7.2.5 Rigging - Constraints - Tracking

Clamp To Constraint

The *Clamp To* constraint clamps an object to a curve. The *Clamp To* constraint is very similar to the *Follow Path* constraint, but instead of using the evaluation time of the target curve, *Clamp To* will get the actual location properties of its owner (those shown in the *Transform Properties* panel, `N`), and judge where to put it by "mapping" this location along the target curve.

One benefit is that when you are working with *Clamp To*, it is easier to see what your owner will be doing; since you are working in the 3D view, it will just be a lot more precise than sliding keys around on a time Ipo and playing the animation over and over.

A downside is that unlike in the *Follow Path constraint*, *Clamp To* doesn't have any option to track your owner's rotation (pitch, roll, yaw) to the banking of the targeted curve, but you don't always need rotation on, so in cases like this it's usually a lot handier to fire up a *Clamp To*, and get the bits of rotation you do need some other way.

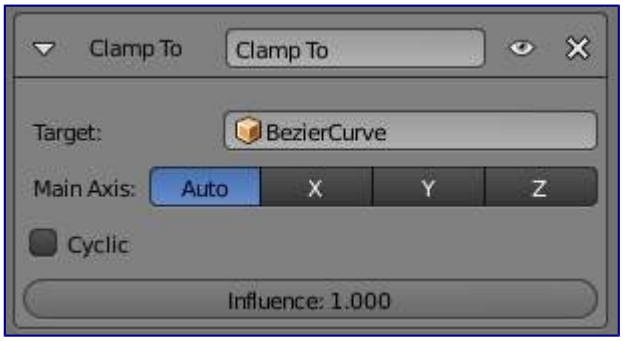
The mapping from the object's original position to its position on the curve is not perfect, but uses the following simplified algorithm (note, I am not the original code author so this may not be 100% accurate):

- A "main axis" is chosen, either by the user, or as the longest axis of the curve's bounding box (the default).
- The position of the object is compared to the bounding box of the curve in the direction of the main axis. So for example if X is the main axis, and the object is aligned with the curve bounding box's left side, the result is 0; if it is aligned with the right side, the result is 1.
- If the cyclic option is unchecked, this value is clamped in the range 0-1.
- This number is used as the curve time, to find the final position along the curve that the object is clamped to.

This algorithm does not produce exactly the desired result because curve time does not map exactly to the main

axis position. For example an object directly in the centre of a curve will be clamped to a curve time of 0.5 regardless of the shape of the curve, because it is halfway along the curve's bounding box. However the 0.5 curve time position can actually be anywhere within the bounding box!

Options



Clamp To panel

Target
: The Target: field indicates which curve object the Clamp To constraint will track along. The Target: field must be a curve object type. If this field is not filled in then it will be highlighted in red indicating that this constraint does not have all the information it needs to carry out its task and will therefore be ignored on the constraint stack.

Main Axis

: This button group controls which global axis (X, Y or Z) is the main direction of the path. When clamping the object to the target curve, it will not be moved significantly on this axis. It may move a small amount on that axis because of the inexact way this constraint functions.

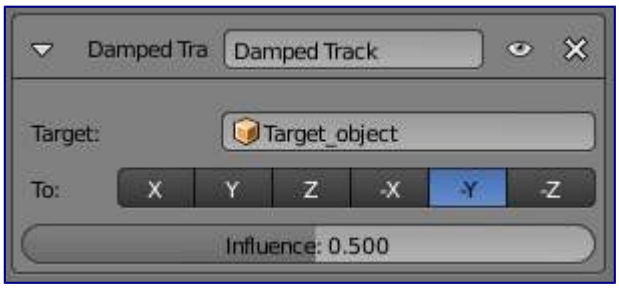
: For example if you are animating a rocket launch, it will be the Z axis because the main direction of the launch path is up. The default *Auto* option chooses the axis which the curve is longest in (or X if they are equal). This is usually the best option.

Cyclic
: By default, once the object has reached one end of its target curve, it will be constrained there. When the *Cyclic* option is enabled, as soon as it reaches one end of the curve, it is instantaneously moved to its other end. This is of course primarily designed for closed curves (circles & co), as this allows your owner to go around it over and over.

Damped Track Constraint

The *Damped Track* constraint constrains one local axis of the owner to always point towards *Target*. In another 3D software you can find it with the name "Look at" constraint.

Options

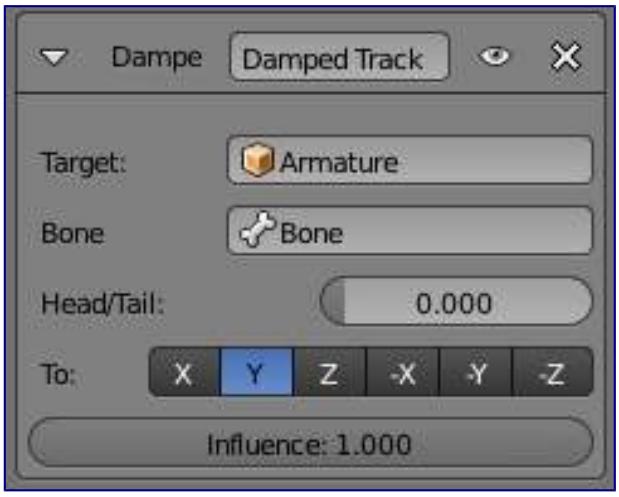


Damped Track panel

Target (Mesh Object Type)

This constraint uses one target, and is not functional (red state) when it has none.

Vertex Group
If *Target* is a *Mesh*, a new field is displayed offering the optional choice to set a *Vertex Group* as target.



Damped Track for Bones

Target (Armature Object Type):

Bone
If *Target* is an *Armature*, a new field is displayed offering the optional choice to set an individual bone as *Target*.

Head/Tail
If *Target* is an *Armature*, a new field is displayed offering the optional choice to set whether the Head or Tail of a Bone will be pointed at by the *Target*. It is a slider value field which can have a value between 0 and 1. A value of 0 will point the Target at the Head/Root of a Bone while a value of 1 will point the Target at the Tail/Tip of a Bone.

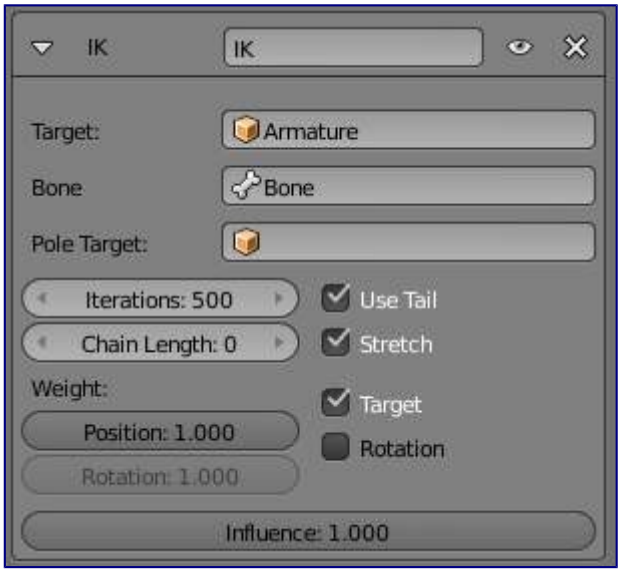
To
Once the owner object has had a Damped Track constraint applied to it, you must then choose which axis of the object you want to point at the Target object. You can choose between 6 axis directions (-X, -Y, -Z, X, Y, Z). The negative axis direction cause the object to point away from the Target object along the selected axis direction.

IK Solver Constraint

The *Inverse Kinematics* constraint implements the *inverse kinematics* armature posing technique. Hence, it is only available for bones. To quickly create an IK constraint with a target, select a bone in pose mode, and press `Shift I`.

This constraint is fully documented in the *inverse kinematics page* of the rigging chapter.

Options



Inverse Kinematics panel

Target
: Must be an armature

Bone
: A bone in the armature

Pole Target
: Object for pole rotation

Iterations
: Maximum number of solving iterations

Chain Length

: How many bones are included in the IK effect. Set to 0 to include all bones

  Use Tail
  : Include bone’s tail as last element in chain

  Stretch
  : Enable IK stretching

Weight:
: **Position**
  : For Tree-IK: Weight of position control for this target

  Rotation
  : Chain follow rotation of target

Target
: Disable for targetless IK

Rotation
: Chain follows rotation of target

Locked Track Constraint

The *Locked Track* constraint is a bit tricky to explain, both graphically and textually. Basically, it is a *Track To constraint*, but with a locked axis, i.e. an axis that cannot rotate (change its orientation). Hence, the owner can only track its target by rotating around this axis, and unless the target is in the plane perpendicular to the locked axis, and crossing the owner, this owner cannot really point at its target.

Let's take the best real world equivalent: a compass. It can rotate to point in the general direction of its target (the magnetic North, or a neighbor magnet), but it can't point *directly at it*, because it spins like a wheel on an axle. If a compass is sitting on a table and there is a magnet directly above it, the compass can't point to it. If we move the magnet more to one side of the compass, it still can't point *at* the target, but it can point in the general direction of the target, and still obey its restrictions of the axle.

When using a *Locked Track* constraint, you can think of the target as a magnet, and the owner as a compass. The *Lock* axis will function as the axle around which the owner spins, and the *To* axis will function as the compass' needle. Which axis does what is up to you!

If you have trouble understanding the buttons of this constraint, read the tool-tips, they are pretty good. If you don't know where your object's axes are, turn on the *Axis* button in the *Object* menu's *Draw* panel. Or, if you're working with bones, turn on the *Axes* button in the *Armature* menu's *Display* panel.

This constraint was designed to work cooperatively with the *Track To* constraint. If you set the axes buttons right for these two constraints, *Track To* can be used to point the axle at a primary target, and *Locked Track* can spin the owner around that axle to a secondary target.

This constraints also works very well for 2D billboarding.

Options

Locked track panel

Target
: This constraint uses one target, and is not functional (red state) when it has none.

To
: The tracking local axis (*Y* by default), i.e. the owner's axis to point at the target. The negative options force the relevant axis to point away from the target.

Lock

The locked local axis (*Z* by default), i.e. the owner's axis which cannot be re-oriented to track the target.

Warning

If you choose the same axis for *To* and *Lock*, the constraint will no longer be functional (red state).

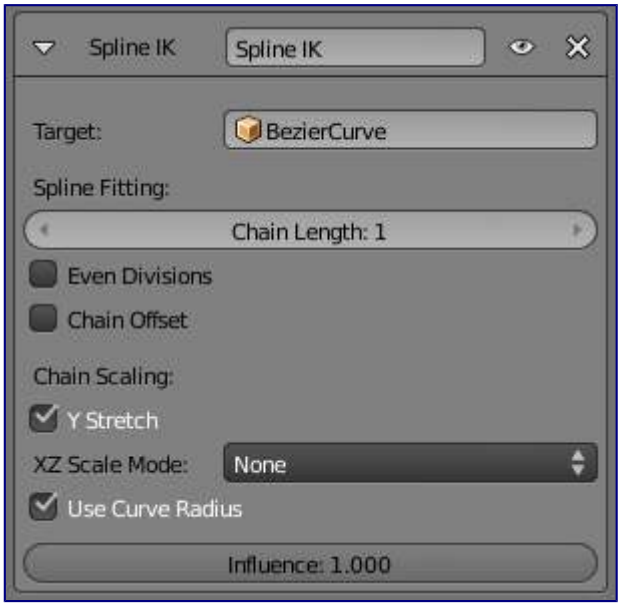
Spline IK Constraint

The *Spline IK* constraint aligns a chain of bones along a curve. By leveraging the ease and flexibility of achieving aesthetically pleasing shapes offered by curves and the predictability and well-integrated control offered by bones, *Spline IK* is an invaluable tool in the riggers' toolbox. It is particularly well suited for rigging flexible body parts such as tails, tentacles, and spines, as well as inorganic items such as ropes.

To set up *Spline IK*, it is necessary to have a chain of connected bones and a curve to constrain these bones to.

- With the last bone in the chain selected, add a *Spline IK* constraint from the *Bone Constraints* tab in the *Properties Editor.*
- Set the 'Chain Length' setting to the number of bones in the chain (starting from and including the selected bone) that should be influenced by the curve.
- Finally, set *Target* to the curve that should control the curve.

Options



Spline IK panel

Target
The target curve
Spline Fitting:
Chain Length

How many bones are included in the chain

Even Division
Ignore the relative length of the bones when fitting to the curve

Chain Offset
Offset the entire chain relative to the root joint

Chain Scaling:

Y stretch
Stretch the Y axis of the bones to fit the curve

XZ Scale Mode:

None
Don’t scale the X and X axes (default)

Bone Original
Use the original scaling of the bones

Volume Preservation
Scale of the X and Z axes is the inverse of the Y scale

Use Curve Radius
Average radius of the endpoints is used to tweak the X and Z scaling of the bones, on top of the X and Z scale mode

See also

This subject is seen in depth in the *Rigging/Posing section*.

- Blender.org 2.56 Release Log for Spline IK

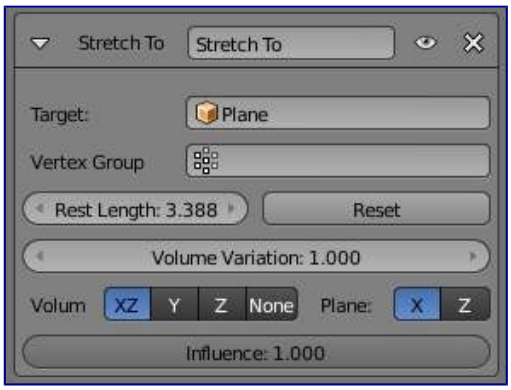
Stretch To Constraint

The *Stretch To* constraint causes its owner to rotate and scale its Y axis towards its target. So it has the same tracking behavior as the *Track To constraint*. However, it assumes that the Y axis will be the tracking and stretching axis, and doesn’t give you the option of using a different one.

It also optionally has some raw volumetric features, so the owner can squash down as the target moves closer, or thin out as the target moves farther away. Note however that it is not the real volume of the owner which is thus preserved, but rather the virtual one defined by its scale values. Hence, this feature works even with non-volumetric objects, like empties, 2D meshes or surfaces, and curves.

With bones, the “volumetric” variation scales them along their own local axes (remember that the local Y axis of a bone is aligned with it, from root to tip).

Options

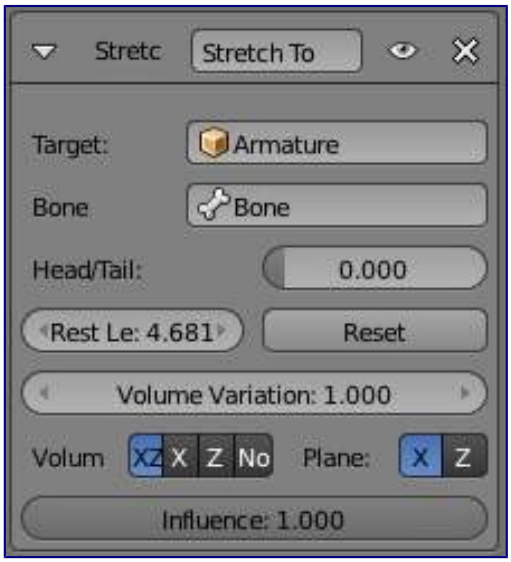


Stretch To panel for a Mesh Object

Target (Mesh Object Type)

This constraint uses one target, and is not functional (red state) when it has none.

Vertex Group
When *Target* is a mesh, a new field is display where a vertex group can be selected.



Stretch To panel for a Armature Object

Target (Armature Object Type)

This constraint uses one target, and is not functional (red state) when it has none.

Bone
When *Target* is an armature, a new field for a bone is displayed.
Head/Tail
When using a Bone *Target*, you can choose where along this bone the target point lies.
Rest Length

This numeric field sets the rest distance between the owner and its target, i.e. the distance at which there is no deformation (stretching) of the owner.

Reset

When clicked, this small button will recalculate the *Rest Length* value, so that it corresponds to the actual distance between the owner and its target (i.e. the distance before this constraint is applied).

Volume Variation
: This numeric field controls the amount of “volume” variation proportionally to the stretching amount. Note that the **0.0** value is not allowed, if you want to disable the volume feature, use the *None* button (see below).

Volume
: These buttons control which of the X and/or Z axes should be affected (scaled up/down) to preserve the virtual volume while stretching along the Y axis. If you enable the *NONE* button, the volumetric features are disabled.

Plane
: These buttons are equivalent to the *Up* ones of the *Track To constraint*: they control which of the X or Z axes should be maintained (as much as possible) aligned with the global Z axis, while tracking the target with the Y axis.

Track To Constraint

Description

The *Track To* constraint applies rotations to its owner, so that it always points a given “To” axis towards its target, with another “Up” axis permanently maintained as much aligned with the global Z axis (by default) as possible. This tracking is similar to the “billboard tracking” in 3D (see note below).

This is the preferred tracking constraint, as it has a more easily controlled constraining mechanism.

This constraint shares a close relationship to the *Inverse Kinematics constraint* in some ways.

Tip

Billboard tracking

The term “billboard” has a specific meaning in real-time CG programming (i.e. video games!), where it is used for plane objects always facing the camera (they are indeed “trackers”, the camera being their “target”). Their main usage is as support for tree or mist textures: if they were not permanently facing the camera, you would often see your trees squeezing to nothing, or your mist turning into a millefeuille paste, which would be funny but not so credible.

Options

Track To panel

Targets

This constraint uses one target, and is not functional (red state) when it has none.

Bone
When *Target* is an armature, a new field for a bone is displayed.

Head/Tail
When using a bone target, you can choose where along this bone the target point lies.

Vertex Group
When *Target* is a mesh, a new field is display where a vertex group can be selected.

To
The tracking local axis (*Y* by default), i.e. the owner's axis to point at the target. The negative options force the relevant axis to point away from the target.

Up
The "upward-most" local axis (*Z* by default), i.e. the owner's axis to be aligned (as much as possible) with the global Z axis (or target Z axis, when the *Target* button is enabled).

Target Z
By default, the owner's *Up* axis is (as much as possible) aligned with the global Z axis, during the tracking rotations. When this button is enabled, the *Up* axis will be (as much as possible) aligned with the target's local Z axis?

Space

This constraint allows you to choose in which space to evaluate its owner's and target's transform properties.

Warning
If you choose the same axis for *To* and *Up*, the constraint will not be functional anymore (red state).