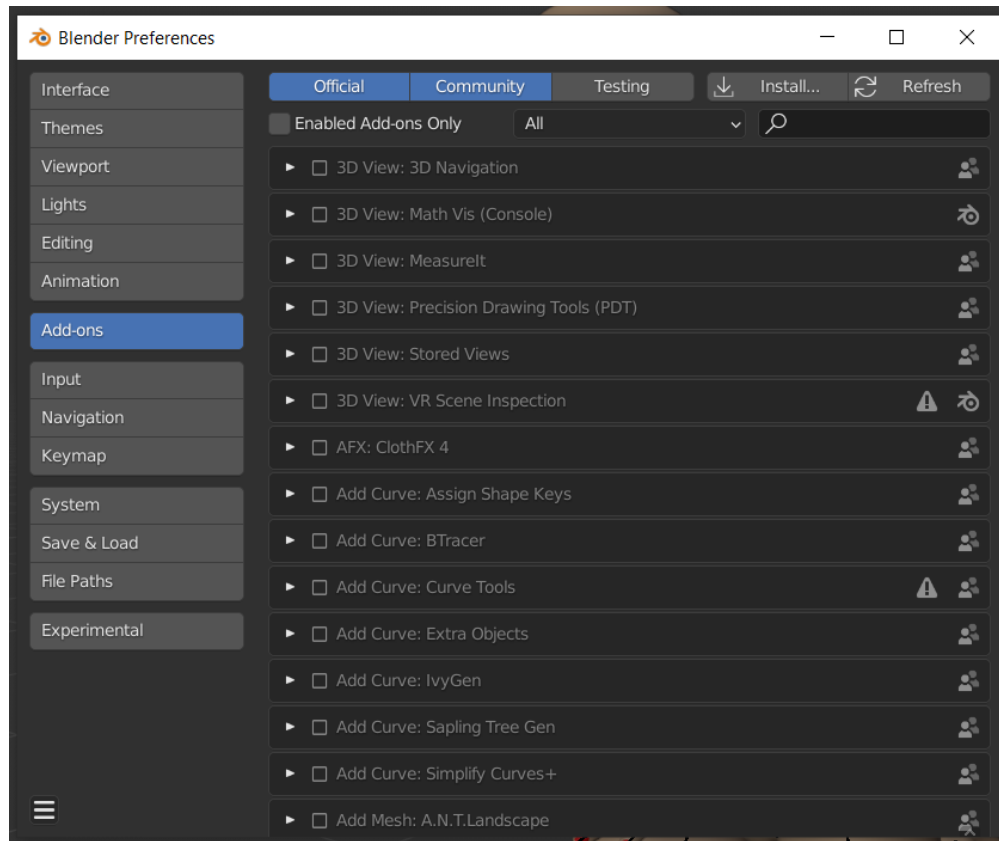
The steps are the following.

1. Open Blender *Settings*.

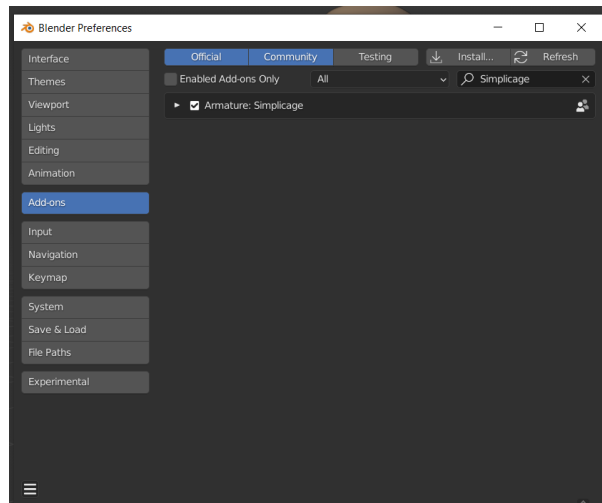


2. Open the *Add-on* tab and click on the *Install...* button.

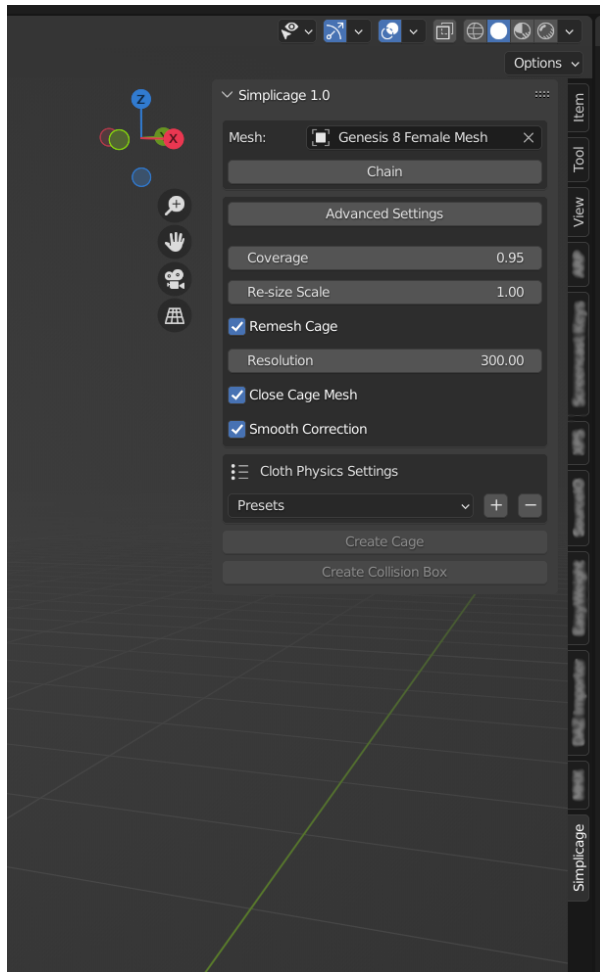




3. Select the file *Simplicage.zip*.
4. In the Setting window it should now appear the Simplicage addon. *Enable it* clicking on the check button.



5. Restart Blender.
6. You can now start using the addon. Go in Viewport and press N: you will enable the tabs on the right as in the image. Search for Simplicage and start using the addon!



### 3.2.2 Updating

If you are updating the add-on, please follow again the guide before. Be sure to restart Blender before using the new version of the add-on.

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**Note:** While updating, the Setting window might not automatically select Simplicage. Simply search for Simplicage with the search field to quickly find the new version of the add-on, and check if it is enabled.

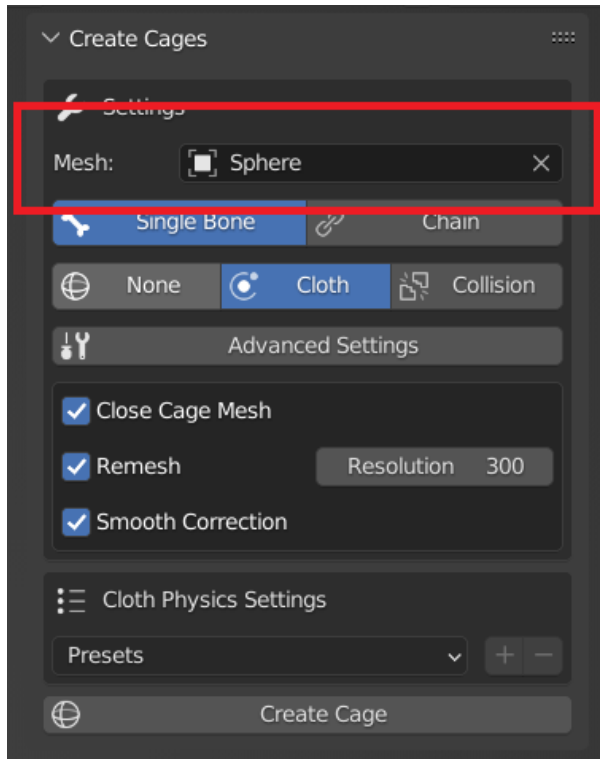
---

## 3.3 First cage

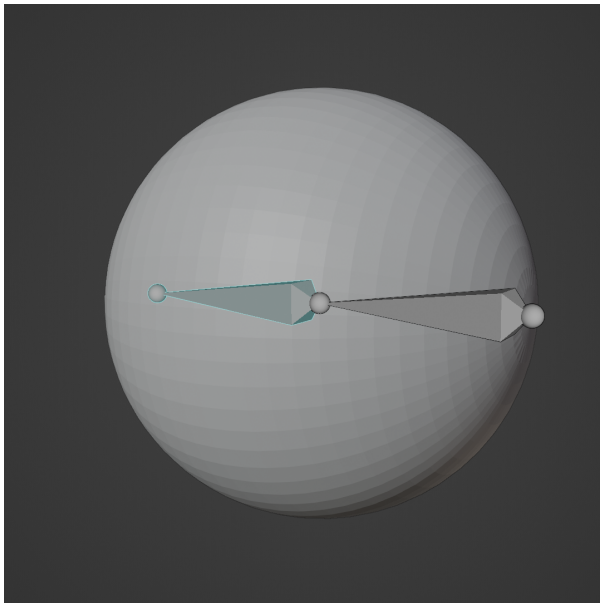
In this section we create the first cage with Simplicage!

The quick cage setup requires only a couple of very simple steps:

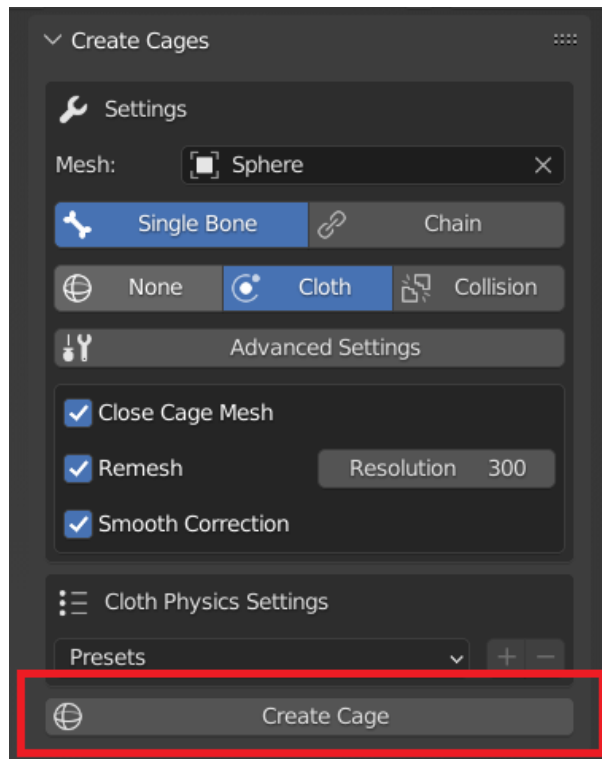
- Open the *Simplicage* tab (see Installation if the tab is not available)
- In the Simplicage tab, firstly *select the Mesh Object* from which the cage should be generated.



- Select a bone of the armature whose Mesh Object is the one selected in the previous step.



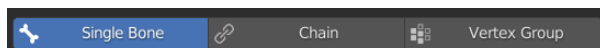
- Click on *Create Cage*.



More advanced options to customize your cage generation are available at [Settings](#)

## 3.4 Modes

### 3.4.1 Cage Modes



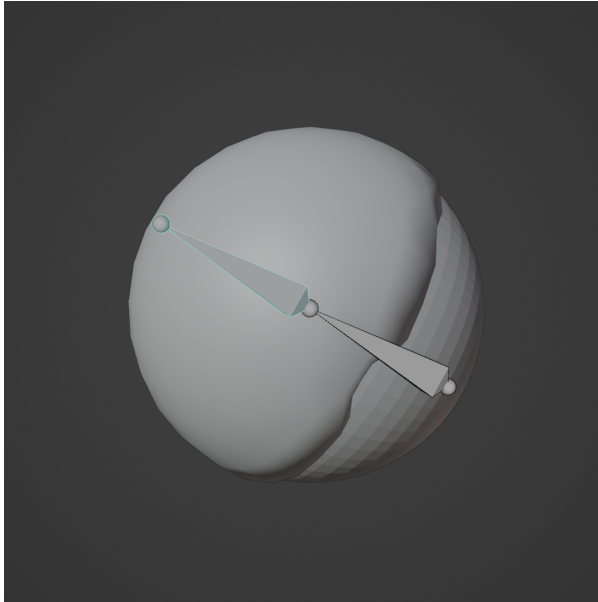
In this section we list the different cage modes available on Simplicage. Note that you might see less modes depending on the version you are using. Check the documentation part on [Versions](#) for more information.

Select one option to choose the method with which you want to select the region to generate the cage from.

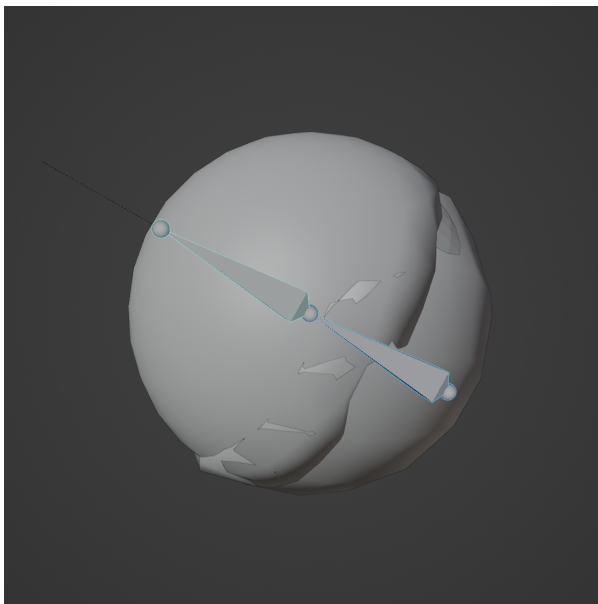
#### Single Bone

The Single Bone mode creates a cage for each of the selected bones.

For instance, if we select one bone we obtain the single cage for the selected bone.

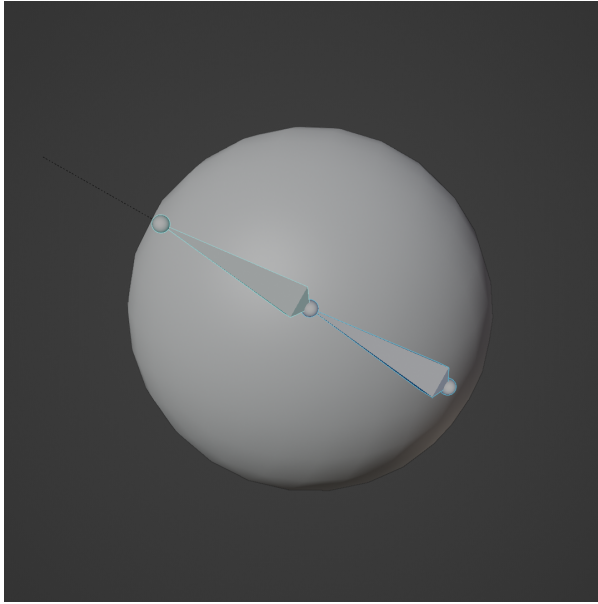


While selecting more bones, the addon will create a cage for each selected bone.



### Chain (Lite Version and Pro Version)

This mode generates a unique cage for the selected bones, instead of one for each bone.



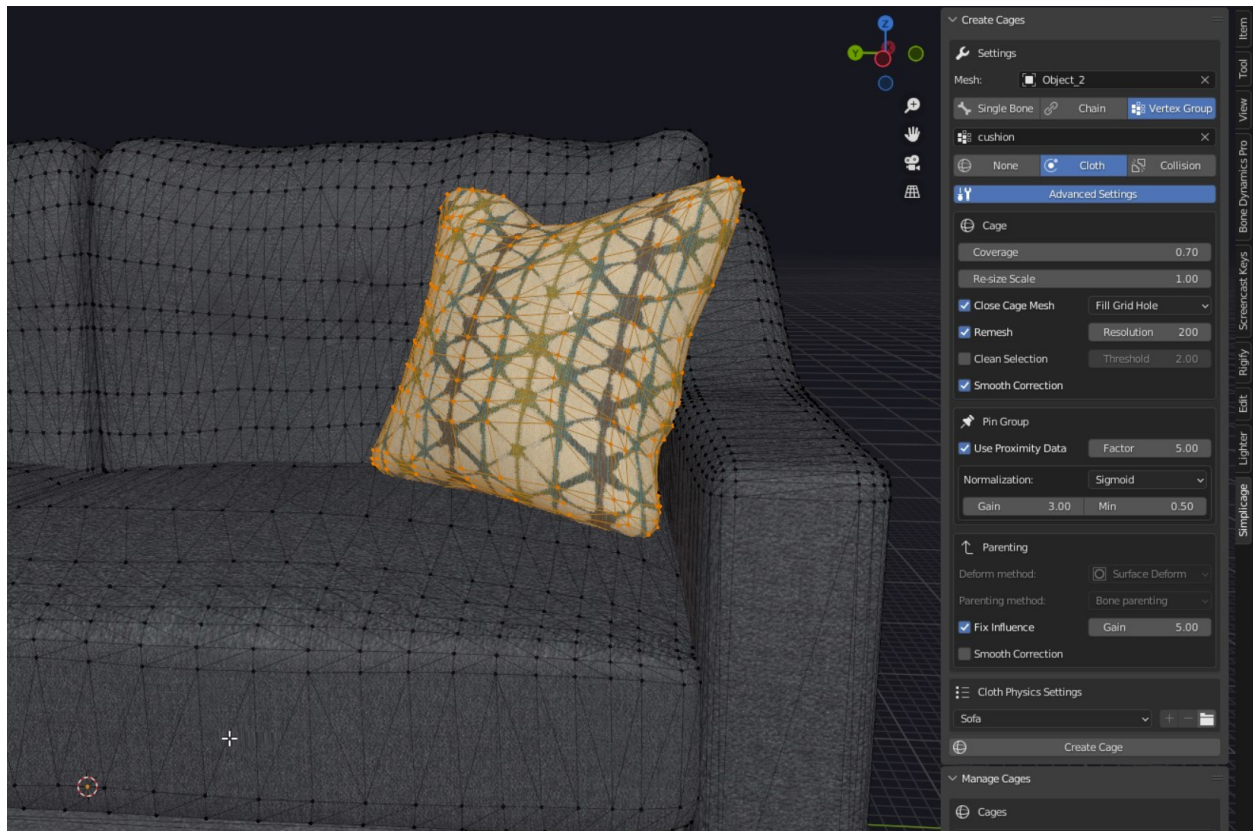
---

**Note:** If only one bone is selected, *Chain* mode will be automatically disabled when you generate the cage.

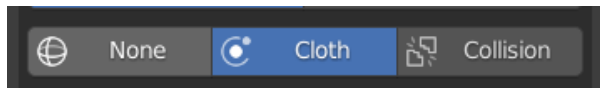
---

### Vertex Group (Pro Version)

This mode generates a cage from the Vertex Group of the Mesh object selected. This mode works also on Objects that are not driven by an Armature.



### 3.4.2 Physics Modes



In this section we list the different Physics modes available on Simplicage. Select one option to choose which kind of physics to apply to the cage.

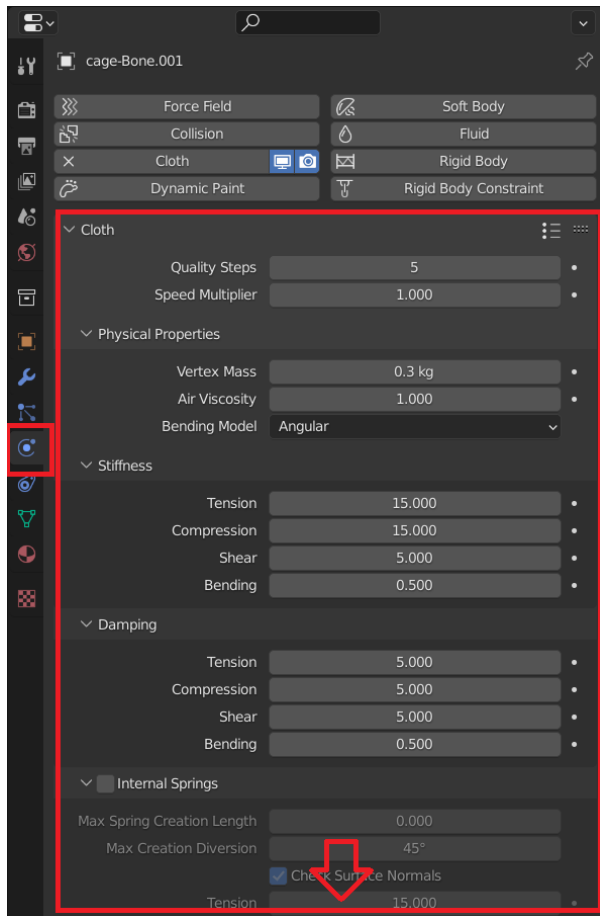
#### None

In this mode, a cage without physics is generated.

#### Cloth

In this mode, a cage with cloth physics is generated. It will also be bound to the Mesh from which it has been created.

Clicking on the generate cage, we can also change the cloth physics settings in the object Physics Options.



### Collision Box

This mode will create a collision box instead of a cage for physics. This means that cages will collide with this collision box.

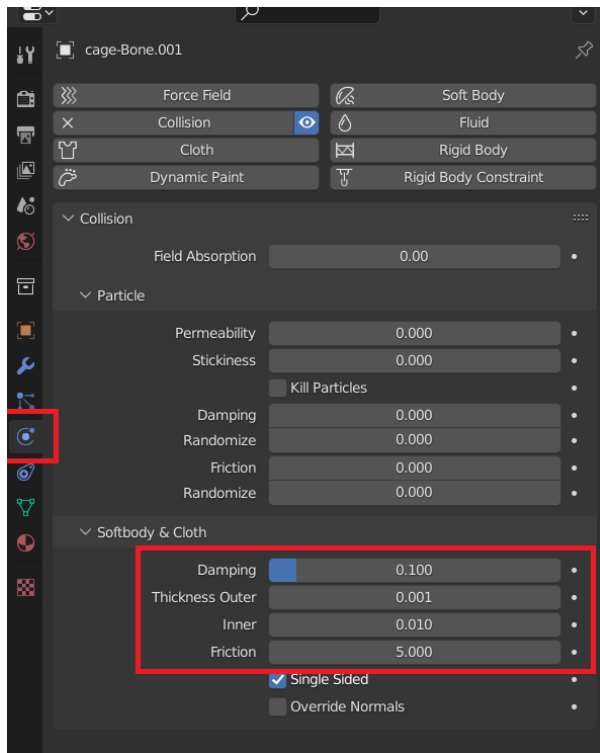
---

**Note:** When creating a collision cage, better results might be achieved disabling the Remesh option and the Close Cage Mesh option.

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Clicking on the generated collision box, we can also change the collision settings in the object Physics Options.





## 3.5 Settings

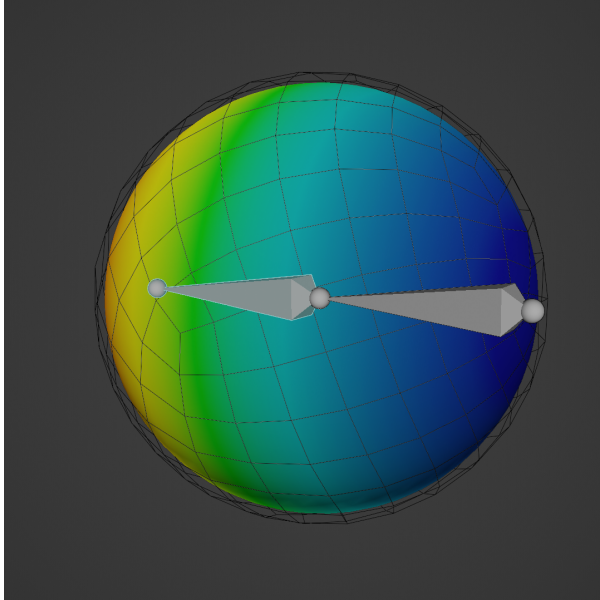
### 3.5.1 Cage

#### Coverage

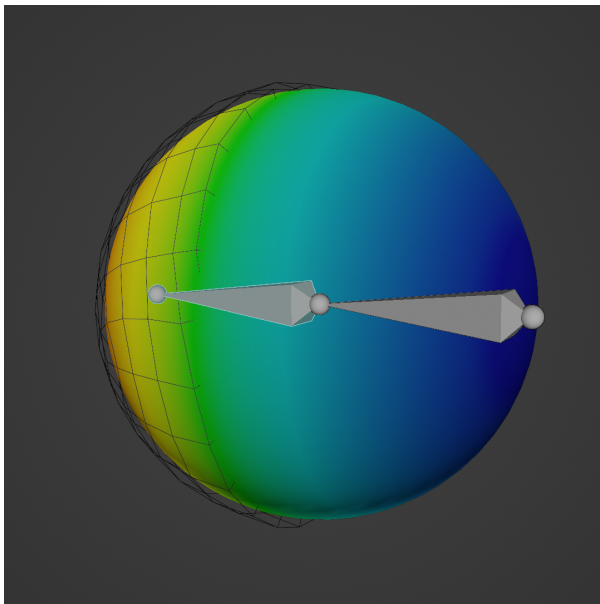
This option controls how much of the selected bone vertex group is considered when generating the cage.

In the example, the vertex group on the sphere of the selected bone is shown. It has non-null values on the whole sphere. Therefore a coverage of 1 will create a cage covering the whole sphere. When selecting 0.5 instead, we cover half the sphere.

1. *Coverage* = 1



2. *Coverage* = 0.5



### Re-size Scale

*Re-size Scale* is the factor with which the final cage is rescaled using the cage *Origin to Center of Mass (Surface)* point as the origin.

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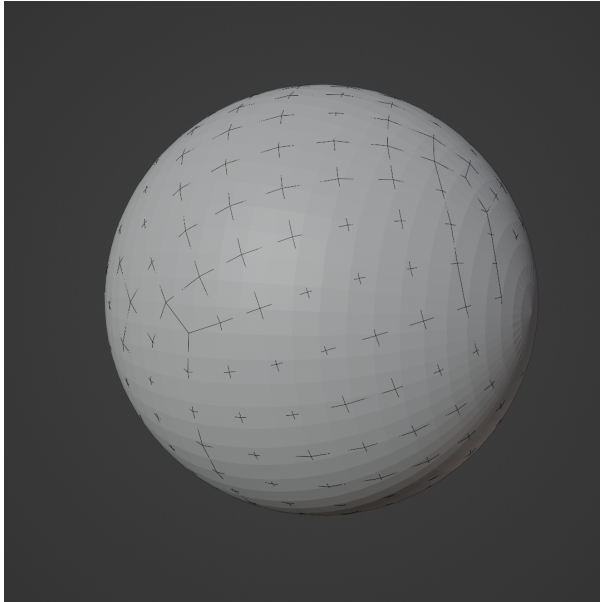
**Note:** We advise to use a value slightly bigger than 1 for physics cages, and a value of 1 for Collision cages.

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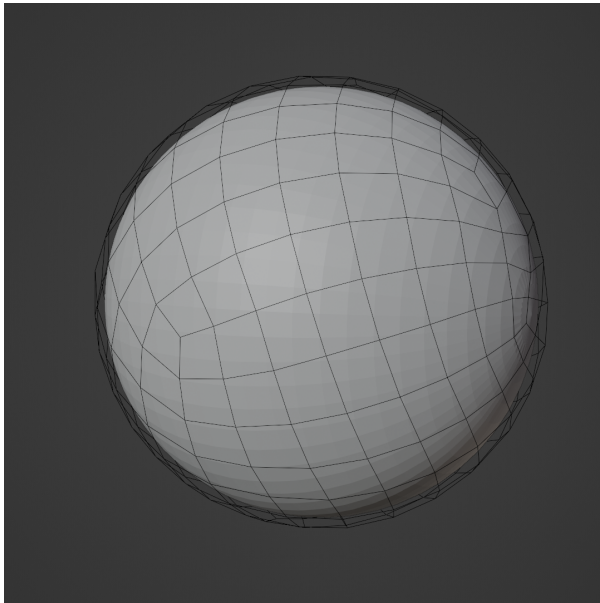
**Warning:** If the mesh is complex, the rescaling might be not perfect due to the choice of the origin. While this is not an issue when using Surface Deform binding option (see below), it might be a problem when using Mehs Deform

as the cage might fail to enclose the whole mesh. In this case, small manual tweaks of the mesh might be needed.

1. *Re-size Scale* = 1



2. *Re-size Scale* = 1.05



## Close Cage Mesh

With this option you can choose to close the mesh, and the method to consider.

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**Note:** When creating a collision cage, better results might be achieved disabling the Remesh option and the Close Cage Mesh option.

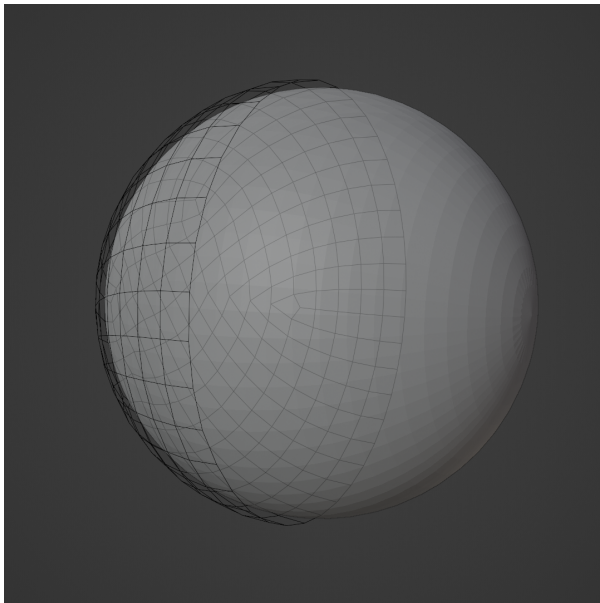
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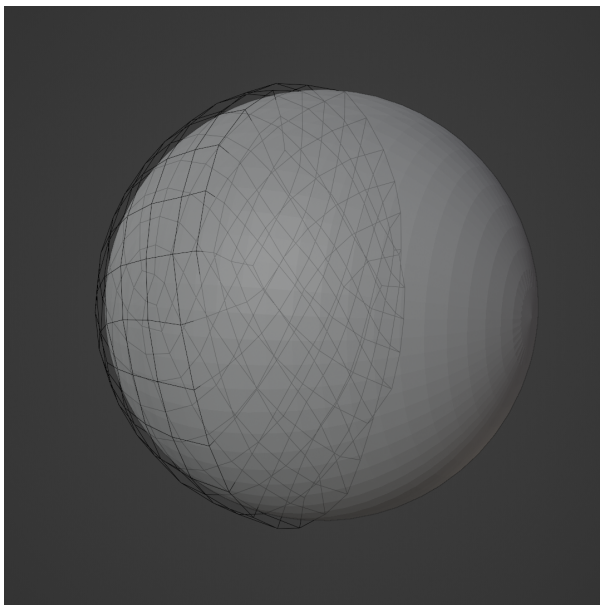
**Note:** We advise to change the method only if errors are generated during mesh creation.

---

1. *Close Cage Mesh* disabled



2. *Close Cage Mesh* enabled



## Remesh

*Remesh* enables the possibility to remesh the generated cage. This in general will provide a nicer topology if you use *Close Cage Mesh*.

You can also use the *Resolution* setting to increase the number of vertices of the generated cages. Be aware that high resolutions can slow the simulation.

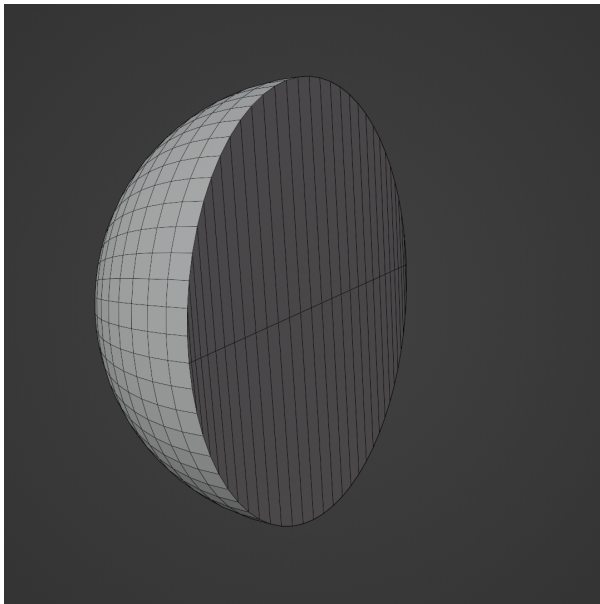
Finally, if some errors appears during the cage generation, you can also try to change the *Remesh seed*.

---

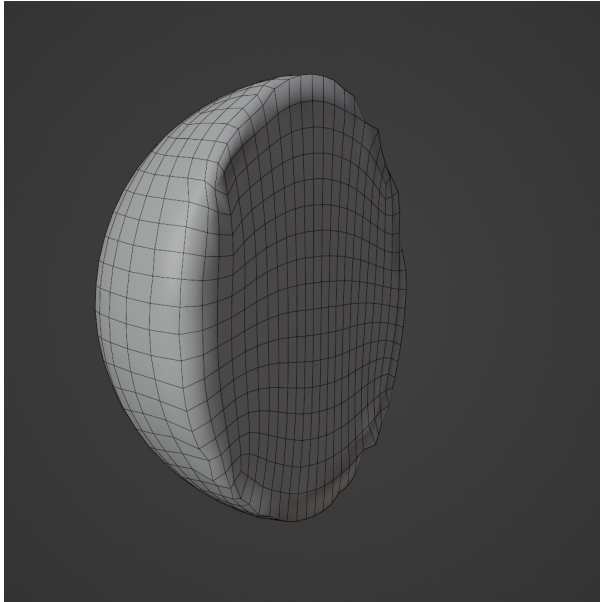
**Note:** When creating a collision cage, better results might be achieved disabling the Remesh option and the Close Cage Mesh option.

---

1. *Remesh* disabled



2. *Remesh* enabled with Resolution 900



---

**Note:** Even if the remeshed cage seems to have some problems at the boundary, it is perfectly fine and will not generate problems during the simulation. In fact, the remeshed mesh will behave better in general, due to the nicer topology, with respect to the non-remeshed one.

---

### Clean Selection

This option improve the selection of the vertices used to generate the cage.

**Clean Selection Threshold (Pro Version):** in the Pro Version you can adjust the Clean Selection Threshold to try to fix some cage generation errors.

---

**Note:** If you are using the Free or Lite version, and the generated cage is not enclosing the whole mesh, disable this option. Otherwise, with the Pro version you can try to increase the **Clean Selection Threshold**.

---

### Smooth Correction

With this option, a Smooth Correction modifier will be added to the cage to smooth the simulation. You can disable it after cage generation as usual, in the Modifier tab of the Cage object.

## 3.5.2 Pin Groups

Pin vertex groups define which parts of the cage will be affected by the cloth simulation, and therefore which parts will actually be moved. In the vertex groups, each vertex has a weight assigned. In the case of pin groups, when the weight is 1, the simulation will not act on that vertex; on the contrary, a null value means that the vertices will fully participate in the simulation. In between values can be useful to smooth out the transition between pinned part (weight = 1) and simulated parts (weight = 0).

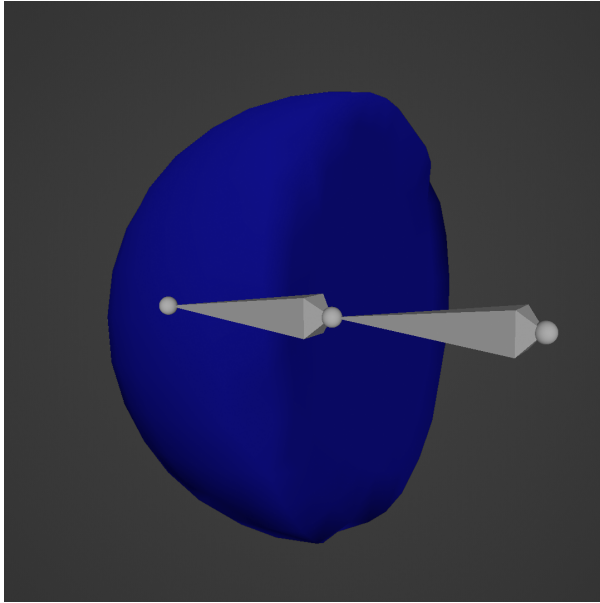
In the images below, 0 values are depicted with blue color, and 1 values are depicted with red. Green/yellow color depicts in between values.

## Use Proximity Data

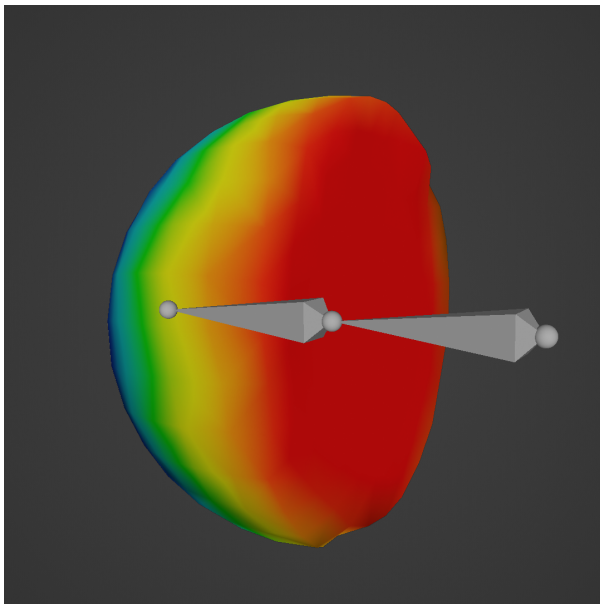
With *Use Proximity Data*, the cage pin group will be generated setting weights to 0 for all vertices that are near the cage mesh. Higher values of the factor can be used to increase the distance.

In the following example, *None* normalization is used.

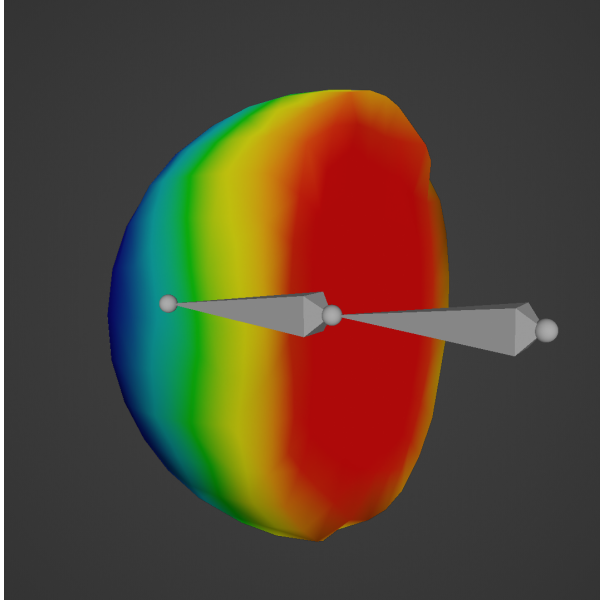
1. *Use Proximity Data* disabled



2. *Use Proximity Data* enabled with default factor 0.02



3. *Use Proximity Data* enabled with max factor 0.2



## Normalization

The normalization options are used to normalize the pin group weights. Most of the time, tweaking this setting might be the key to achieve good pin groups and therefore nice results.

The normalization functions, and effects of different normalization functions on a simple example, are the following. All of the following examples weights are computed with *Use Proximity Data* enabled with default factor.

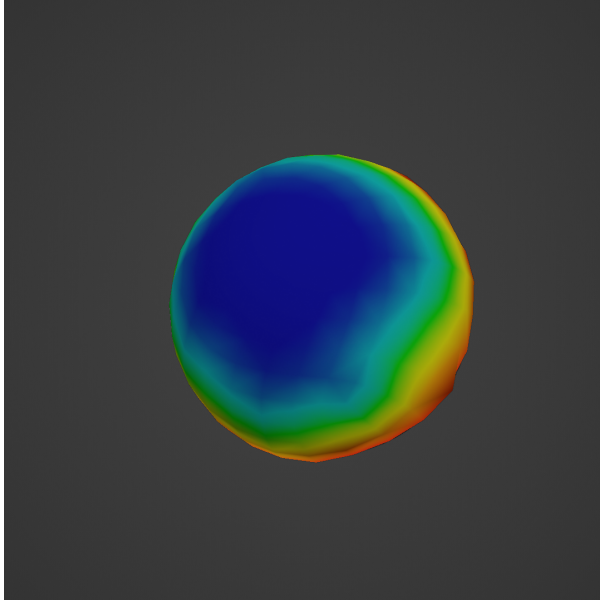
1. *None* normalization

$$Norm(w = \text{weights}) = 0$$

This function effectively set all weights to 0. If *Use Proximity Data* is disabled, the pin group would be all null. If enabled like in the figure, you still get a nice pinning on the part flat part of the half sphere.

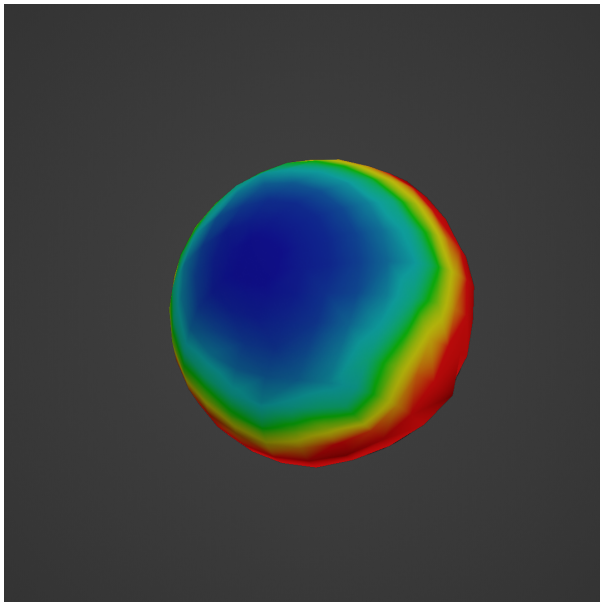
It is useful to create simple weights, or without *Use Proximity Data* when we want to create a cage that is not pinned. In the latter case, the whole mesh will be simulated and it will interact with collision objects.





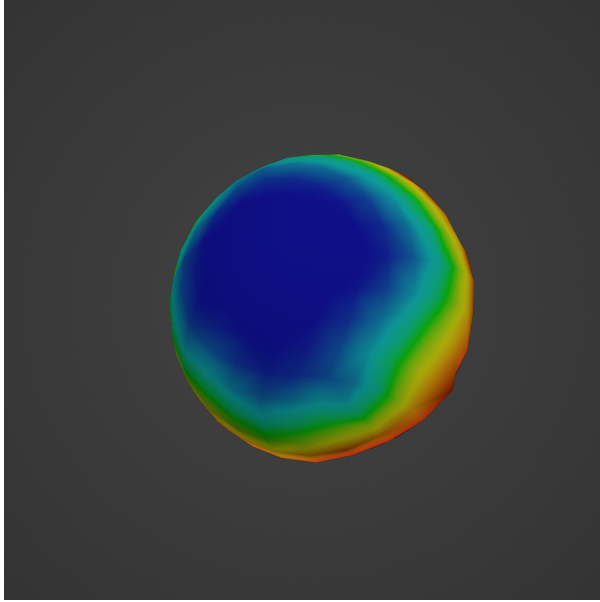
2. *Linear* normalization

$$\text{Norm}(w = \text{weights}) = w$$



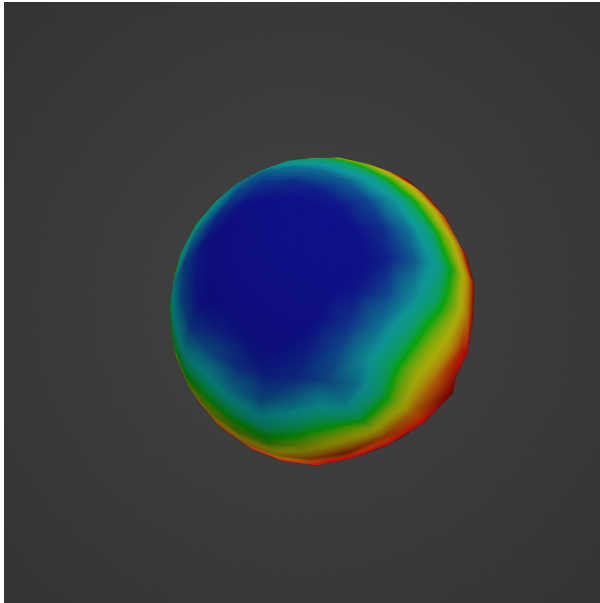
3. *Square* normalization

$$\text{Norm}(w = \text{weights}) = w^2$$



4. *Sigmoid* normalization (default values)

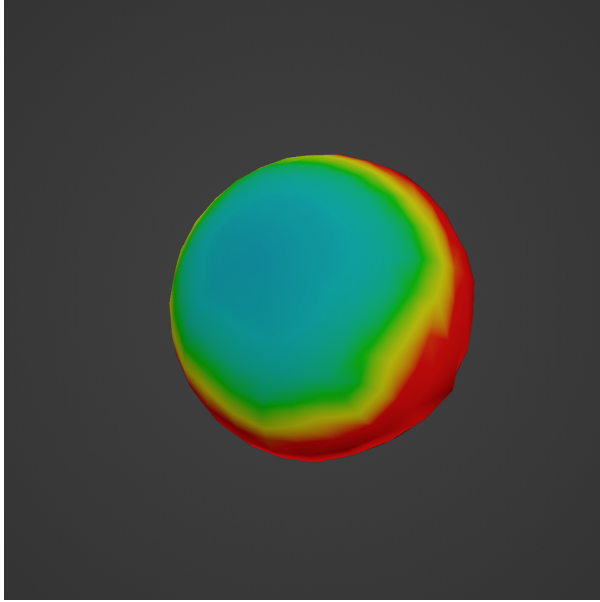
$$Norm(w = \text{weights}) = \frac{1}{1 + \exp[-f * (w - s)]}$$



5. *Tanh* normalization (gain 0.8 and min 0.2)

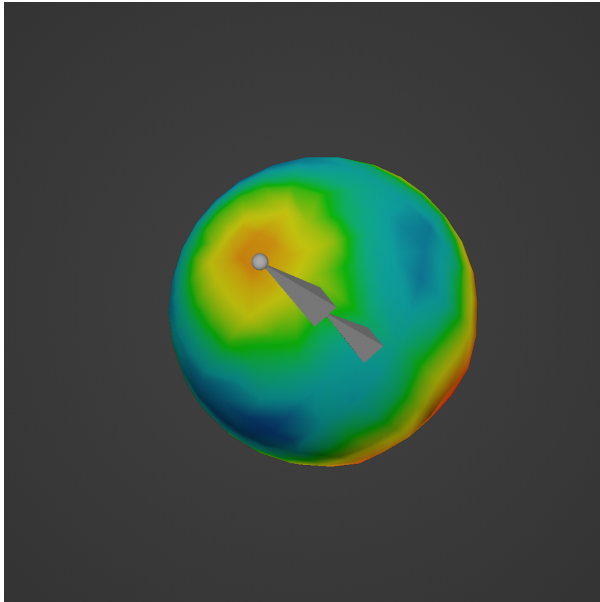
$$Norm(w = \text{weights}) = \tanh(g * w) + m$$

The gain  $g$  amplifies the vertex weights of the selected bone(s) and applies it to the newly generated cage, while min  $m$  is the minimum vertex weight that will be used.



6. *Arcsch* normalization (gain 1. and min 0.)

$$Norm(w = \text{weights}) = 1 - \tanh(w/g) + m$$



**Note:** Mathematically, we are normalizing the cage pin group generated from the inverted bone group of the parent mesh, using the selected normalization function. We do this using the normalization function as value of the weight instead of the value of the weight itself.

For those interested, you can plot these functions with [Desmos](#).

### 3.5.3 Parenting

#### Deform Method

Different methods to deform the mesh with the cage are available.

1. *Surface Deform*

The default option, which in general provides better results and support parenting of the mesh with the armature. Therefore with this option the cage will firstly follow the armature bones, and then evaluate the physics simulation.

2. *Mesh Deform*

This option can be selected if the Surface Deform binding keeps failing. It only support single bone parenting methods (see below).

#### Parenting Method

If Deform Method is choosen to be Mesh Deform, this option is available to choose parenting.

1. *Bone parenting*

The cage will be parented to the bone with standard Blender parenting. Inverse transformation will be applied.

2. *ChildOf*

A Child Of modifier will be used for parenting.

#### Fix Influence

*Fix Influence* creates a better influence group (the group used to defined with parts of the mesh are influenced by the cage in the Surface/Mesh Deform modifier) for the mesh.

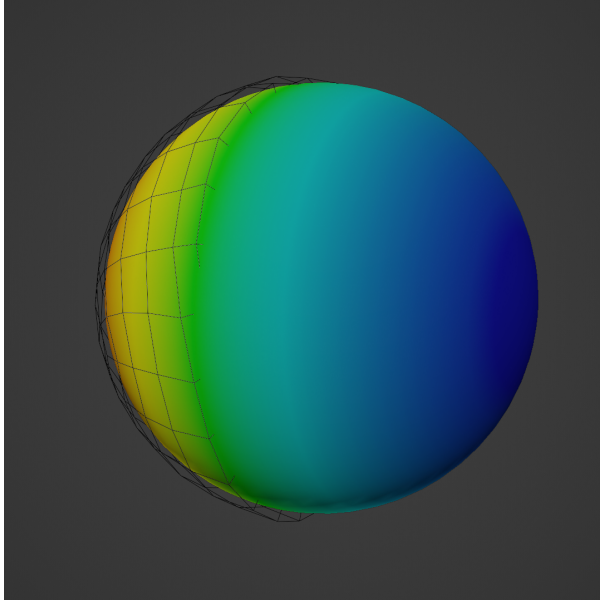
If not enabled, the bone group will be used instead.

---

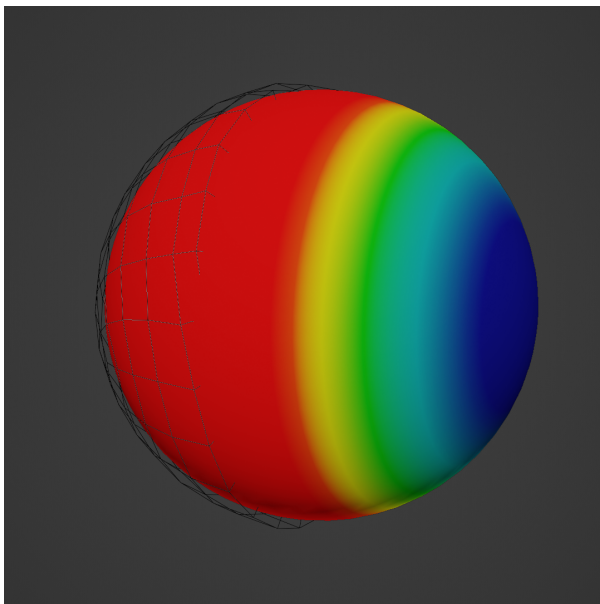
**Note:** We advise to always keep it enabled, with default factor.

---

1. *Fix Influence* disabled



2. *Fix Influence* enabled with default setting



## Smooth Correction

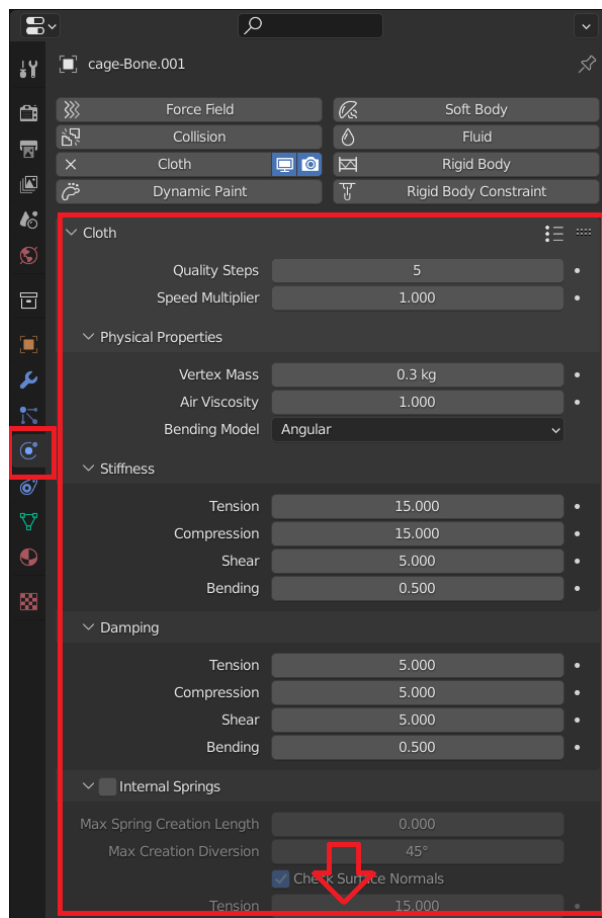
With this option, a Smooth Correction modifier will be added to the mesh to smooth the simulation. You can disable it after cage generation as usual, in the Modifier tab of the mesh object.

### 3.5.4 Cloth Physics Settings

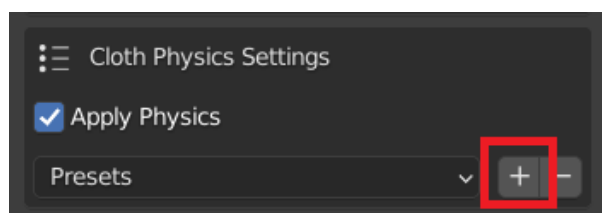
In this section you can select the preset to use.

Some are available by default. To create new ones:

1. Change the cloth settings of the cage



2. Press on + button near the preset list



3. Choose a name and Create

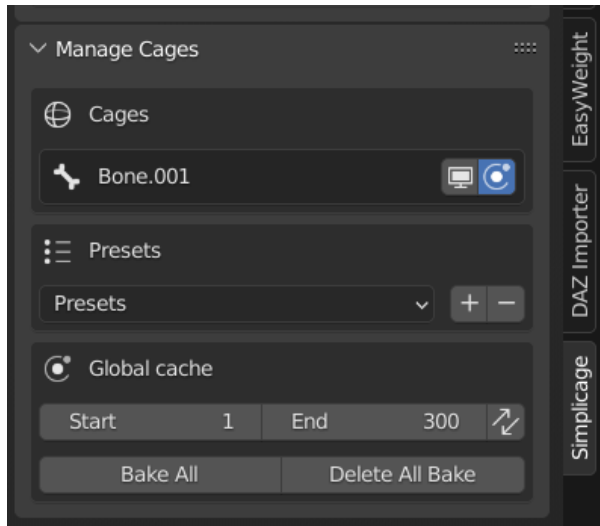
Then you can call a preset just selecting it from the list. To delete a preset, click on the - button.

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**Note:** You can also generate a cage without physics, disabling *Apply Physics*.

---

## 3.6 Manage Cages



In this window you can manage the cages/collision boxes that are on the scene.

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**Note:** This window is available only if at least one cage/collision box is available on the scene.

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### 3.6.1 Cages

This part lists all the cages available on the scene.

With the buttons you can show/hide in viewport (by default cages are always hidden in Render), and enable/disable physics simulation, each cage/collision box independently. Moreover, the X button deletes the cage from the scene and its mesh data.

### 3.6.2 Presets

In this section, you can change the preset **for the selected cage**. See [Cloth Physics Settings](#) for more informations about how to create or delete presets.

### 3.6.3 Global Cache

In this section you can bake the physics for all available cages. You can choose the initial and final frame, and with the double arrow button you can synchronise those values with the current initial and final animation frames values.

---

**Note:** All generated cages will consider these values as initial and final frames for physics computation. Changing these values will change the value of all Simplicage cages, but not other physics objects you have in the scene.

---

**Warning:** Before changing initial/final frame values or baking, it is advised to Delete All Bake. This will prevent issues related to already baked cages.

## 3.7 Examples

### 3.7.1 General tutorial (advanced)

In this tutorial we show how to use the add-on, in particular showing some advanced functions and some manual tweaks that might help improve your animation physics results.

### 3.7.2 Hair physics (with bones)

In this tutorial we show an example on how to generate quick hair physics on a mesh with bones. We use Bone Dynamics for the bone physics, and Simplicage to generate the collision cages.

**More tutorials will arrive soon!**

## 3.8 Troubleshooting

### 3.8.1 Errors

- **Error:** *An error occurred while remeshing. Try to re-restart Blender and re-try.*

This error appears because of Blender remesher. We are working on a solution, for the moment the workaround if this happens is to save the file, close Blender and re-try.

- **Error:** *An error occurred while binding the mesh. Try with different Coverage and Resolution settings, or change Close Cage Method.*



This error occurs because Blender can not bind the generated cage with the mesh. Try the following: \* Decrease *Coverage* by steps of 0.05 \* Increase/decrease *Remesh Resolution* by steps of around 100/300 \* Change *Close Cage method* \* Change *Deform method* to *Mesh Deform*. Use this only as last resource, as this method has some limitations, see [Deform Method](#).

### 3.8.2 Physics Simulation

- Cages are not simulating physics correctly.

Sometime Blender caches the physics and does not flush them when a new simulation is started. To solve most of the issues, you should go in the Physics Cloth settings of the cage and manually change the final frame value on the Cache tab. This will force Blender to consider the current cache obsolete.

### 3.8.3 Cage generation

- The Create Cage button can not be clicked (it's grey) when I select a bone.

The only bones accepted are the ones with Deform activated. This prevents generation of cages with 0 vertices.

Sometime advanced rigs use proxy bones. You might need to search for bones in other layers, to find the actual deforming ones.

- Generated cages are not enclosing the whole mesh.

Try to disable [Clean Selection](#).

### 3.8.4 Debug

If you enable the console (on Windows, press F3 and search for *Toggle System Console*), some debug infos will be written when the cage is generated. If an un-documented error happens, please send use the content of your console to help us fix the error.

## 3.9 Limitations

In this section we list the current limitations and the known bugs.

### 3.9.1 Known Bugs

No known bug is known at the moment.

Let's hope this list will not become too long :-)

## 3.10 Contacts

### 3.10.1 Discord

You can contact us on the [dedicated Discord server](#) for help/bug report/feedbacks.

### 3.10.2 Twitter

You can also contact us on Twitter

- [Morelewd](#)
- (NSFW alert) [Mustard](#)